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**FIRST MOVER OR FOLLOWER ADVANTAGE IN A DYNAMIC MARKET**

by

**Ivan C. Abel**

**A dissertation submitted to the Graduate Faculty in Business in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.**

**1995**

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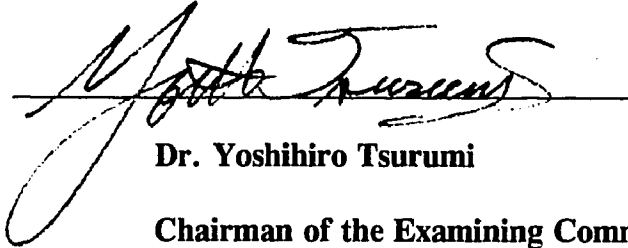
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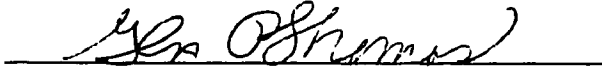


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**ABSTRACT****First Mover or Follower Advantage in a Dynamic Market**

by

Ivan C. Abel

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Timing of market entry is one of the most critical decisions that firms have to make. The basic question of whether first movers are more successful than followers still remains unanswered. This study examines three fundamental entry order questions: (1) Do first movers establish a long run dominant market position? (2) If not, what is the entry order of the firms which do so? (3) When and why do some first entrants succeed while others fail?

Fifty two consumer and industrial product categories were analyzed in two time periods. The results show that for the first entrants only 7.7% remained market leaders and the average market share was only 4.3%.

Furthermore, it was found that the relationship between entry order and market dominance is not that of decline with later entry as reported in earlier studies, but curvilinear - lowest for first entrants and pioneers, highest for early followers and somewhat lower for late entrants. 97% of the firms that dominated the markets entered as followers, on an average 9.3 years after the first mover. Neither the organizational nor innovation characteristics influenced first entrants success.

Firms most likely to pioneer a new product category were small industry newcomers (46.1%), but the firm most likely to dominate the new category were

large incumbents (59.5%). These results challenge the established view that pioneering by industry newcomers leads to leadership turnover in favor of the pioneering newcomers. The newcomers that gained industry prominence entered as followers.

Neither the endogeneity nor the exogeneity arguments of the first mover advantage theory were found valid simply because first entrants did not succeed. In over 80% of the product categories the reputation of pioneer was usually bestowed upon one or more successful followers, some entering more than two decades after the first mover. True pioneers were a mere footnote in the annals of the product history. Major reasons for first entrant failure were market and technological uncertainties in the introductory stage and the intense competition that ensued after the market was proven. In order to maintain market dominance, the first entrant had to replicate complementary capabilities of the strongest follower. That proved far more difficult than for the followers to imitate and improve the first mover's product.

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## CHAPTER 1

### INTRODUCTION

#### I. PROLOGUE

The desire to be first, a pioneer, is deeply imbedded in western culture. Men race cars, fly into space and explore places where no one had been before, just for the honor of being first - because no one remembers the second. The following ad that appeared in 1900 illustrates the point.

Men wanted for hazardous journey. Small wages, bitter cold, long months of complete darkness, constant danger, safe return doubtful. Honor and recognition in case of success.

Ernest Shackleton

Source: Levitt (1986, p.129)

To no one's surprise, the ad had an overwhelming response.

In the United States, more than in any other culture, the pioneering spirit is at the pinnacle of all virtues. Its preeminent position is perhaps rooted in American history: the discovery of America and later, the conquest of the West.

Cultural values not only affect our every-day lives but also influence the way companies conduct their business. The dominant measure of individual and corporate success is the amount of profit earned from pioneering endeavors. Pioneers who became legends are not hard to find. Henry Ford, Edwin Land and, more recently, Seymour Cray, Steve Jobs, William Gates (and their respective firms) are just a few of the often cited success stories.

#### II. RESEARCH ISSUES

Timing of market entry is one of the most critical decisions firms have to make. The question revolves about whether a firm should be a pioneer or a follower. While first entrants have the opportunity to preempt the market, they also face

technological and market uncertainty and carry the cost of developing the market. Later entrants may take a free ride and even leapfrog pioneers with improved products. However, waiting until uncertainties are resolved, later entrants take the risk of being shut out of a market.

Although recently challenged in several studies (Olleros, 1986; Schnaars, 1986; Teece, 1986; Lieberman and Montgomery, 1988; Mitchell, 1991), the predominant view in academic and business literature is that being first to the market leads to long run market dominance (Bain, 1956; Schmalensee, 1982; Valaskakis, 1982; Holberton, 1991; Dumaine, 1991). One prescribed formula for company success is: Be a pioneer and an innovator; beat the competition to the market with new and innovative products or technologies and you will gain a dominant position (Levitt, 1960). In short, there seems to be a generally accepted notion that there is a causal relation between being first in the market and subsequent higher profits (Bond and Lean, 1979; Whitten, 1979; Dasgupta and Stiglitz, 1980; Urban et al., 1986; Lambkin, 1988; Robinson, 1988).

The explanation of this phenomenon seems simple, rational and appealing. In summary, literature states that pioneers tend to be more successful because they establish reputation among customers (Schmalensee, 1982; Lane and Wiggins, 1981), gain cost advantage vis-a-vis competition due to experience effect (Spence, 1981; Ghemawat, 1984, 1985; Abell and Hammond, 1979), which they translate to long-run marketing mix advantages (Bain, 1956; Hauser and Shugan, 1983; Biggadike, 1976; Robinson, 1988; Lambkin, 1988), and thus are able to erect barriers to entry to later entrants (Porter, 1980; Ghemawat, 1986).

The notion of first-mover advantage has been so widely accepted that it is

considered by many a scientific fact. For example, Miller et al. (1989, p. 198) states that "...a number of empirical studies have generated convincing evidence that early entrants have significantly higher market share than later entrants...". Then, the authors proceed to provide yet another piece of dubious empirical evidence that "significant competitive benefits accrue to pioneers", and advance that "new ventures should enter as pioneers, rather than as followers".

Contrary to common belief, first-mover advantage is not a scientific fact supported by overwhelming empirical evidence. Rather, our current knowledge about the effect of order of entry on firm performance is based on:

- abundance of normative literature exhorting the benefits of pioneering interlaced with anecdotes of successful pioneers,
- case studies describing the demise of non-innovators or late entrants,
- number of still unsubstantiated theoretical works primarily in the field of economics,
- and about a dozen empirical studies that over-estimate the benefits of pioneering because of faulty methodology

While normative literature, case studies of non-innovators and conceptual works provide important insight and lay the groundwork for further studies, by no means are they evidence that pioneering generates long-run competitive advantage. It is a leap of faith to infer that if non-innovators and late entrants do poorly, then earlier entrants do better. The same applies to the contention that, if earlier is better, then first must be best.

The economic literature dealing with entry order proposes that innovations disturb the state of technological and industry equilibrium, leading to monopolistic competitive position with supranormal returns to pioneers (Comanor, 1967; Dasgupta

and Stiglitz, 1980). However, empirical research to support this claim is not forthcoming, perhaps because an industry in equilibrium is yet to be found.

Although in the field of strategy, most empirical studies strongly support the first-mover advantage model, the evidence is misleading. A majority of studies that purport to test the model are so plagued with definitional and methodological problems as to cast doubt on the validity and interpretability of their findings.

Literature review in chapter 2 reveals that the studies overestimate the success of pioneers because of the following problems:

- improper choice of unit of analysis,
- sample selection bias that excludes nonsurvivors and pioneers of failed innovations,
- reliance on self-reported order of entry
- loose and noncomparable categories of order of entry,
- loose and noncomparable measures of success or failures,
- use of cross-sectional data to measure longitudinal relationships.

In conclusion, in spite of voluminous literature on the subject of the order of entry, the fundamental questions of when to enter, and whether it is more advantageous to be a pioneer or a follower, remain unanswered (Lieberman and Montgomery, 1988; Moore et al., 1991; Mitchell, 1991). With the exception of case studies of a single innovation, to date, only Golder and Tellis (1993) examined the success of first movers.

### **III. PURPOSE AND SIGNIFICANCE OF THE STUDY**

The purpose of this research is to examine whether first entrants indeed establish long run dominance of the industries and gain the major benefits from their

pioneering effort. The study examines the following research questions:

#### Primary Research Questions:

1. Do first entrants establish long-run dominant market position?
2. What was the order of entry of the firms that established long-run dominant market position?
3. Are first entrants more successful than followers?

#### Related Research Questions

##### Influence of Innovation Characteristics

4. Do innovation characteristics (product newness and type) influence first entrant's success?

##### Influence of Entrant Characteristics

5. Do organizational characteristics (industry status, organizational size) influence first entrant's success?
6. Do organizational characteristics predispose firms to pioneer or follow?
7. When and why do some first entrants succeed while others fail?

This study should contribute to the ongoing debate in first-mover advantage in both theory-building and empirical confirmation. The study is divided into two parts. The empirical analysis is covered in Chapters 4 and 5, while the results of the qualitative analysis are presented in Chapters 6 and 7.

In the empirical part, this study addresses many of the shortcomings of previous empirical research critiqued in the ensuing literature review. To improve validity, particular attention was paid to avoiding the sample selection biases that plague nearly all earlier research. Specifically,

- first entrants for each innovation were identified
- order of entry of followers was confirmed, and,

- nonsurviving first entrants and pioneers of failed innovations were also included.

Furthermore, to track the changing performance of industry participants, a longitudinal design was used. This way, the question of whether first-mover advantages are lasting can also be explored. Likewise, previous studies have largely ignored the linkage between innovation characteristics and performance of the pioneering firm. This study compares the performance of pioneers of radical innovations against the performance of pioneers of incremental innovations, as well as pioneers of consumer products against pioneers of industrial products. Last, this study takes into consideration the differences among entrant characteristics, such as organizational size and whether the pioneer was an incumbent or an industry newcomer.

The purpose of the qualitative analysis is to cross-validate, clarify and elaborate on the findings of the empirical part of this study, and to uncover those germane variable that can be used later to build a more comprehensive paradigm of first mover advantage and order of entry theory. The qualitative analysis is based on historical review of individual products from the time of their commercial introduction to the present. Chapter 6 explores the strategies and competitive conditions under which the first entrants succeeded. Chapter 7 covers the unsuccessful first entrants and the reasons for their demise.

## **CHAPTER 2**

### **LITERATURE REVIEW**

The purpose of this literature review is to critically evaluate and summarize the current state of the knowledge about first-mover advantages, to identify the gaps in theory formulation and empirical verification, and to sort out what needs to be done to advance the understanding of linkage between the order of entry and the firm's performance.

This review will show that first movers are not as successful as had been suggested by the literature. The concept of first entrant or pioneer, in most empirical studies, has been so broadly operationalized as to encompass all entry categories including late entrants. Typically, the title of product pioneer is claimed by several surviving firms. Therefore, empirical research that purported to study first-mover advantages actually examined the performance of surviving followers. This fact seems to have eluded (or is ignored by) many academics, practitioners and policy makers who base their strategic recommendations on this faulty evidence.

#### **I. CONCEPTUAL MODEL**

The process by which first-mover advantages lead to dominant industry positions is shown in Figure No. 2.1. According to Lieberman and Montgomery (1988), the initial first-mover opportunity arises from a combination of environmental change, technological leadership, market foresight or luck. Environmental change leads to market opportunities. The firm that recognizes these opportunities and, through technological leadership or luck, enters the market first gains a lead time over

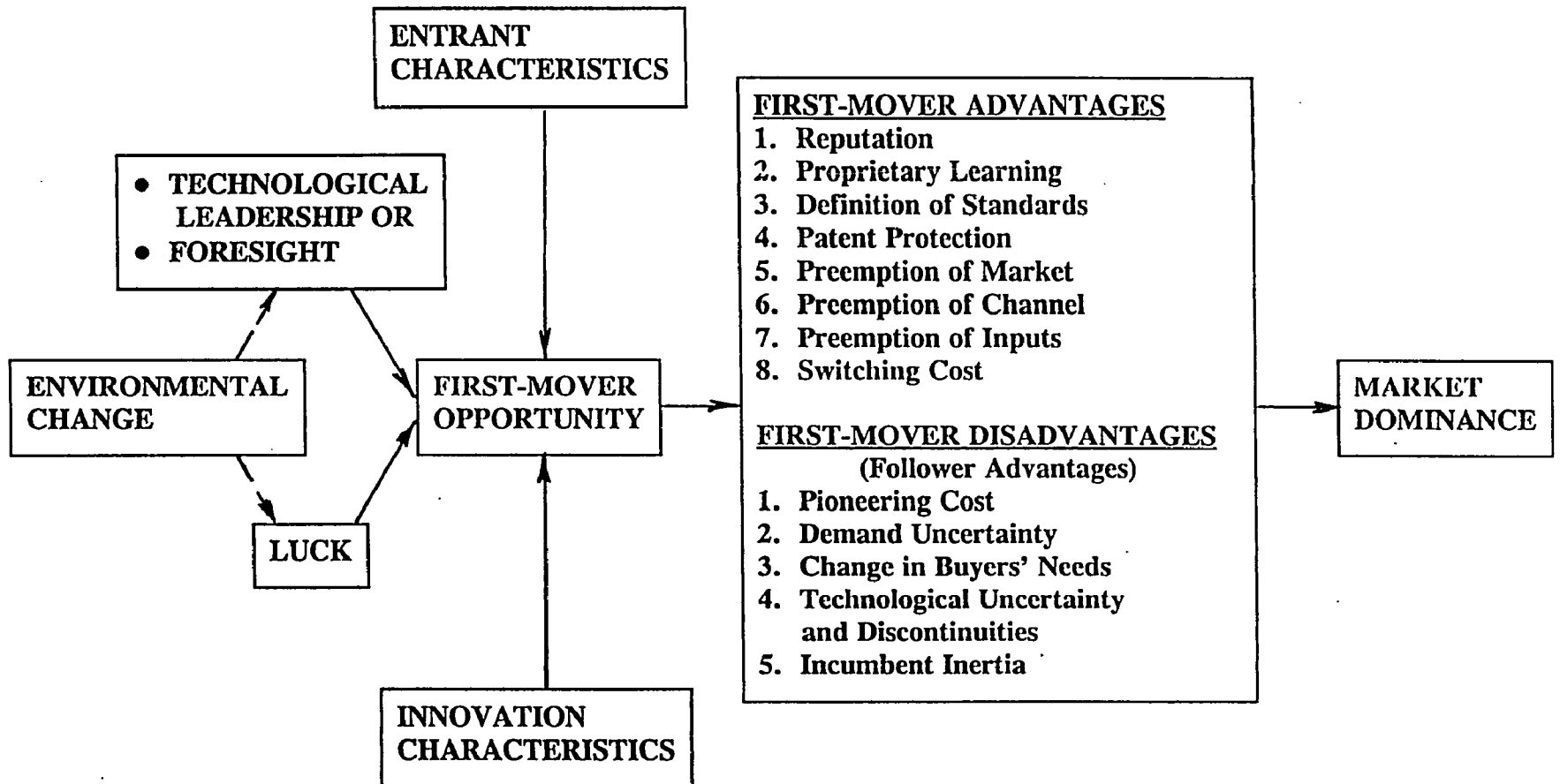


Figure 2.1 Conceptual Model of First-Mover Advantage

later entrants. During this lead time, it is assumed, a firm can pursue several sources of first-mover advantages and erect formidable barriers to later entrants, thus establishing market dominance. These pioneering advantages include:

1. enhanced company reputation
2. proprietary learning
3. opportunity to define industry standards
4. patent protection
5. preemption of market position
6. preemption of distribution channels
7. preemption of scarce inputs, and
8. establishment of buyer switching cost

In general, Porter (1985, p.73) says, "a first-mover gets the opportunity to define the competitive rules" in an emerging market. But pioneers also pay penalties for being first. These disadvantages (also called follower advantages) include:

1. pioneering cost
2. demand uncertainty
3. change in buyer needs
4. technological discontinuities, and
5. incumbent inertia.

Whether the first entrant succeeds is also a function of innovation characteristics and company comparative resources and capabilities with respect to followers.

The review of the theoretical and empirical literature in the first two sections of this chapter is organized according to the first-mover advantages and disadvantages

enumerated above. The third section briefly summarizes the findings and evaluates whether empirical evidence supports the contention that first entrants outperform followers. The last section critically examines some conceptual and methodological issues including problems of validity, definitions, measurements and comparability.

## **II. FIRST-MOVER ADVANTAGES**

### **A. Reputation Benefits**

Being first has got an aura of superiority, ingenuity and vision. In general, the normative and theoretic literature dealing with timing of entry postulates that one of the major advantages of being first in the market is the enhanced reputation the firm enjoys as a pioneer and a leader (Porter, 1985). The payoffs from this reputation include higher brand recognition, customer loyalty and willingness to pay more (Schmalensee, 1982), ability to attract talented workers and other long-lasting image benefits which followers find difficult to overcome (Bain, 1956; Porter, 1985; Robinson and Fornell, 1985). Is there empirical support for the contention that pioneers enjoy reputational advantage?

Reflecting the view of some, Miller et al. (1989, p. 197) state that "there is considerable theoretical and empirical evidence that pioneers are able to generate competitive advantage through name recognition, image leadership...". Surely, suggesting that theoretical studies are evidence was an oversight, but the authors also fail to cite any research that probed the issue. My own literature review uncovered no empirical studies that measured the reputation advantage of the pioneers. Therefore, the following discussion will rely on incidental examples drawn out of case studies and normative literature.

Even casual observations reveal that reputation of a pioneer is not instantly

bestowed on the first entrant. The reputation advantage accrues only to those firms that are able to generate substantial sales rapidly after the product introduction and remain prominent players throughout the growth period as, for example, Adidas and, later, Nike did in the athletic shoe industry, or Xerox and Polaroid did in copiers and instant photography, respectively. According to Porter (1985, p. 187), "a small company may not succeed in enhancing its reputation by moving first because it lacks the resources to publicize its lead".

This is especially true in pioneering a technologically discontinuous innovation where the product is often crude, unreliable and costly, thus representing a substantial risk to the customer (Mitchell, 1989, 1991; Romanelli, 1989; Schoonhoven et al., 1990).

Radical innovations are usually introduced by new entrants, often newly formed firms unconstrained by earlier technologies (Mitchell, 1989). These innovations create a new product class and are followed by industry ferment until dominant design emerges (Anderson and Tushman, 1990).

The original discontinuity rarely becomes the dominant design. Rather, the industry standard is a result of a series of continuous improvements or other discontinuities brought about by later entrants. But, by then, the pioneering firm that opened up the product class is usually no longer a major player or, worse, is out of business. One or several early followers that survive and prosper reap the reputation benefits for pioneering the industry.

In the diagnostic imaging industry, all major innovations were introduced by industry newcomers. As the products matured, pioneers failed or became minor players. It was the incumbents' ability to improve on the original innovation, their

established reputation with users, service network and financial stability that allowed them to take over the market leadership (Friar, 1986; Mitchell, 1989).

More incidental examples where the pioneers never gained the recognition and reputation are given by Olleros (1986), Schnaars (1986) and Teece (1988). For example, deHavilland suffered an irreversible loss of reputation by rushing into the commercial jet aircraft business. After three crashes of its Comet I, the orders dried out quickly. Two years later, learning from de Havilland's errors, Boeing introduced the now-famous 707 (Teece, 1986, 1988) and has dominated the market ever since.

At times, as key success factors change, persistent innovation may actually harm the brand's image. During the 1970s, Honda, Yamaha, Suzuki and Kawasaki took over the U.S. motorcycle market through fast innovation and aggressive pricing. In the process, they nearly bankrupted Harley Davidson.

However, the same strategy precipitated Honda's loss of the leader position in the late 1980s as the market matured. Its market share dropped from 47% in 1984 to 26% in 1991. A combination of rapid innovation and low price brought on quick obsolescence and low resale value for Japanese motorcycles. Harley improved reliability and service and positioned its motorcycles as American classics which would not become obsolete. Now, Harley is the industry leader with 31% market share of the U.S. street bikes (up from 9.4% in 1984) and still sells its motorcycles at a substantial premium over its Japanese rivals (Deutsch, 1992).

On the other hand, in frequently purchased inexpensive consumer products, the reputation of being a pioneer and proper positioning can lead to long lasting competitive advantage. Davidson (1976) reports that in the United Kingdom, twelve of eighteen pioneers in grocery categories introduced since 1945 are still the market

leaders. In the record industry, because of its early success in bringing records to the top of the charts, CBS is able to attract top talent and promising artists, thus perpetuating its reputation (Ghemawat, 1986). Likewise, Häagen Dazs ice cream, Kleenex tissues and Scotch tape were also able to benefit from their pioneering reputations.

In conclusion, reputation benefits accrue over time. Technological success and being first in the market may not be a sufficient condition to be recognized as a pioneer and leader. It is evident that firms which gained this reputation possessed (or were able to arrange for) complementary capabilities in manufacturing, marketing and finance and consistently offered superior products and service (Caminiti, 1992). Those that did not were forgotten or easily overshadowed by those followers who possessed the resources. When we speak of jet airplanes, calculators, computed tomography (CT) scanners, videocassette recorders and personal computers we think of Boeing, Casio, General Electric, Matsushita and Apple, not deHavilland, Bowmar, Ampex or MITS, respectively, the true pioneers.

### **B. Learning Curve Advantage**

The greatest, and most widely studied, advantage accrued to the first mover is said to be due to the experience effect, whereby the costs will decline by a fixed percentage each time cumulative production doubles (Abell and Hammond, 1979; Porter, 1980). The reductions in cost are most dramatic at the start when experience doubles quickly. For example, as experience increases tenfold and the product is on an 85% experience curve, the cost will drop by 42%. The implication is that the company should enter the market early, charge a low price, achieve the largest market share and establish sustainable cost advantage. The low price serves two purposes:

one, to penetrate the market, and, two, to erect barriers to entry and discourage competitors (Spence, 1981). According to Bain (1956) and Robinson and Fornell (1985), the pioneering firm can further consolidate its position by channeling part of its cost savings back to the customer via further price decreases, increased promotion and R&D.

Because of the simplicity of the concept, and its wide popularization by the Boston Consulting Groups in the late 1960s and 1970s, sliding down the experience curve became the buzzword in the corporate planning rooms. The message was clear: rush to the market and go for the share.

However, is there empirical evidence supporting the notion that pioneers enjoy cost advantage due to experience effect?

Granted, the experience curve has been observed thousands of times (Henderson, 1980) so, indeed, the early entrant can gain cost advantage. Empirical support for the pioneer's experience-based advantage are offered by Abell and Hammond (1979), Ghemawat (1985, 1986) and Shaw and Shaw (1984), among others. For example, in a span of eleven years, Ford was able to cut its costs on the Model T by 75% through process innovation, division of labor, backward integration and product standardization. Incremental price reductions increased Ford's market share from 10% to 55%. In the same fashion Lincoln Electric, a pioneer in electric arc welders, ninety years later still enjoys a 7% to 15% cost advantage over its competitors (Ghemawat, 1985, 1986). Other successful pioneering firms which command cost advantage are DuPont in titanium dioxide and spandex and Coca Cola in soft drinks.

However, recent empirical research suggests that pioneers have no cost

advantage over their competitors. Two PIMS studies of consumer and industrial products by Robinson and Fornell (1985) and Robinson (1988) found no difference in cost in spite of pioneers' larger market shares. Another PIMS-based research by Miller, Gartner and Wilson (1989) found that pioneers actually had a 9% cost disadvantage, but the results were not statistically significant.

Lieberman's (1989) analysis of thirty-nine chemical products revealed cumulative output differences to be poor predictors of inter-firm cost differences. Industry-wide learning spillover, technical discontinuities and inter-company variability in learning rate confound the cost-predictive power of the learning curve construct.

Furthermore, contrary to the given view in strategy literature (BCG portfolio matrix, etc.), even a large cumulative output lead by incumbents did not discourage other firms from entering the market. Rather, market growth and capacity utilization were major stimuli for entry and exit (Lieberman, 1989, p. 446). Results also showed that "entrant survival was unrelated to order of entry" (p.431).

Mitchell's (1989, 1991) research in the diagnostic imaging industry concurs with Lieberman's conclusions. Pioneers and early entrants gained no proprietary experience advantage because of industry-wide learning, frequent product changes due to improvements and low production volumes.

Mixed support for learning curve advantage was reported by Lambkin (1988). In her PIMS data based study of 129 start-up and 187 adolescent businesses, Lambkin found that the pioneers in the start-up sample had the highest cost followed by early followers and late entrants. In the adolescent sample, on the other hand, pioneers had the lowest cost, trailed by late entrants and early followers.

In spite of the many examples of successful pioneers who maintained cost leadership, it is now recognized that proprietary experience-based advantages are less prevalent than it was once believed.

In addition to the studies already cited, in the past decade, researchers (Day and Montgomery, 1983; Abell and Hammond, 1979; Porter, 1980, 1985; Teece, 1988; Mansfield, 1985; Ghemawat and Spence, 1985; Yip, 1982; Aaker and Day, 1986; Stalk 1988) have uncovered several problems that may preclude the first-mover from gaining a cost advantage.

To begin with, cost reduction due to experience does not occur automatically. There has to be a concerted effort and constant pressure to improve productivity, quality, and lower cost at every stage of a firm's value chain -- inbound logistics, manufacturing, outbound logistics, marketing service and administration. But in many American firms only the production function is held responsible for reducing cost. Thus, when faced with increased competition, the U.S firms either move manufacturing to low-wage countries (Tsurumi, 1986) or abandon manufacturing altogether and become distributors of someone else's products. For example Tsurumi and Tsurumi (1980, 1983, 1985, 1991) found that Japanese firms, although late entrants, became low cost producers in DRAM chips, television sets and automobiles, not through cost cutting, but through productivity gains and quality improvement by investing in production processes, people and market development. Between 1970 and 1983 the value-added per employee of the four leading Japanese auto manufacturers increased three to six fold (Tsurumi and Tsurumi, 1985).

Because of faster productivity gains even firms with lower sales volumes can be lower on the experience curve than firms with much larger cumulative experience.

For instance, in 1979 it took Mazda 47 labor hours to produce one subcompact car while Ford took 112 hours. Mazda also produced higher quality cars (Tsurumi and Tsurumi, 1985).

Furthermore, if learning is proprietary, to reduce costs faster than the competition, the company needs to secure larger market share, which is a feat in itself. However, if other firms pursue the same strategy, price wars sharply reduce the profitability in the industry and what once may have been an attractive growth market becomes a grave yard of fallen companies (Fruhan, 1972). Examples of price wars abound in the literature.

When Yamaha challenged Honda for leadership in 1981, the huge oversupply of motorcycles resulted in losses for all involved (Stalk, 1988; Buzzell and Gale, 1987). Texas Instruments' aggressive price-cutting based on experience curves in digital watches and home computers led to its own withdrawal from both product lines at substantial loss (Aaker and Day, 1986). The rush of large competitors like G.E., Siemens and Phillips, among others, into the CT scanner market pioneered by EMI decimated profits almost from the start and eliminated two thirds of the entrants including EMI (Barron, 1979; Teece, 1988; Aaker and Day, 1986).

Another problem with the proprietary experience-based advantage is the assumption that competitors enter the market with the same starting cost. The truth of the matter is they do not. Recent literature shows that there is industry-wide learning due to reverse engineering, work force mobility, scientific publications, scrutiny of patents etc. Thus, followers, in general, enter the market with lower initial cost (Aaker and Day, 1986; Spence, 1981; Teece, 1988). Moreover, learning spillovers increase the number of entries into the market (Ghemawat and Spence,

1985; Mitchell, 1989). In his study of 100 American corporations in 10 industries Mansfield (1985) found that, on an average, competition gained full knowledge about new product development within 6 to 12 months and within 6 to 18 months about process technology. In another study of 48 product innovations in four industries, Mansfield et al. (1981) discovered that average imitation cost was 65% of innovation cost and average time to imitate was 70% of the time to innovate. This explains why many firms (especially large ones) wait and enter as followers (Lipman and McCardle, 1987).

Other reasons why later entrants may start further down the experience curve are:

- Later entrants may benefit from shared experiences (Abell and Hammond, 1979; Porter, 1986)
- Later entrants have access to the latest technological improvements in products and production processes hence can leapfrog the pioneer (Olleros, 1986; Yip, 1982; Teece, 1988)
- Later entrants may enter the market in larger scales and enjoy instant cost advantage (Yip, 1982).

In conclusion, experience-based strategic advantages are far less prevalent than once purported to be. The first mover can attain lower costs if the learning is proprietary, technological improvements that follow the initial innovation are not radical and disruptive, and the pioneer has enough resources and market clout to take advantage of economies of scale. More often than not, the followers are able to match or even beat pioneers' cost by using more up-to-date production technologies (Stalk, 1988; Takeuchi and Nonaka, 1986; Tsurumi and Tsurumi, 1985), improving and simplifying product design and avoiding high initial R&D expense.

### C. Definition of Standards

With no competition, the first mover can define industry standards including the salient product features and complementary services which followers will have to imitate (Romanelli, 1989; Bain, 1968). This ability to define the standards gives a firm a sustainable competitive advantage (Porter, 1985). Again, in the literature, there are numerous incidental examples that support and some that refute the proposition, but systematic empirical tests are rare.

Indeed, some products are actually better known by the pioneer's brand name than by the generic product class they represent. Thus, people speak of frigidaires, coke, gillettes, xerox machines and polaroid pictures, rather than refrigerators, cola-based soft drinks, razor blades, copier machines and instant photography.

Other examples where the pioneering firms were able to set the industry standards are scattered throughout the literature. For example, in personal stereos, the Sony Walkman is still the industry standard holding over 50 percent of the market share (Schnaars, 1986). In the superpremium ice cream market, soon after its introduction in 1961, Häagen Dazs's reputation spread beyond its home base (the Bronx, New York). Its ice cream became the industry standard that followers such as Frusen Gladje, Alpen Zauber or Ben and Jerry's tried to imitate. Thirty years after introduction, Häagen Dazs still dominates the segment.

Pioneers, however, are not always able to define the industry standard. In the VCR industry, Sony's Beta system lost out to the later entrants' (JVC and Matsushita) VHS systems, partly due to Sony's restrictive licensing policy (Rosenbloom and Cusumano, 1987). Similarly, nearly all personal computer firms that used the CP/M and other operating systems failed after late entrant's (IBM) DOS-based computers

became the industry standard (Ahl, 1984). Even Apple relinquished its leadership position.

*Emergence of industry standards for radically new technological innovations* has been covered in literature dealing with technological change by Abernathy and Utterback (1978), Abernathy and Clark (1985), Friar (1986), Rosenberg (1982), Olleros (1986), Teece (1986), Tushman and Anderson (1986), Anderson and Tushman (1990), and Wernerfelt and Karnani (1987) among others. Collectively, these studies concur that the original technological discontinuity that starts a new product class does not become a dominant design.

Those who propose that the first entrant can define the industry standard represent the false stereotypical view that radical innovations are culminating points of some basic research and new knowledge (Rosenberg, 1982, p.156). That they are not. Rather, the initial innovation signals industry turmoil and the beginning of a series of new developments where a number of different designs compete to become industry standard.

After some trial and error period, one design or a small group of designs evolve as the more prominent because they better satisfy the needs of a broad spectrum of customers. Once a dominant design emerges, reduced uncertainty shifts the competition from design to price. In an attempt to lower costs, firms focus on process innovation exploiting specialized capital, economies of scale and learning. If the series of followup improvements are rapid or radical, the pioneer's initial breakthroughs quickly lose their value in the market. Therefore, innovators in these kinds of markets, who zealously hang on to their proprietary technology and try to go it alone, tend to fall hopelessly behind and eventually disappear (Abernathy and

Utterback, 1978; Olleros, 1986; Teece, 1988).

Empirical evidence in support of this opposing view is provided in two studies by Tushman and Anderson (1986) and Anderson and Tushman (1990). In their longitudinal studies of cement, glass and minicomputers, the researchers found that:

- the niche opening technological discontinuity never became the industry standard (16 out of 16 cases)
- average time for industry standard to emerge was 9.6 years ranging from 5 to 20 years (12 cases) after the initial discontinuity was introduced
- in four discontinuities which did not lead to industry standards, two had strong patent protection, and the other two were quickly leapfrogged by other discontinuities
- dominant designs were technologically conservative and incorporated features pioneered elsewhere
- niche opening innovations that evolved into a new product class were quickly overshadowed by other advances introduced by later entrants

Analyzing medical ultrasound imagers, Friar (1986) found that, in over thirty years of the product's existence, no dominant design emerged. Even though equipment designed on one technology can be used to diagnose different disorders in several medical specialties (cardiology, obstetrics, neurology, etc.), each specialty has a preferred technological design. Therefore, the ultrasound industry remained very fragmented with no one company having more than 10% of the total ultrasound market. Of the seven firms (all small startups) that introduced major innovations and pioneered new segments, none gained any lasting benefits. Most withdrew from the market (Friar, 1986). Firms that succeeded were late entrants typical of divisions of larger established firms such as General Electric, Phillips, Picker, Hewlett Packard, Toshiba, and Johnson and Johnson. Whereas having a dominant design may be an

asset in the earlier stages of the product life cycle, it may be a liability in a mature stage when customer needs may change. Literature is replete with examples where the industry leaders were reluctant to change from mature technologies that were highly profitable. In Cooper and Schendel's (1976) sample of 22 companies, all but one continued aggressive improvement of old technology while making some effort to participate in the new technology. Only 3 firms were successful in a long run. Xerox, Ford, Gillette (Ghemawat, 1986) and Medtronic (Yip, 1982), among others, also suffered major losses of market share by trying to hang on to aging product designs too long.

From the above review, several conclusions emerge.

- First, in consumer nondurables the pioneering brands tend to remain in consumers' evoked set and become the industry standards (Davidson, 1976; Ries and Trout, 1986). Therefore it pays to launch these products as early as possible (Yoon and Lilien, 1985).
- Second, in emerging technology - based industries, the pioneer's products are usually leapfrogged by later entrants and pioneers often get stuck with obsolete technology (Olleros, 1986; Anderson and Tushman, 1990).
- Third, large firms have a much better chance of setting an industry standard than small ones, even if they enter the market later (Teece, 1988; Wernerfelt and Karnani, 1987).
- Fourth, for technological innovations, emergence of standard is not an engineering issue determined by a pioneering firm, but a result of strategic alliances (Anderson and Tushman, 1990).
- Fifth, in industries where customer needs are substantially different, or when the pioneering firm controls the technology through strong patent protection, dominant design may not emerge (Friar, 1986; Anderson and Tushman, 1990).

#### **D. Patent Protection**

Theoretical literature has proposed that pioneers can gain a long run advantage

if the technological know-how can be kept proprietary through patent protection or other means (Porter, 1985). Most economic models dealing with this issue assume that the patents protect the company from imitation for duration of its life (Mansfield, Schwartz and Wagner, 1981). Even though there are some examples to support that assumption, empirical evidence shows that those are the exceptions rather than the rule.

Some instances where the first movers were able to enjoy long-term patent protection include DuPont in Spandex (Hirsch, 1989), Xerox in copiers (Bresnahan, 1985), Polaroid in instant photography (Cole, 1989) and GE in light bulbs (Lieberman and Montgomery, 1988). Since the introduction of spandex (a fiber used to make tightfitting stretchable clothes), DuPont still dominates the market even after patent expirations because of the difficulty in mastering the process know-how (Hirsh, 1989).

In spite of Polaroid's wall of patents in instant photography, Kodak entered the market and infringed on Polaroid's patents. After prolonged law suits Kodak withdrew from instant photography and faced \$6 to \$18 billion in damages for patent infringements (Cole, 1989).

Mansfield's et al. (1981) study found that 60% of patented innovations were imitated within four years at a cost some 30% below the innovator's. Only in the pharmaceutical industry were patents regarded as important and indeed increased the cost of imitation over the median by about 30%. In two studies by Robinson and Fornell (1985) and Robinson (1988), only about 20% of pioneers claimed significant benefits from a product patent or trade secrets but their market share was only 1% higher than that of pioneers without patent protection. Therefore, it seems that

patents do not protect the pioneering firm from imitators.

If the market is of key strategic importance to a follower, or the innovator threatens incumbent's core products, the pioneer's patents will not deter an entry. For example, in the diagnostic medical equipment industry, patents on computed tomography scanner (CT) held by EMI Ltd. were ignored by all followers. Although EMI eventually won patent infringement law suits, industry incumbents forced EMI out of the market by 1980 (Barron, 1979; Teece, 1988).

In conclusion, research now shows that patents offer only weak protection, because competition can invent around them or outright ignore them.

#### **E. Preemption of Market Position**

Another advantage available to the first entrant is that it can preempt its competitors by positioning its product in the most desirable and lucrative market segment(s) (Bain, 1956; Porter, 1985; Robinson and Fornell, 1985).

Since there are limited number of profitable market opportunities followers are forced to enter less lucrative segments unless they want to engage in head on competition with the incumbent firm. In that sense, the pioneering firm erects barriers to entry to subsequent followers.

The theoretical model formulated by Hauser and Shugan (1983) simulates just such market positioning scenario. In their model the pioneering brands sales and market share depend on how well the first entrant designed the product attributes to satisfy the broad and heterogenous consumer preferences. If the pioneer chose the optimal position in a multiattribute space, the follower will end up with lower market share and inferior position if it wants to differentiate its product. Nevertheless, if the pioneer brand did not understand the consumer choices, the second entrant can gain

competitive advantage and lasting market share benefits.

Literature dealing with the order of entry considers two types of space preemption strategies: preemption along geographic space and preemption through product attribute space.

### **1. Geographic Preemption**

Theoretical work on geographic preemption in the economic literature has been explored by Prescott and Visscher (1977), Eaton and Lipsey (1979), and Rao and Rutenberg (1979). They proposed that, as the market grows the pioneers fill the market niches before the competition is able to establish a foothold. However, empirical study of a newspaper industry by Glazer (1985) suggests that geographic preemption strategies are rarely successful. The author explains that even though the industry structure is such that geographic preemption is possible, pursuance of such strategy would eliminate all profits.

On the other hand geographic preemption strategies in the convenience store industry, discount retailing, and fast food seem to have been effective. In the convenience store industry, the first entrant, Southland Corporation's 7-Eleven stores, maintained its leadership position for the past sixty years. In 1978, 7-Eleven had combined revenue of \$3. billion (35% market share) in an industry consisting of 33,000 stores with sales of \$8.7 billion. In comparison with its competition, 7-Eleven was about eight times the size of Manford, the nearest rival, and twice as large as the next eight firms combined. Comparably, profit margins for 7-Eleven stores were substantially higher than the industry average. One of the key factors to Southland's success was its meticulous store site selection (Thompson and Strickland, Case No. 10, 1987).

Likewise, a case study of Wal-Mart discount stores (Ghemawat, 1986) supports the feasibility of geographic preemption strategies. Wal-Mart successfully penetrated the small towns and rural areas which competitors thought to be unprofitable. Since the markets were too small to support another large retailer, Wal-Mart preempted others from entering. In conclusion, there is some evidence that geographic preemption, at least in the retailing industry, leads to defensible first-mover advantage. However, the retailing industry is a special situation where a good store location determines commanding position in the market.

## **2. Preempting a Product Position**

The term product positioning refers to the space a product or brand occupies in a market. There is some empirical evidence to the notion that pioneers tend to preempt the product space. Studies by Lambkin (1988), Robinson and Fornell (1985) and Robinson (1988) indicate that pioneers tend to enter the markets with higher quality products and broader product lines to cover multiple market segments. The higher quality and broader product line lead to significant market share advantages for pioneers. In the case of industrial goods Robinson (1988) found that pioneers' higher quality yields 4.3 share point advantage while a broader product line increases pioneers' average market share by additional 3.8%. In comparison, in consumer goods pioneers' broader product line leads to 8.1% market share advantage whereas higher quality yields only 2.9% market share points (Robinson and Fornell, 1985). This finding supports the notion that product quality is more critical to buyers of industrial products than to buyers of consumer products. However, the authors also found that for both product groups pioneers' quality advantage deteriorates drastically over time. Product breadth advantage deteriorates only for pioneers in consumer

goods.

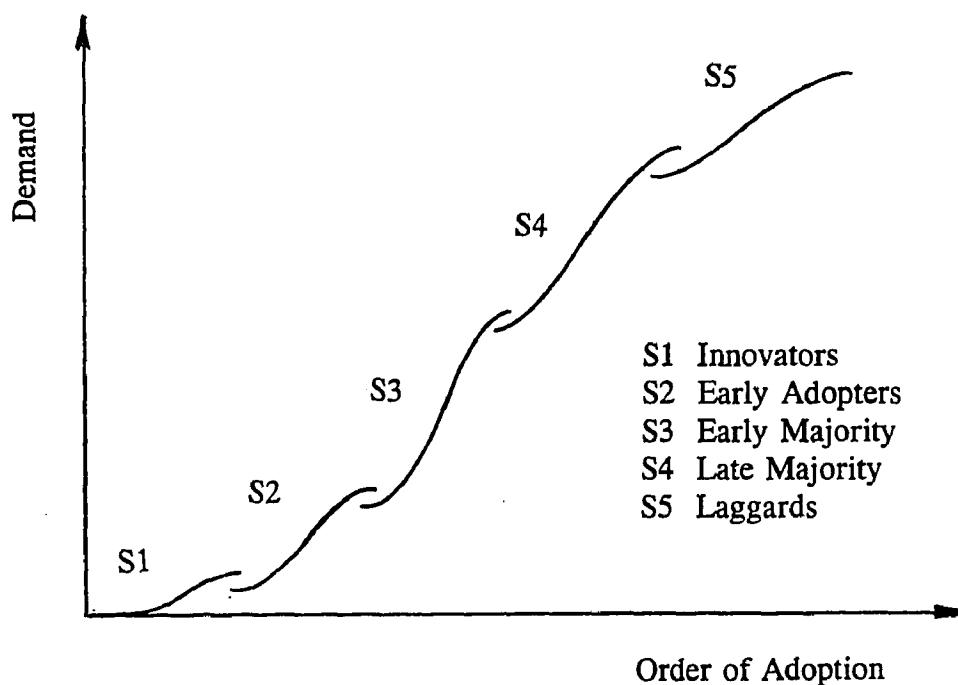
On the other hand, a study by Urban et al. (1986) found that pioneers were not significantly better at positioning their products in the more desirable market segments. Often a follower enters with a product that is noticeably better on dimension(s) that customers value. For instance, Maxim lost its leadership in freeze-dried coffee to Tasters Choice by positioning itself as better tasting (Aaker and Day, 1986).

Likewise in his study of the paging industry (beepers) Schellinck (1983) found that the later entrants were better positioned in the market and offered a broader product line. First entrant's market share suffered accordingly, dropping from 70% to 30% by the fourth year as new firms entered the market.

In emerging high technology industries positioning is often a combination of luck and staying power. The product designs and market conditions often change so rapidly that any attempt to preempt a position in early stages are futile (Teece, 1988). Olleros (1986) found that in the semiconductor industry, the early pioneers like General Electric, RCA, Transitron, Philco, Raytheon Germanium Products and Sylvania faded away because the later entrants (National Semiconductor, Texas Instrument, Fairchild etc.) literally leapfrogged the technology and went on to dominate the market at least until even later entrants, mostly Japanese firms, took over the leadership with better quality and lower cost products (Tsurumi et al. 1991).

Furthermore, the contention that the first entrant can select the most lucrative market segment is based on the assumption that there is a large, latent and identifiable market at the time of innovation introduction. That is hardly the case, especially for radically new innovations. As the theory of diffusion of innovation predicts, the

largest and most lucrative segments are the early and late majority. To figure out who they are and when they come aboard is the major uncertainty that the pioneers have to contend with. While waiting for these segments to emerge, the first entrant needs to develop and satisfy the smallest segments - the innovators and early adopters. However, as the uncertainties resolve and market enters rapid growth (S3), large followers enter and are able to grow very rapidly by targeting the mass markets (early and late majority) with improved products (Figure 2.2).



**Figure 2.2 Effect of Adopter Categories on Demand**

In conclusion, pioneers, indeed, have the opportunity to preempt the product or market position but whether they are able to seize this opportunity and defend the position had not yet been answered because of the cross-sectional nature of the empirical studies. It appears that pioneers may be more successful preempting a

position in inexpensive consumer products than in industrial products. Likewise, preemption is easier and more lasting if the technology evolves gradually and customer needs are more homogeneous. Attempts to position an innovation in the mass market in the emerging stage of the product life cycle (PLC) is infeasible and counterproductive because mass markets usually do not yet exist.

#### **F. Preemption of Channels of Distribution**

Perhaps one of the even more critical advantages a first mover may enjoy is the preemption of the channels of distribution. While the pioneering firm can have a pick of the best distributors or retailers the followers may have to settle for second best or even be left out (Porter, 1985; Gemawat, 1986; Yip, 1982). For instance, in the diamond industry, De Beers controls 80% of the western market (Ghemawat, 1986). It would be difficult, to say the least, for any diamond mine to market its product without De Beers concessions. Even USSR "voluntarily" sells a good portion of its output through De Beers.

In the heavy equipment market, Komatsu was able to gain only 3% of the U.S. market share (Yip, 1982) in spite of comparable product quality and 10% to 15% price advantage because Caterpillar has tied-up the distributors. In the premium ice cream segment in 1981, Häagen Dazs was sued by Alpen Zauber for threatening to withhold its ice cream from the distributors who also carried Alpen Zauber (Thompson and Strickland, 1987, Case No. 16). Even though Alpen Zauber won the case it was forced out of the market partly because retailers themselves did not want to carry more than a small number of superpremium brands.

The matter was worse in personal computer and software industries. By 1982 there were over 150 PC manufacturers desperately fighting for the limited shelf space

at the retail level (Aaker and Day, 1986). Channel overcrowding precipitated later industry shakeout.

However, preemption of distribution channels is a double-edge sword. Currently, there are too many new products chasing too few shelf spaces. Even worse, in the last decade, the power has shifted from the manufacturers to retailers. Not only are the retailers reluctant to accept new products but also, often, they require slotting fees, at time in excess of six figures. Obviously, a new entrant, unless from a major manufacturer, is going to have an extremely hard time penetrating the market.

In conclusion, the literature concurs that, in both industrial and consumer products, preemption of distribution channels serves as a very effective deterrent to new entries into the market. However, even this conclusion is mostly based on isolated examples of firms where the entry order had not been verified. There is no empirical evidence that it is the first mover that preempts the distribution channels. None of the empirical research on first-mover advantage examined this issue.

#### **G. Preemption of Inputs or Other Scarce Resources**

Favorable access to facilities, inputs or other scarce resources is another advantage that first movers may enjoy over followers (Porter 1985; Ghemawat, 1986). In emerging industries shortages of raw materials are very common. The exploding demand and inadequate supply often drive the price of key components through the roof. The most quoted example is that of the airline industry after the deregulation. The early entrants to the market were able to buy used aircraft at a fraction of new airplane's cost, lease unused terminal space at infrequently traveled airports and hire unemployed pilots, mechanics and other ground personnel. Thus, in

1981 and 1982, People Express bought 17 Boeing 737's from Lufthansa for \$70 million (\$4.1 million per plane) when new ones were going for about \$13 million (Thompson & Strickland, 1987, Case No. 2). Later entrants faced much higher prices, because of the dearth of used airplanes.

In the same manner, James River Corporation was able to keep its assets-to-sales ratio to two thirds the industry average by buying obsolete commodity paper machines at fire-sale prices and converting them to specialty products (Ghemawat, 1986). In high technology industries such as computer, electronics and biomedicine, the early entrants, including new startups, were able to raise "cheap money " on Wall Street. As disappointments poured in, the lofty price/earning ratios were scaled down and many later entrants were not able to raise money at all.

How widespread and advantageous is the strategy of preempting scarce inputs by pioneers is not known because empirical studies on order of entry did not address this issue. However, one can speculate that it would play an important role in such industries as natural resources, airlines, television and radio broadcasting and telecommunications (where the government regulates the assignment of frequencies), among others.

#### **H. Switching Costs**

Switching costs in context of first mover advantages are the one-time costs associated with buyer's converting from one vendor to another. Conventional wisdom among marketing practitioners supported by somewhat spotty empirical evidence is that first entrants to the market can capture future sales if switching costs are high. Theoretical work on this subject by Bain (1956), Schmalensee (1982), and others sets forth that customers remain loyal to pioneer's brand (because of uncertainty that the

second brand will work) and, for the follower to attract away customers not only does the firm have to give substantial discount, but it must also offer a product with distinct advantage. In a nutshell, to try a new brand, the customer must receive enough incentive to overcome his switching cost.

Perhaps the most compelling empirical evidence to support this proposition is presented by Davidson (1976). In his study of 100 new grocery brands Davidson found that 70% of new brands failed because they were "me toos" and "me threes" that brought nothing new to the customer thus providing no incentive to switch. A study by Ghemawat (1986) on sustainable advantage also supports the notion of consumer's risk aversion. As a pioneer, Borden was able to attain dominant position in processed lemon juice because consumers did not feel it was worthwhile to take a chance on untried brands.

Besides buyers' propensity for risk aversion, the following types of switching costs are said to enhance the first mover's advantage:

- switching costs due to time and resources required to evaluate a new supplier,
- switching costs due to retraining and relearning in use of a substitute vendor's product,
- switching costs due to sunk cost in product and related complementary equipment, and
- switching costs due to contractual agreements or captive customer (e.g. frequent-flyer program).

The argument and support for the value of these switching costs to the pioneers is based more on intuitive reasoning illustrated with some incidental examples rather than systematic large scale empirical evidence.

For instance, Ghemawat (1986) says that Tandem computers (a pioneer of

non-stop computers) has maintained preferred access for upgrades even after other competitors entered the market because changeover from one system to another is very expensive. Also Tandem made upgrading very simple by designing its computers in modular form and compatible with older models.

In spite of the shortage of empirical studies dealing with switching cost and timing of entry, some generalizable conclusions about its value can be drawn out.

First, switching cost represents substantial barriers to entry to followers when the evolution of technology is gradual rather than rapid and discontinuous. In the later case, the followers are able to leapfrog the pioneer, Olleros (1986), Yip (1982).

Second, for switching cost to be of value in a long run, it is necessary that the pioneer captures and maintains dominant market share through the rapid growth stage. Yoon and Lilien (1985) in their study of 112 French industrial products found that if the pioneer did not capture leading market share at the beginning it did not succeed in the long run.

Third, the switching cost is a more durable disincentive when consumer benefits from brand switching are relatively small (applicable to inexpensive, infrequently purchased products). Thomas (1985) reports that despite increased competition from later entrants Airwick was able to maintain 60% market share of the rapidly growing carpet deodorizer segment.

In conclusion, if substantial switching cost exists the preferred marketing strategy for the pioneer is to go for initial high market share even at the expense of profits. The drawback, however, is that if the followers pursue the same strategy competition for share will fritter away industry profits even in the later stages of the product life cycle.

### III. FOLLOWER ADVANTAGES - OR FIRST MOVER DISADVANTAGES

Competitive advantages are not always captured by the pioneering firm. Often, the principal beneficiaries of the pioneer's quests are the follower firms or customers. This portion of the paper, then, will review the literature concerning the first-mover disadvantages, which often are the same as the advantages of the followers. Therefore, the phrases will be used interchangeably.

The early literature (see Bain, 1956; Robinson and Fornell, 1985; Robinson 1988; Dasgupta and Stiglitz, 1980; Loury, 1979) either ignored these disadvantages or assumed that the pioneering-based advantages overwhelmingly outweighed the disadvantages. But this position came under some criticism in the mid 1980s. Several researchers proposed that the advantages of pioneering have been overestimated (Schnaars, 1986; Olleros, 1986; Aaker and Day, 1986; Mansfield, 1985; Teece 1988; Mitchell, 1989)

The ensuing section of the literature review will focus on:

- A. the cost of pioneering and the free-rider benefits of followers
- B. environmental uncertainty
  - 1. market demand uncertainty
  - 2. change in buyer needs
  - 3. technological uncertainty
- C. incumbent inertia that leads to stagnation.

#### **A. Cost of Pioneering and the Free-Rider Effect**

First movers carry the brunt of the cost associated with inventing and commercializing the new products. Besides the upfront money to develop the new product, the costs include: gaining regulatory approvals, achieving code compliance, educating buyers, developing infrastructure, developing complementary products, and

absorbing the high cost of early inputs (specialized tools and machinery, work force training, etc.) (Porter, 1985). These costs increase with the increasing degree of newness of the product (Donnelly and Etzel, 1973).

It often overwhelming even for large corporations, the expense and amount of effort can be disastrous for small firms. In his study of emerging high-technology industries, Olleros (1986) concluded that the majority of pioneers burn out before the market takes off. With their investments they open new markets, but the benefits accrue to later entrants, who get a free ride. Thus, early pioneers in the semiconductor industry lost out to second- and third - generation entrants. Furthermore, Teece (1988) points out that although technically successful, pioneers often fail to extract the economic value from the innovation because they lack resources or otherwise fail to develop cost-competitive capabilities downstream from R&D (production, distribution, promotion, service, etc.). For example, in electronic calculators, Bowmar could not withstand the competitive pressure from a later entry by Texas Instruments (Teece, 1988).

In a study of new ventures in the U.S. semiconductor industry, Schoonhoven, Eisenhardt and Lyman (1990) found that new entrants with incremental improvements of existing products were more successful than entrants with more radical technological innovations. Also, they found that new entrants into markets with more competitors (more mature markets) outperformed new entrants in markets with fewer competitors (evolving markets). These findings contradict the first-mover advantage model and suggest that new organizations are better off targeting existing markets with incremental improvements rather than trying to gain market acceptance of breakthrough innovations.

The ability of the later entrants to capitalize on the pioneer's investment has been investigated in the economic literature under the heading of free-rider effects. While the theoretical work concentrates on intra-industry diffusion of technology in the form of learning spillovers in R&D and the production process (Spence, 1981 and 1984; Ghemawat and Spence, 1985; Lipman and MacCardle, 1987), it ignores all other costs imputed to pioneering. Hence, these studies underestimate the free-rider effects. Even so, their conclusions are that the learning - curve spillovers reduce cost differentials among firms, lower entry barriers, and accelerate industry-wide cost reduction, but they discourage firms from investing in R&D since the know-how cannot be kept proprietary. Prior empirical evidence of technology leak-out and low cost of imitation has been presented by Mansfield et al. (1981) and Mansfield (1985) (already discussed in the earlier section on the experience effect).

#### **B. Environmental Uncertainty**

Besides absorbing the initial cost, pioneers face high risks due to uncertainty in the environment. These uncertainties arise from:

1. market demand uncertainty (amount, timing, which market segment)
2. change in buyers' needs
3. technological uncertainty

Conceptual work by Wernerfelt and Karnani (1987) consider the trade-off between entering early and entering late when uncertainty is resolved, and the trade-off between betting on a single scenario (focus) and maintaining flexibility through pursuing several scenarios. The writers propose that in situations without major first-mover advantages, a firm should wait for the uncertainty to resolve itself. On the other hand, a firm should enter early and focus if it has the market power to

influence the resolution of uncertainty in its favor.

### **1. Market Demand Uncertainty**

With respect to market demand, the pioneering firms face the questions of: level of demand and market growth rate for several years ahead; the appropriateness of timing of entry; and which market segment(s) to pursue. If the demand forecasts are high and the product has high visibility, the industry will attract many new entrants. In such situations, shakeout is inevitable soon after introduction and is triggered either by an unanticipated slow-down in growth, plant overcapacity from aggressive investments, or an assault by a later entrant cutting prices (Aaker and Day, 1986). Such scenarios have been observed in the airline industry after deregulation (where some 220 new firms entered, but by the mid 1980's, only about 30 survived), in video games (Williams, 1988), oil drilling (Nusbaum, 1986), CB radios (Schnaars, 1986) and robotics (Olleros, 1986), among others.

Pioneers may face demise by selecting the wrong segment of the market. Olleros (1986) gives an account of three pioneering companies (MITS, IMSAI, and Processor Technology) in the personal computer industry which entered the market prior to 1976, two years before Apple, but failed to become a permanent force in the market because they focused on the small computer-buff market. Not only did these pioneers not survive, but also the title of pioneer was bestowed onto Apple - an early follower which better positioned itself in the market. This supports the point made in the introduction that the title of the pioneer often goes not to the first entrant, but, rather, to an early survivor who stays in the limelight the longest. The crown jewel, the dominance of the market, however, was taken by a late follower, IBM, which targeted the office segment while Apple was tapping the home and education

segments. Other examples of false starts where substantial demand did not materialize include Anheuser Busch's entry into low-alcohol beer and RCA's entry into videodiscs (Schnaars, 1986).

In conclusion, the advantage of delayed entry is that the company can learn from the pioneer's experience. Market forecasts, especially for radically new products, are inherently inaccurate. Therefore, a follower is in a far better position to assess the total market demand and thus decide what plant capacity to invest in. Likewise, it can select the most lucrative market and attack the early entrant where it is weakest. Most later entrants usually rely on some type of competitive advantage in the form of superior resources, market power, production capabilities and product improvements.

## **2. Change in Buyer Needs**

Besides experiencing uncertainty concerning the amount of demand and which market segment to pursue, the pioneer is also vulnerable to changes in buyer needs. For example, the firms that rushed to develop alternate sources of energy after the "oil shocks" in 1973 and the early 1980s suffered huge losses and bankruptcies when the price of oil dropped. Such was the fate of shale oil developers, wind mill generator and solar energy cell manufacturers.

Likewise, in 1970 the U.S. manufacturers of color television sets began to lose their dominant position to Japanese firms as the demand shifted from large console models to table and portable models (Tsurumi and Tsurumi, 1980). The models of Japanese manufacturers were also cheaper, yet more reliable.

Similarly, the oil crises of 1973 and 1979 precipitated a sudden change in preference of U.S. consumers for small cars. The oil shock caught the U.S. firms

completely unprepared but the timing could not have been better for the Japanese firms. By 1970, the Japanese auto industry had completed its transition into efficient mass production era and was fully capable of meeting the U.S. demand for small cars (Tsurumi and Tsurumi, 1980, 1983).

### **3. Technological Uncertainty**

In rapidly evolving industries, technological discontinuities work against the pioneer by making his investment obsolete (Porter, 1986) early in the product life cycle. These discontinuities provide an opportunity for followers to leapfrog the pioneer and establish new standards in the industry. Olleros' (1986) and Anderson and Tushman's (1990) studies of high-technology industries reveal that the dominant design may not emerge until several product generations later. By the time the game of "musical chairs" (Teece, 1988, p. 51) is over, the pioneer may be at a disadvantage or gone from the market.

In the initial stages many firms will follow false leads and fail in the process. According to Olleros (1986) and Anderson and Tushman (1990), the threat of the new technologies is often not that obvious because the "old" technology is still growing, so the pioneer may not react until it is too late.

In other instances the new technology may be completely incompatible with the previous one. For instance, in the semiconductor industry, Fairchild's breakthrough introduction of silicon in 1960 made the investments in germanium technology of earlier pioneers such as Hughes, Raytheon, Germanium Products, and Transitron worthless overnight (Olleros, 1986). Likewise, the early designs of minicomputer pioneers such as Burroughs, Packard Bell and Monroe were made obsolete by Digital Equipment's 1965 architecture that used integrated circuits (Tushman and Anderson,

1986). Similarly, Matsushita's VHS videotape recorder introduced in 1976 displaced the earlier incompatible formats of Sony (Betamax), Sanyo (V CORD II), and Quasar (VX).

### **C. Incumbent Inertia**

While industry dominance is what the pioneer strives for, it may be a liability in the later stages of the product life cycle. The problems stem from reluctance to introduce new products in order to avoid cannibalization of the existing product line; and the firm may become too big and rigid to respond effectively to market changes.

The issue of cannibalization of current product has been addressed by Cooper and Schendell (1976), Yip (1982), Ghemawat (1986), and Lipman and McCardle (1987). The authors concur that the incumbents are more reluctant to invest in R&D and that they try to milk their current products even though their market position may be suffering. When BIC introduced the 19-cent ball point pen, Gillette lost its leadership because it did not want to compromise the higher-priced Paper Mate Line (Cooper and Schendel, 1976). Likewise, IBM and Xerox dragged their feet in introducing new products because of their large rental base of not yet depreciated equipment and IBM's insistence on the compatibility of new products with its old line (Ghemawat, 1986).

Empirical evidence of large firms being less responsive to market changes is provided by Mansfield et al. (1977), Stalk (1988), Anderson and Tushman (1990) and Mitchell (1991). In separate studies of the steel, petroleum, coal and pharmaceutical industries, Mansfield and his co-authors found that large firms accounted for fewer product and process innovations (as measured by proportion of assets or sales) than their smaller counterparts. Moreover the innovations of large firms were more likely

to be only product line extensions or marginally new products rather than revolutionary new products. Mitchell (1989, 1991) found that, in the medical imaging industries, large incumbents were followers and only entered the new technical subfield when the demand was proven. Yet, because the incumbents' specialized assets (distribution network, service, reputation, etc.) retained their value from one product generation to another, incumbents were able to take over the market in the new technological subfield.

#### **IV. SUMMARY OF FINDINGS**

In spite of the shortcomings of many studies, some central conclusions emerge from the literature. Many of these conclusions are contrary to current dominant thinking and empirical evidence, thus they are only conjectures still to be verified.

##### **Product characteristics**

1. Success of pioneers is a function of product class and degree of product newness.
2. Pioneers of inexpensive consumer products tend to be more successful than followers.
3. Pioneers of discontinuous innovations tend to be less successful than early followers or late entrants.
4. Pioneers of incremental innovations tend to be more successful than pioneers of radical, technologically complex innovations.

##### **Company characteristics**

5. Large industry incumbents tend not to be pioneers of radical innovations.
6. Radical innovations tend to be introduced by new entrants.
7. Because of their superior resources and ability to come from behind, large incumbents can afford to be followers and still become a dominant force in the market.

8. Small pioneering firms tend to lack the complementary capabilities down-stream from R&D, therefore they extract less value from the innovation than their large counterparts.

#### Industry standards

9. First movers' ability to define the industry standards depends on the rate of technological change. Technological discontinuities penalize first entrants.
10. Initial technological discontinuities do not become industry standards.
11. Industry standards emerge later in the product life cycle.
12. Designs that emerge as dominant tend to be technologically conservative and incorporate features pioneered elsewhere.

#### Reputational benefits

13. Reputational benefits accrue over time. If the pioneer does not survive, the reputation for pioneering is bestowed upon the successful later entrant.
14. First-mover's enhanced reputation is more sustainable in consumer products than in industrial products (subject to survival).

#### Environmental uncertainty

15. First-mover advantages are more durable in slowly evolving environments.
16. Delay of entry is risk-shifting strategy where pioneers absorb technological and demand uncertainty for followers.

#### Durability of first-mover advantages

17. Over time, as the number of competitors increases, order-of-entry becomes secondary to product superiority, product positioning, advertising, and manufacturing capabilities.
18. Because of industry-wide learning, first movers do not gain a lasting cost advantage from experience effect.
19. Patents offer only a weak protection to pioneers.
20. First-mover advantage from geographic preemption seems to be strong and durable in the retailing industry. However, other industries had

not been explored.

21. First-mover advantage from preempting a product position is more lasting in consumer products than in industrial products.
22. Pioneers of radically new innovations cannot preempt most lucrative market segments because these markets emerge later in the product life cycle.
23. Preemption of channels of distribution is one of the strongest and most durable advantages available to first movers.
24. Preemption of scarce inputs is only important in certain emerging rapidly growing industries. This advantage tends to be only of a short duration.
25. For a switching cost to be of value in a long run it is necessary that the first mover captures and maintains dominant market share through the rapid growth stage.

There is a general theme running through the reviewed literature of emerging industries. While the innovator is the source of the fundamental scientific breakthroughs and the early design of the product, more often than not, it is the imitator improving the basic design and the production process who ultimately reaps the benefits of the newly created market.

## **V. OPPOSING SCHOOLS OF THOUGHT**

The preceding review of the literature analyzing the issue of sequence of entry into the market and the subsequent company performance reveals rather diverging streams of thought. Exact comparison and tabulation of all empirical findings is impossible because studies used inconsistent definitions of success and failure and noncomparable measures of order of entry. Therefore, findings are summarized in four separate tables.

### **A. Proponents of First-Mover Advantages**

The dominant school of thought represented by Bain (1956), Britain and

Freeman (1980), Dixit (1979, 1980), Eaton and Ware (1987), Lambkin (1988), Schmalensee (1982), Spence (1979, 1981), Robinson and Fornell (1985), Robinson

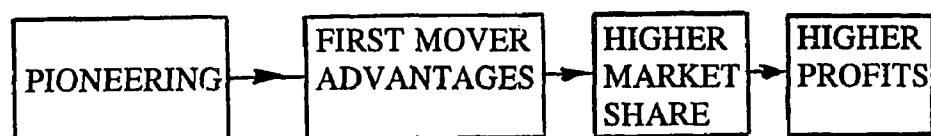


Figure 2.3 Pioneering leads to dominant position in the market.

(1988), Urban et al. (1986), Grabowski and Vernon (1987), and Miller et al. (1989), among others, assumes that the advantages of first entrant, such as scale economies,

Table 2.1 Relationship between order of entry and market share: Summary of three studies

	Robinson & Fornell (1985)	Robinson (1988)	Lambkin (1988)		Average of the four samples	Share relative to pioneer brand
			Startup sample	Adolesc. sample		
	Average		market share			
Pioneers	29%	29%	24%	32.6%	28.9%	1.0
Early Followers	16%	21%	9.6%	18.8%	16.4%	.57
Late Followers	11%	9%	9.7%	13.7%	10.6%	.37
Sample size	371	1209	129	187	----	---
%-age variation explained by order of entry	18%	8.9%	13%	21%	15.2%	---

experience effect, favorable access to inputs and markets, preemption of position or other strategic opportunities will lead to sustainable superior performance in the market. In short, their position is that pioneering leads to success and a dominant position in the industry, while later entry results in a significant market share penalty and lower profits (Figure 2.3). The disadvantages of pioneering are not considered.

And indeed, the evidence of five large-scale empirical studies by Robinson and Fornell (1985), Robinson (1988), Lambkin (1988), Miller et al. (1989) and Urban et al. (1986) in Tables 2.1, 2.2 and 2.3 show support for this school of thought. The results of three PIMS data-based studies (Table 2.1) suggest that the early-followers can expect to achieve only 57% of the pioneer brand's sales and late followers mere 37%. Order-of-entry alone explained 15.2% variation in market share.

Similar order-of-entry penalties were confirmed by Urban's et al. (1986) sample of 129 consumer packaged goods summarized in Table 2.2. Urban's study also reveals that as the number of brands increases, the marginal order-effect penalty decreases.

### **B. Challengers of First-Mover Advantages**

A later group of researchers represented by Lieberman and Montgomery (1988), Mansfield (1985), Mitchell (1991), Schnaars (1986), Olleros (1986) and Teece (1986) challenges the unequivocal first-mover advantage on several fronts. They propose that the advantages are often not sustainable, a function of other intervening variables (entrant characteristics, innovation newness) or outweighed by first-mover disadvantages.

In an empirical study of 129 French industrial products, Yoon and Lilien (1985) found that firms which introduced radically new innovations gained higher

market share if they delayed an entry until the product was "debugged" and the market more developed. On the other hand, if firms introduced only marginally new products, higher market shares were correlated with earlier entry. Hence, Yoon and Lilien showed the potential danger in the notion that "earlier is better", irrespective of product characteristics.

The effect of inter-firm differences on market share and survival was demonstrated by Mitchell (1991) in a study of five radically new innovations in the medical diagnostic imaging industry. Although followers, industry incumbents gained larger market share and survived longer than industry newcomers. In the short run, earlier entrants attained higher initial market shares. This share advantage was retained in the long run, only if the firm survived. However, survival was higher among later entrants. His findings help to explain why cross-sectional studies that contain only survivors tend to find positive relationship between early entry and higher market share.

**Table 2.2 Order of Entry Penalty in Urban's Study. (Source: Urban et al., 1986)**

Entry Order	Share Relative to Pioneering Brand	Share (%)					
		1st	2nd	3rd	4th	5th	6th
First	1.0	100	-	-	-	-	-
Second	.71	58.5	41.5	-	-	-	-
Third	.58	43.6	31.0	25.4	-	-	-
Fourth	.51	35.7	25.4	20.8	18.1	-	-
Fifth	.45	30.8	21.9	17.9	15.5	13.9	-
Sixth	.41	27.3	19.4	15.9	13.8	12.4	11.2

**TABLE 2.3 Performance of Pioneers in Seven Empirical Studies**

AUTHOR	MEASURE OF PERFORMANCE	FINDINGS
Fesser and Willard (1990)	5 year avg. corp. growth (%)	Firms growth rate was unrelated to order entry
Lieberman (1989)	survival	Survival was unrelated to order entry
Lilian and Yoon (1990)	Product growth to a product class	Most successful 3rd & 4th entrants, followed by 7th or later, followed by 5th & 6th, followed by 1st & 2nd entrants
Mitchell (1991)	SBU mkt. share (%)	Later entry associated with longer survival but lower market share. Incumbents outperformed new entrants in spite of later entry. Incumbents' decreasing mkt. share with later entry only when compared to other incumbents
Miller et al. (1989)	SBU mkt. share (%)	Decreasing mkt. share with later entry
Moore et al. (1991)	SBU mkt. share (%)	Results mixed. Propose that pioneers outperform followers because pioneers are stronger competitors to begin with, not because pioneering causes change in market structure that benefits pioneers
Vanhonacker & Day (1987)	SBU mkt. share (%)	Same as Moore et al. (1991)

### C. Who is right?

Ignoring the conceptual paper and just using the method of "vote counting" of the empirical studies (Table 2.4), one would conclude there is strong evidence in support of the first-mover advantage model. Eight samples indicate that earlier entry has a positive influence on market share, two found negative effect and three indicate mixed or insignificant influence.

**Table 2.4 Support for First Mover Advantage**

STUDY BY	Influence of pioneering entry on market share		
	Positive	Negative	Mixed or Insignificant
Fesser & Willard (1990)	X		
Lambkin (1988) - start up sample	X		
- adolescent sample	X		
Lilien & Yoon (1990)		X	
Miller, Gartner, Wilson (1989)	X		
Mitchell (1991)- subj. to survival	X		
Moore, et al. (1991)			X
Robinson & Fornell (1985)	X		
Robinson (1988)	X		
Urban, et al. (1986)	X		
Vanhonacker and Day (1987)			X
Yoon & Lilien (1985)- RFNP sample	X		
- ORNP sample		X	

However, this simple vote count would lead to a false conclusion because all but Mitchell's studies suffer from methodological and definitional problems which exaggerate the benefits of pioneering. These problems will be discussed next.

## VI. CRITIQUE

The reviewed literature can be critiqued on the merits of theory development, selection of unit of analysis, sample selection bias, definitional and measurement problems, and use of cross-sectional data to measure dynamic processes.

### A. State of Theory Development

Academics in the field of economics, marketing, strategic management and industrial organization have developed numerous models of first-mover advantage and order of entry effect. Because each discipline has its own preferred methodology, frame of reference and purpose, the models have dealt with different issues of entry timing and its consequences. In aggregate, this interdisciplinary effort can be credited with the development of a comprehensive set of advantages and disadvantages that first entrants encounter. But, lack of inter-disciplinary coordination is responsible for the fact that, to date, there is still no unified, tightly formulated theory of first-mover advantage with agreed upon set of constructs, laws of interaction, boundaries and empirical indicators.

Absence of a unified theoretical model, of course, resulted in a plethora of verification methodologies and measurements with conflicting but noncomparable findings. Therefore, the results of these studies are noncumulative, there is a scarcity of generalizable findings and the theory is not being verified.

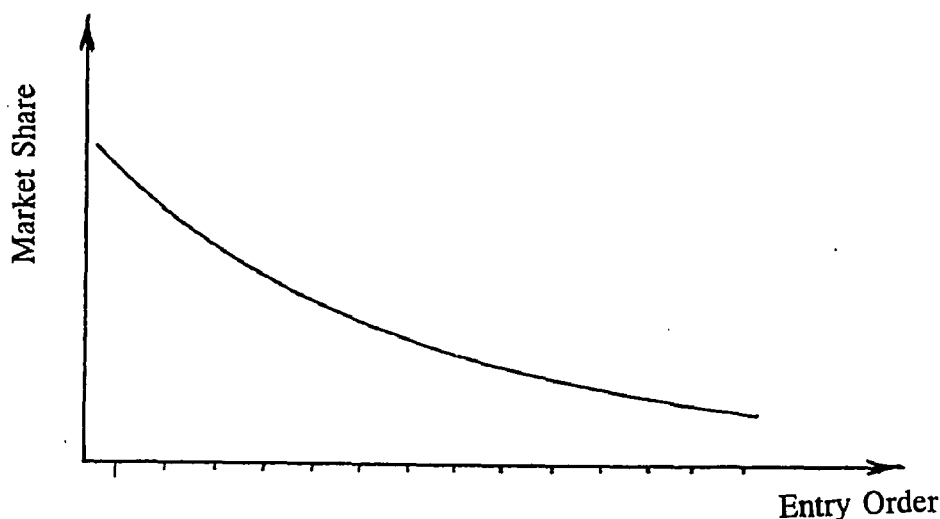


Figure 2.4 Hypothesized market share behavior in order of entry model

Conflicting findings also arise from confusing first-mover advantage with order of entry effect. In the literature the two terms are used interchangeably, but there is a difference. In the order of entry model, performance of all entrants is considered. It proposes that the later the entry, the smaller the market share (Figure 2.4).

When all but the first entrant are dropped, order of entry is reduced to first-mover advantage model. This model predicts that first entrants maintain dominant market position in the long run. It says nothing about how followers perform vis-a-vis one another, but it is implied that they are less successful than the first-mover. One can think of first-mover advantage as a subset of the order of entry model.

All but two empirical studies (Urban et al., 1986; Lilien and Yoon, 1990) in Table 2.5 used a design and statistical analysis that are adequate to test the order of entry effect but are far too insensitive to extricate the performance of first entrants. Unfortunately, even Urban's and Lilien's studies lack validity because their samples include only surviving major entrants.

Even though Mitchell (1991) identified exact order of entry of each entrant (including nonsurvivors), his method of analysis provides only trends for all entrants but does not reveal how successful were first movers in the market. Thus, it can be said that, to date, performance of first-movers had not yet been empirically verified.

### **B. Exogeneity vs. Endogeneity Assumptions**

Four empirical studies - Robinson and Fornell (1985), Robinson (1988), Lambkin (1988) and Miller et al. (1989) - that use the PIMS data base suffer from lack of validity and reliability. The theme of their research is that early entrants enjoy an enduring competitive advantage over later entrants. They imply that early entry causes lasting competitive advantage (exogeneity assumption). However, what

they test is an alternative explanation which is: stronger competitors tend to enter the market first (endogeneity assumption). To prove the point, here are a few hypotheses from Robinson (1988) and Robinson and Fornell (1985):

- H1: Higher product quality increases market share and market pioneers tend to have higher product quality (Robinson, 1988, p. 38).
- H2: Broader product lines increase market shares and market pioneers tend to have broader product lines (Robinson and Fornell, 1985, p. 307).
- H5: Lower prices increase market share and market pioneers tend to charge lower prices ((Robinson and Fornell, 1985, p. 308)

In that respect, if the hypotheses were supported (and they were), a pioneer's success may be attributed to company proficiency and not to early entry. [This issue is discussed in more detail in Lieberman and Montgomery (1988) and Moore et al. (1991)]. Unfortunately, even this explanation is not valid because of the sample selection bias of PIMS data base discussed later.

### C. Unit of Analysis

Confusion and scarcity of generalizable findings also stem from noncomparable definitions of unit of analysis. Several levels have been used: corporate, business unit, four digit SIC code, product class and product form, among others. The most relevant level of analysis seems to be at product class, because it best captures interbrand competition, orders of entry and subsequent innovation improvements. Five of the twelve empirical studies in Table 2.5 used this definition.

Although researchers that used PIMS data make inferences to brand level competition, all their measures are at business unit level (SBU). Unless the business unit produced a single product line, SBU's market share or survival as an empirical indicator of brand's performance is utterly meaningless.

Product class represented by a four digit code that Fesser and Willard (1990) used is also too broad because it often contains non-competing products or components. Furthermore, Fesser, et al. used corporate revenue growth as an indicator of performance in a product class. Did the companies produce only a single product? I doubt it.

In conclusion, while SBU's or corporate revenue as a unit of analysis may be acceptable in timing of entry studies in the field of economics, it is far too aggregate a measurement level in the field of strategy where the focus is on inter-brand competition in a given product segment.

#### **D. Who is First Entrant?**

The question of who is a pioneer, early follower or late entrant thus far has not been resolved. Researchers use the term first mover and pioneer interchangeably, but its meaning varies drastically from study to study. The confusion arises from lack of agreement on what constitutes an innovation, use of inconsistent order of entry classification schemes, and reliance on self-reported order of entry.

#### **Degree of Newness**

Definition of first entrant is partly a function of innovation's newness. As Lieberman and Montgomery (1988, p. 50) point out, the fundamental question revolves about "how large a discontinuity from existing practice is required to cross the threshold for definition as a pioneer?" Are firms, which introduce some product modifications to existing markets or exploit new market segments with existing products, first entrants? Indeed, that is a difficult issue. If criteria are loose, or if market segments are very narrowly defined, multiple firms are classified as first movers in the same product class (Lieberman and Montgomery, 1988).

Of the twelve empirical studies in Table 2.5, only five considered this issue, thus avoided counting multiple firms as first entrants in the same market segment. However, in four out of the five studies, the true first-movers and order of entry of followers are not known because researchers did not consider failed entrants or firms with small market share.

### **Inconsistent Classification Schemes**

Besides the confusion caused by lack of agreement on what constitutes an innovation, noncomparability of results is also due to use of inconsistent classification schemes of order of entry, and reliance on self-report of respondents. While some researchers used numerical rank order in the sequence of entry, others used simple dichotomies classifying firms as pioneers or late entrants. Other comparisons include: first vs. second; first vs. follower; pioneers vs. early followers vs. late entrants; and first vs. pioneers vs. early followers vs. late entrants.

Even a comparison of research that used same schemes is difficult because cut-off points for different categories were left to the judgment of respondents. Especially troublesome are the six studies that used PIMS data where 31% to 52% of firms (Lambkin, 1988; Buzzell and Gale, 1987) claimed to be pioneers, and that included respondents in the same market segment. In Fesser and Willard's (1990) research, over 75% of firms claimed to be first or among first to enter and that study analyzed "single", albeit broad, product class represented by a four digit SIC code (3573). Indeed, such broad and haphazard spectrum of classifications renders cumulation of results almost impossible.

### **E. Censored Sample Selection**

Validity of findings is further compromised by sample selection bias. Among

the twelve studies in Table 2.5, only Mitchell (1991) included nonsurviving entrants in the sample. The PIMS studies include only cross-sectional sample of surviving subsidiaries of large, successful corporations (most in the Fortune 500). Failures and small companies were left out altogether. Yet there is some evidence (Friar, 1986; Mitchell, 1991) that innovations are pioneered by small, startup firms. In addition, all studies excluded pioneers of failed innovations. Use of such data overestimates success of pioneers because sampling is done on the dependent variable (success) that is purportedly being tested.

#### **F. What is the Measure of First-Mover Advantage?**

Even though there are a number of intermediate first-mover advantages (lower cost, higher reputation, etc.), the ultimate measure of performance should be the profit (ROI, ROE, or ROS) a firm earns from the innovation (Lieberman and Montgomery, 1988). However, disaggregate profit figures for each product or a product line are proprietary and even rough estimates are hardly ever available. Therefore, researchers have used surrogate measures such as market share, gross sales in units or dollars, sales growth, growth of a product into a product line, survival, or even more nebulous terms such as success or dominant position without defining what those terms mean.

The most commonly used measure had been market share. But even among the studies that used this measure, the findings are noncomparable because market shares were measured at corporate, business unit, or brand level. Depending on selection of measures performance, one could come up with almost any kind of success or failure ratios even in the same data set.

**Table 2.5 Summary of Methodologies of Empirical Studies on First-Mover Advantage**

STUDY	SAMPLE (BIAS)	INNOVATION	DESIGN	DEGREE OF INNOVATION NEWNESS
1. Fesser & Willard (1990)	24 high, 18 low growth firms (biased)	SIC 3573, computers, peripherals	CS	NC
2. Lambkin (1988)	316 SBUs in PIMS (biased)	NA	QL	NA
3. Lilien & Yoon (1990)	52 large French firms (biased)	91 industrial products	CS	NC
4. Lieberman (1989)	258 entrants (biased)	39 chemical commodities	L	NC
5. Miller et al. (1989)	119 new SBUs in PIMS (biased)	NA	CS	NA
6. Mitchell (1991)	314 entries in medical imaging (unbiased)	5 diagnostic imaging innovations	L	radical, niche-opening
7. Moore et al. (1991)	593 SBUs in PIMS (biased)	NA	CS	NA
8. Robinson & Fornell (1985)	371 SBUs in PIMS (biased)	NA	CS	NA
9. Robinson (1988)	1209 SBUs in PIMS (biased)	NA	CS	NA
10. Urban et al. (1986)	129 brands in cons.pkg. goods (biased)	36 low cost cons. innovations	CS	niche-opening innovations
11. Vanhonacker & Day (1987)	2142 SBUs in PIMS (biased)	NA	CS	NA
12. Yoon & Lilien (1985)	52 large French firms (biased)	112 industrial innovations	CS	original vs. reformulated

**Table 2.5 Summary of Methodologies of Empirical Studies on First-Mover Advantage (cont'd)**

STUDY	ENTRANT CHARACTERISTICS	ORDER ENTRY DETERMINATION	ORDER ENTRY CLASSIFICATION	SUCCESS MEASURE
1	Emerging firms	self report	pioneer 75% vs. followers 25%	5 year avg. corp. sales growth (%)
2	Population ecology framework	self report by survivors	3 categories evenly distributed	SBU market share (%)
3	NC	# of competitors at entry (self report)	rank order 1st...nth	product growth into prod. line
4	NC	date of entry, incumbents excluded	relative rank order	chance of failure
5	NC	self report by survivors	pioneers vs. followers	SBU market share (%)
6	incumbent vs. new; firm size	date of entry includes failures	rank order 1st...nth	mkt. share (%), survival
7	NC	self report by survivors	pioneer, early, late followers	SBU market share (%)
8	NC	self report by survivors	pioneer, early, late followers	SBU market share (%)
9	NC	self report by survivors	pioneer, early, late followers	SBU market share (%)
10	NC	date of entry, survivors	rank order of major brands	relative market share
11	NC	self report by survivors	pioneers (52%) followers (48%)	SBU market share (%)
12	NC	# of firms at entry, selfreport	rank order 1st...nth	mkt. share, prod. growth into line

**Legend:** CS = Cross Sectional, L = Longitudinal, QL = Quasi Longitudinal  
 NA = Not Applicable (innovation = business units), NC = Not Considered

### **G. Cross-sectional Data**

No less disturbing is the tendency of using cross-sectional data to test the theory. Order of entry is a dynamic model concerned with entries and exits of firms and their performance over time. Among the twelve researchers in Table 2.5, only two used longitudinal data, yet nearly all make inferences about this dynamic process.

Determination of entry order in eleven papers was only relative to other survivors at a particular point of time, not to the total population of entrants. Measurement of market share in a single time period will lead to wrong conclusions if there is a substantial turnover of participants from year to year. Therefore, any general conclusions from these studies must be considered with caution. To get accurate readings on how the pioneers performed, the true pioneers have to be identified and entry order of followers confirmed. This requires longitudinal design and tracking of individual firms through the different stages of the product life cycle. Scarcity of longitudinal data had been a significant deterrent to such research.

### **H. Entrant Characteristics**

Last, differences among entrant characteristics such as technological know-how, possession of complimentary assets, resources, incumbents vs. industry newcomers, or organizational size were considered only by Mitchell (1989, 1991) and Lambkin (1988). However, even Lambkin's findings are compromised because her samples were composed of relatively homogeneous divisions of large firms from PIMS data. Other researchers assumed that companies are equally adept at pioneering and following, or ignored the issue altogether. Yet, as Teece (1986), Wernerfelt and Karnani (1987) and Mitchell (1991) point out, entrant characteristics often determine who reaps the major benefits from the innovation.

## VII. CONCLUSION

In this chapter, theoretical and empirical literature addressing the advantages and disadvantages of the first-mover has been reviewed. In aggregate, the conceptual framework is adequately developed, but because of disjointed interdisciplinary effort it still lacks cohesiveness. Empirical support for first-mover advantage is dubious and fuzzy. There are several reasons for this.

First, in the fields of marketing, strategic management and industrial organization, a predominant number of studies focused on the merits of first-mover or follower strategies, referring to incidental real world examples as a surrogate empirical support for their thesis. Obviously, strategic implications are important but they should not be based on hearsay and spotty but convenient evidence.

Second, confirmatory empirical studies to date are rare and most which had been undertaken are short on validity. With few exceptions, researchers try to compensate for lack of relevant data in their sample by using more sophisticated analysis. If the sample contains only surviving incumbents in which more successful firms claim to be pioneers, no matter how this data is analyzed, "pioneers" will come on top. Whether the success is due to pioneers being more competent to begin with, or a result of change in the market caused by the innovation, is irrelevant at this point. The basic question still remains unanswered: are pioneers more successful than followers?

The economic literature also contributes its share to the current glut of papers which enhances our misunderstanding about the research question at hand. With their exhaustive list of assumptions, but very nimble number crunching, they try to prove that the reality, indeed, is very near to their conclusions. Empirical verification,

however, is usually not attempted largely because of the severity of assumptions (e.g. industry in an equilibrium, choice of entry order, firms are equal in all respects but their entry order).

In conclusion, our ability to resolve the confusion on first-mover advantage hinges on better research, not more of the same. It will require that researchers develop their own longitudinal data that include nonsurvivors, rather than rely on convenient but inappropriate data such as PIMS. Another option is to do qualitative case studies of single or related innovations. Nearly all significant insights on the order of entry came from such studies. It is more insightful to draw conclusions from one or a few accurate cases than from several hundred inaccurate ones.

## CHAPTER 3

### HYPOTHESES AND METHODOLOGY

#### Introduction

In spite of numerous studies done on the first-mover advantage, little has been accomplished with regard to cumulation of generalizable knowledge on the subject matter. As Lambkin and Day (1989, p. 16) point out: "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."

That means empirical verification needs a fresh approach. The first order of priority is to examine whether first movers are indeed as successful as the proponents suggest. Second, if they are not, then what was the order of entry of those firms which dominate the emerging product class category? These two questions are the focal point of this study.

In the previous chapter, I identified three sets of variable, that influence the performance of the entrant: (1) order of entry, (2) company characteristics (industry status and firm size), and (3) innovation characteristics (innovation newness and product type).

In this chapter, I will provide background and reasoning behind the hypothesis, describe the methodology to test those hypotheses and how the sample was selected.

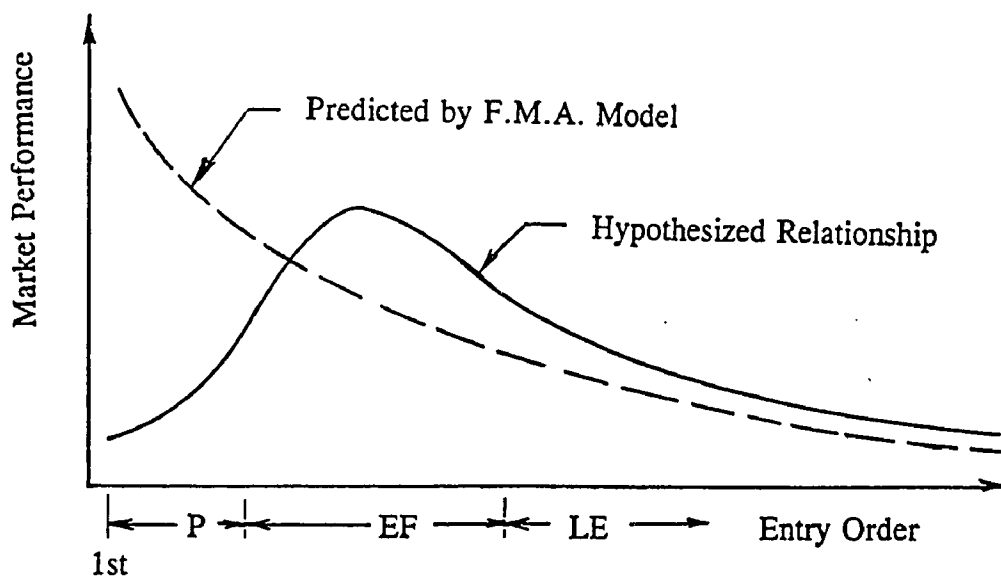
#### I. BACKGROUND AND HYPOTHESES

##### A. Are First-Movers More Successful Than Followers?

The given view in the normative literature is that first-movers tend to be more successful than followers. Empirical research showed strong support for the theory. However, the few qualitative case studies that identified the first entrant (Olleros,

1986; Friar, 1986; Teece, 1988) and a recent empirical work by Golder and Tellis (1993) concluded that, in nearly all cases, the first entrant failed. Where lies the truth?

There, indeed, is a relationship between order of entry and firm's performance but it is not declining with later entry as the theory predicts. Rather, it is unimodal as shown in Figure 3.1.



**Figure 3.1 Relationship Between Order of Entry and Firm's Performance**

**Legend:** 1st = first entrant, P = pioneers, EF = early followers, LE = late entrants

Although, in the early stage of innovation life cycle first entrants perform better than followers, as the innovation matures the firms that end up dominating the market tend to be early followers. It appears that most first movers and immediate followers fail in the market or become minor players. However, a small portion of those who survive, tend to be very successful in the long run.

So why did empirical studies find support for the theory? The answer lies in

the selection of the sample. Any study that compares only successful first entrants against followers will show a decreasing performance with later entry. The same results are observed if successful followers proclaim themselves to be first or pioneers. (I have yet to see an annual report where a company attributed its success to "shameless" imitation of someone else's innovation. Success is nearly always attributed to "pioneering effort"). Since most studies relied on self-reports of successful surviving firms, strong support for first-mover theory was found. Some studies that found no relationship were confounded by the fact that too many firms (up to 75%) claimed to be pioneers.

Thus far, I have proposed that, in the long run, early followers outperform both first entrants and pioneers because the latter usually do not survive. I also proposed that a small portion of surviving first movers tend to be more successful than most followers. I have not explained the reasons behind these propositions. The explanation follows next.

### **1. Dynamic Stages of Market Evolution**

Except for a few studies (Lambkin, 1988; Lambkin and Day, 1989; Mitchell, 1989, 1991) the influence of the product life cycle has been largely ignored in the literature dealing with the first mover advantage (FMA). However, since FMA is a dynamic model, the changing competitive and market factors should be considered. Not only do these conditions determine entrants' success, but also present different entry order incentives.

Critical factors for entrant's success change at each stage. Experience gained in an early stage may not necessarily carry over to the next. Therefore, even effective strategic choices at one stage are not likely to be successful later. For example,

Tsurumi and Tsurumi (1991) found that in the semiconductor industry change of leadership in DRAM occurred with each new DRAM generation about every three years. The changing nature of the market and competitive conditions over the first three stages is summarized in Table 3.1. The table and the ensuing brief discussion is based on generally accepted knowledge described in marketing strategy and product policy textbooks (see Kotler, 1991; Hisrich and Peters, 1991).

**Introduction:** The initial stage is characterized by slow growth, frequent product changes, technical problems with production and high cost of market and distribution development (Lambkin and Day, 1989). Since the costs are high and revenues are low, the product may not reach profitability until the growth stage. The first generation product may not be well-conceived and requires frequent redesigns to work out the problems and modify the features to better appeal to the consumers' needs. The product appeals to a narrow market segment of innovators with higher income and tolerance for risk (Schiffman and Kanuk, 1987). This group of adopters responds to a more informative appeal and a positive word of mouth. The price is high, because of high cost of development, low production volume and a need for high margins to cover the cost of promotion and market expansion. Because of frequent product changes, low sales volume and market uncertainty, manufacturing is not yet suitable for efficient, large scale production process.

In the introductory stage, low entry barriers, low intensity of competition and the opportunity to establish a foothold in the market attract small, emerging firms. But this stage of market evolution is the riskiest, most volatile and uncertain, and may last from a few years to several decades. In addition, lack of capital and organizational

**Table 3.1 Changing Market and Competitive Conditions During Product Life Cycle**

	<b>Introduction</b>	<b>Growth</b>	<b>Maturity</b>
<b>Market Characteristics</b>			
Customers	Innovator/ High income	High income/Mass	Mass & segmented
Sales	Low	Rapidly rising	Peak
Demand	Uncertain	More predictable	Predictable
Buyer needs	Unsure	Changing	Known
Risk	Very high	Declining	Low
<b>Competitors</b>			
Number	Few	Many/Rising	Fewer
Type	Mostly small firms	All type	All type
Ind. concentr.	High	Lower	High
Intensity	Low	Intensive & Rising	High
<b>Product</b>			
Configuration	Basic/Proprietary	Improved/Different.	Std. but segmented
Quality	Poor	Improving	Highest
Technology	Rapid change	Ind. std. Emerges	Mature
<b>Marketing</b>			
Distribution	Selective	Broad	Broad/Multiple
Ad message	Awareness/Educate	Brand superiority	Value
Ad media	Specialized	Mass media	Mass media
Price	High	Declining	Low
Price elasticity	Low	Rising	High
Income elasticity	High	Declining	Low
R&D	Prod. dev./Improve	Prod./Process Improve	Process/Prod. Improve
<b>Manufacturing</b>			
Methods	Craft/Small batch	Flexible/Mass	Mass
Capacity	Low but over	Rising - over/under	Optimum

problems stemming from "liability of newness" result in frequent failures (Lambkin and Day, 1987). Failure rates range from 30% to as high as 90%, depending on the industry or market (Crawford, 1979).

**Growth:** During the growth stage sales rise rapidly, demand and buyer needs become segmented but more predictable, and risk declines. Although profits may be positive, cash flow tends to be negative due to heavy investment in plant expansion. As customers shift from high income segment toward mass markets, demand becomes less income elastic and more price elastic. A growing market attracts many new competitor including large established firms, competition intensifies and price experiences the fastest decline.

The emergence of an industry standard signals the end of technological turmoil, and product and quality gains become progressively more tied to process improvement and design simplification. The emphasis of R&D gradually changes from product development to incremental improvement. Large sales justify investment in efficient mass manufacturing, but the process requires flexibility to quickly respond to demand shifts and product changes. Promotion switches from educating customers to brand superiority and mass media is more widely used.

Declining uncertainty, rising sales, increased standardization, rising importance of efficiency and resources make it feasible for large firms to enter the market. Keen competition for market share, plant overcapacity and declining prices precipitate industry shakeouts before the product reaches maturity. These conditions will further reduce the ranks of pioneering firms (Lambkin and Day, 1987).

**Maturity:** In the mature stage sales peak, market is composed of several major segments and a number of smaller niches, buyer needs are known and market

uncertainty is the lowest. In this stage, market share gains come at the expense of other participants, therefore, price competition is intense. Since price elasticity of demand is the highest even small price reductions may result in large increase in sales volume. Emphasis is on cost reduction, product value and brand loyalty. Superior management skills, strong corporate image and market power become paramount. Manufacturing is capital intensive and large scale, often highly specific to a particular product. Both product and process technology are standard and product improvements are closely tied to incremental process innovations. Major product innovation is less likely.

Knowledge about the product technology is widely diffused and not a serious barrier to entry. But capital requirements to serve the mass market and potential competitive response are significant deterrents. Therefore, new entries are tied to acquisitions, exploiting smaller niches or finding new usage for the product.

### **Changing Importance of Core and Complementary Assets**

From the discussion of stages of product life cycle several key patterns that influence firms entry order and market performance emerge. As the product moves from introductory to growth and maturity stage:

1. The core technical knowledge of the innovation and entrepreneurship become less important (See Figure 3.2).
2. The industry changes to large-scale, capital intensive mode. Complementary assets such as marketing (distribution, logistics, service, advertising and promotion, firm reputation) manufacturing and continual product improvement become more important (Tsurumi, 1983, 1991). (See Figure 3.2)

3. Technological and market uncertainties, as well as, risk decline as demand rises.
4. The changing nature of the environment attracts different types of firms at different times. Emerging, entrepreneurial firms tend to pioneer, and large established firms prefer to follow (Abell, 1978; Mitchell, 1989, 1991; Lambkin and Day, 1987).

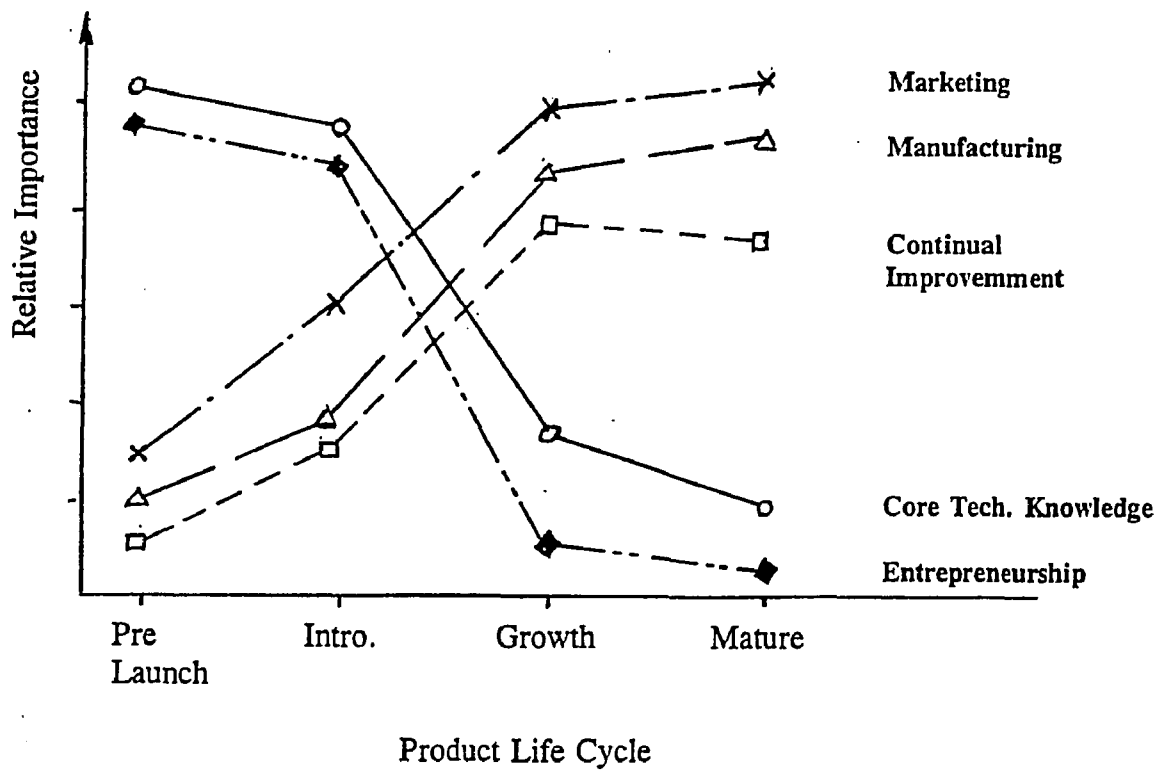


Figure 3.2. Changing Importance of Core and Complementary Competencies

## 2. Influence of Entrant Characteristics

**Industry Status.** Review of innovation case studies revealed that even when the innovating firm had done well initially, often it was the later entrant that ran away with the pot of gold. Therefore, it appears that there are both first-mover and follower advantages in the market, but at different points in time. This is because it takes different skills and resources to succeed as the market evolves. In the early stages, it takes vision, entrepreneurial spirit, risk taking, knowledge of emerging technology, speed and some luck to bring a new product to the market.

Luck has a lot to do with who brings radical innovation to the market. According to the National Science Foundation (1980) the development of knowledge that leads to technologically radical innovations greatly depends on luck. Partly because of this random element the source of new technological breakthrough is much more likely to be outside the existing industry (Porter, 1980; Mitchell, 1989). Therefore, pioneers of radically new innovations tend to be industry newcomers.

Even though the industry incumbents possess the resources, market access, and basic technical competence, it is the small firms driven by that small chance of big profits who tend to bring about radically new innovations. Through a combination of speed, proficiency and luck, some succeed to be in the market first and even make some initial profits. Sometimes, however, the innovation fails soon after introduction and those who waited avoid a costly mistake and even learn from pioneers' errors.

**Firm size.** If the innovation is accepted, in the later stages success depends on marketing and manufacturing skills, financial staying power and ability to bring about continuous stream of incremental innovations. Here the large incumbents have an advantage (see Figure 3.3). When the technological and demand uncertainties begin

to resolve and the market accelerates in growth, large incumbents can enter the mass market and grow rapidly.

		FIRM'S INDUSTRY STATUS	
		INCUMBENT	NEW ENTRANT
FIRM SIZE	LARGE	<ul style="list-style-type: none"> <li>● Large scale industry specific complementary assets</li> </ul>	<ul style="list-style-type: none"> <li>● Core technological knowledge</li> <li>● Large scale generic complementary assets</li> </ul>
	SMALL	<ul style="list-style-type: none"> <li>● Industry specific complementary assets</li> </ul>	<ul style="list-style-type: none"> <li>● Core technological knowledge</li> </ul>

**Figure 3.3** Distribution of Core and Complementary Assets Among Participants in a New Product Category.

Since large incumbents are better equipped than small emerging firms to come from behind, they have less incentive to be first movers (Wernerfelt and Karnani, 1987; McKenna et al. 1984; Mitchell, 1989). Large firms tend to act on better, more accurate information. It does not pay to enter the market in a small way because the impact on the revenue is negligible. On the other hand, to commit a major sum of money for an "acceptable size" market entry, the firm wants to be relatively sure the investment will not be a failure. Capital Asset Pricing Model (CAPM) is often used

in these decisions. (See Harrington, 1983). CAPM allows management to evaluate competing product line decisions on amount of expected returns and risk (variation in return on investment). Simply put, the method recommends that the higher the risk the higher the required rate of return (hurdle rate) for the product-market alternative. The alternative is accepted if the expected return exceeds the required return. Since new product development involves long time horizon and high risk, the expected returns are usually below the hurdle rate and the alternative is rejected.

Delay in entry also allows the incumbent to acquire the core technological know how and to improve on pioneer's initial innovation. So, leading incumbents prefer the strategy of early follower and let the pioneer absorb the risk of uncertainty (Mitchell, 1989).

In that sense, imitation rather than pioneering may be a more effective strategy at least for those firms that are well established in the market. That is because multiple competencies, rather than single competency (completion of product development), are necessary to succeed in the long run. As Wheelwright (1988) points out, successful completion of innovation design by no means guarantees success in the market. The innovation must also be economically manufacturable. Few pioneering firms possess the complementary assets necessary to compete effectively.

From the above arguments it does not follow that the later the entry the better the performance. When the first incumbents begin to enter others, follow quickly driven by the fear of being preempted. Once the large incumbents establish their position the mass markets are effectively closed to followers. To avoid head on competition late entrants are relegated to explore less lucrative market niches.

However, they do have one advantage over their predecessors. Late entrants know

the competitive and technological situation in the established market and can adopt their entry strategy to survive under those conditions. Thus, late entrants trade a higher chance of survival for lower market share. Empirical evidence supporting this rationale is offered by Mitchell (1989, 1991). In a study of diagnostic medical equipment, he found that, the later the firm entered the longer it survived but at the expense of market share.

The reasoning in this section suggests that:

- In general first movers fail to hold on to their dominant market position as the innovation matures.
- Being an industry incumbent improves the first entrant's chance of market dominance.
- Large organizational size improves the first entrant's chance of market dominance.
- Companies first to enter a new product category tend to be small industry newcomers rather than large incumbents.
- Initially, delay in entry improves the firm's chance of market dominance, peaks with early followers and declines below the levels of pioneers and first movers.
- New product categories tend to be dominated by large incumbents rather than new entrants or small incumbents.

### **3. Influence of Innovation Characteristics**

**Innovation newness.** Literature review revealed that few empirical studies examined the relationship between the degree of innovation newness and success of the first-mover. Yet the prevailing view among scholars and practitioners is that, the more revolutionary the innovation, the greater the potential for the pioneering firm to succeed (Levitt, 1960). In his article "Marketing Myopia", Levitt (1960) criticized industry incumbents for "product provincialism" preoccupied with a self-deceiving

cycle of marginal improvements of existing products and efficiency of production. Rather, he proposed, the firms should engage in creative destruction of "what now produces their livelihood" (p. 145) with revolutionary products of the future, or face the fate of the buggy whip industry. In particular, Levitt noted that the petroleum industry and the electric utilities were again letting industry outsiders "steal marvelous opportunities" in chemical fuel cells, powerful electric storage batteries, and solar cells. He advised that oil firms "have to develop these power units before their competitors, so they will not be companies without an industry" (p. 159).

In the same article Levitt predicted that the dry cleaning industry would be made obsolete by "that powerful magician, ultrasonic" (p. 144), solar-powered car might be common by 1980, "that within twenty-five years the oil industry may find itself in much the same position of retrospective glory that the railroads are now in" (p. 148) and, "the companies that are working on exotic fuel substitutes are heading directly into outstretched arms of the irritated motorists" (p. 159). In retrospect, thirty-five years later, dry cleaning is still a thriving business, solar cars are still experimental with a bleak future, the oil industry is bigger than ever and still watching developments, and most pioneers that were developing alternative energy sources, ended in the bankruptcy court rather than in the outstretched arms of the consumer.

From the incumbents prospective, staying on the sideline watching the developments, they avoided false leads that would unnecessarily drain their resources and hurt the core business.

It has been proposed that radical innovations go beyond the existing technical know-how. They depend on creation of new knowledge and technological

breakthroughs (Abernathy and Utterback, 1978; Brittain and Freeman, 1980; Mitchell, 1989). Because they are discontinuous, they require a new set of competencies and cause a break with the past (Olleros, 1986). Thus, radical innovations redefine competitive terms in an existing industry or open up new product class. They serve as a vehicle for new firms to enter the market and undermine incumbent's technological and organizational abilities. Thus, it is believed that, the more radical the innovation, the greater the first mover advantage.

Why is it, then, that most pioneers of radical innovations fail to benefit from their endeavor? Technological breakthroughs have sufficient impact to bring mature industries to renewed rapid growth. But these breakthroughs also induce radical frequent changes which destabilize the environment. In this volatile market, the pioneer is faced with increased competition from waves of new entrants, rising capital requirements and quick technological obsolescence.

Unlike incremental innovations, the early forms of technologically discontinuous innovations are often crude, unreliable, costly and underperform mature well-refined products they are to replace. This is partly due to reaching beyond the prevailing technical standards and knowledge, lack of resources to refine the innovation, and a pressure to launch the product as soon as possible (Romanelli, 1989; Schoonhoven et al., 1990). So, the pioneer faces a problem that buyers are interested but they want the second generation of the innovation. The problems are often so overwhelming that the first entrant frequently burns out even before the market takes off. Those which survive are caught in a race to keep up with the improvements in product capabilities brought about by leapfrogging followers.

While in the introductory stage, product improvements may be decoupled from

the production process, in the growth and maturity stages further improvements and cost competitiveness are closely tied to process innovation which requires large capital outlays. At the same time, heavy marketing expenditures are necessary to maintain market position against large incumbents who entered the market. These conditions raise the barriers of entry and staying in the business to but a few well endowed and technologically competent firms. Therefore, in the rapid growth and maturity stage, the competitive conditions favor the large established incumbent firms that dominated the previous product class with the addition of few surviving new entrants that managed to carve out their own market niche.

Incremental innovations are refinements and extensions of established technologies based on unique combinations of existing knowledge typically tied to redesign and improvement in manufacturing technology. Since incremental innovations are less disruptive and draw on existing organizational capabilities, they reinforce the dominance of established incumbents (Abernathy and Utterback, 1978; Olleros, 1986; Romanelli, 1989). Customers are already familiar and have experience with the product, therefore, enhanced performance, improved quality and novelty of the product facilitate faster acceptance of the innovation in the market.

In summary, it was proposed here that majority of innovations pioneered by industry incumbents would be of incremental nature , while a majority of innovations introduced by industry newcomers would be radical innovations. This proposition is consistent with current empirical evidence (Tushman and Anderson, 1986; Friar, 1986; Schoonhoven et al., 1990; Mitchell, 1991). Furthermore, because of greater market instability, product failure and rapid technological obsolescence, it is expected that pioneers of radical innovations tend to be less successful than pioneers which

introduce incremental innovations. This proposition is contrary to the given view in the normative literature on order of entry (Olleros, 1986).

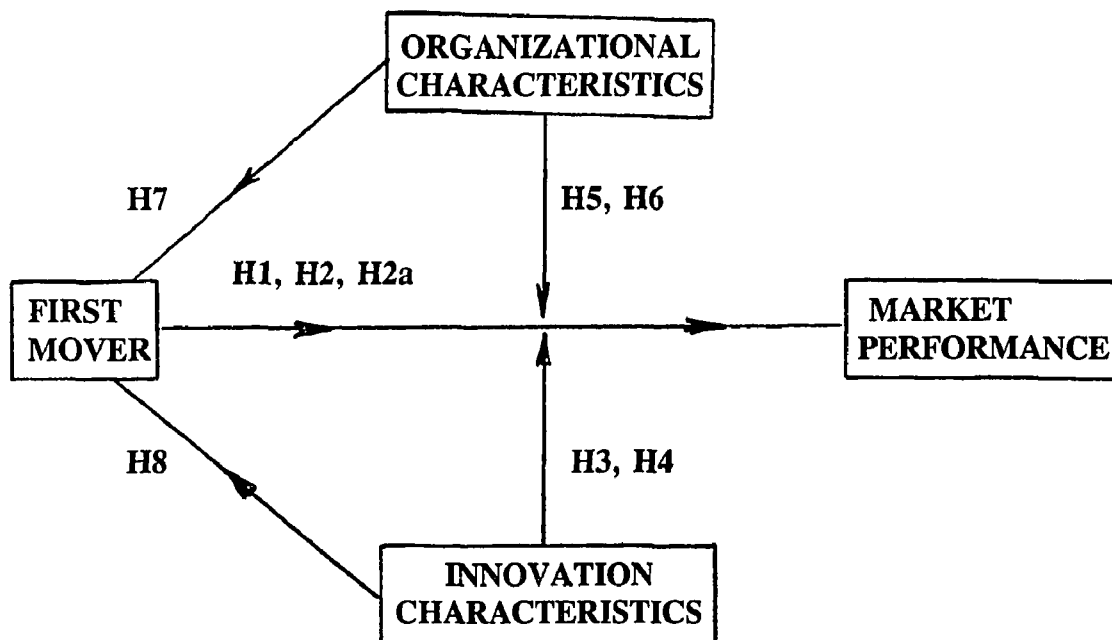
**Product type.** Not only innovation newness but also product type may influence the success of first movers. In general, it is believed that first mover advantages are more durable in consumer industries than in industrial products. Several complementary explanations have been put forth. First, in the context of imperfect information and a desire to minimize risk, Schmalensee (1982) reasoned that consumers will stick with the first brand in the new product category since, through usage, they know with certainty that the product performs satisfactorily. Such brand loyalty should be especially durable in low involvement, convenience goods where the cost of search outweighs benefits. Other authors apply learning theory to explain formation of consumer preference for first mover's brand. In an experimental study, Carpenter and Nakamoto (1989) demonstrated that, in the absence of competing messages, the first mover's brand receives disproportionate attention among consumers. Initially, consumers have no preset notion about the importance of the various product characteristics. Thus, the first mover can influence consumer perception of the ideal attribute combination and define the industry standard against which follower products would be judged.

These risk minimization and learning effects are said to be more prevalent among consumer than industrial buyers, "since the latter's larger purchase volume justifies greater investment in information acquisition activities" (Lieberman and Montgomery, 1988, p. 46). Empirical evidence that pioneers of consumer products have greater market share advantage over early and late followers than pioneers of industrial products is provided by Robinson et al. (1985), Robinson (1988) and Parry

and Bass (1990). This reasoning and existing empirical research suggest that first movers in consumer markets tend to outperform first movers in industrial markets.

### B. Hypotheses and Propositions

The conceptual model indicating the hypothesized relationship between first movers and their short and long run market performance in the presence of organizational and innovation characteristics is shown in Figure 3.4. This model is used to test hypotheses H1 to H8 which deal with sample of 52 first entrants only. Figure 3.5 shows a conceptual model that relates market dominance in the new product category to the firm's entry order and organizational characteristics. With this model hypotheses H9 to H11 are tested using the sample of 214 firms which dominated 46 new product categories.



**Figure 3.4 Hypothesized Relationship Between First Movers and Market Performance in the Presence of Organizational and Innovation Characteristics**

## List of Hypotheses and Propositions

### Predictions About First Movers (sample of first entrants in 52 innovation categories)

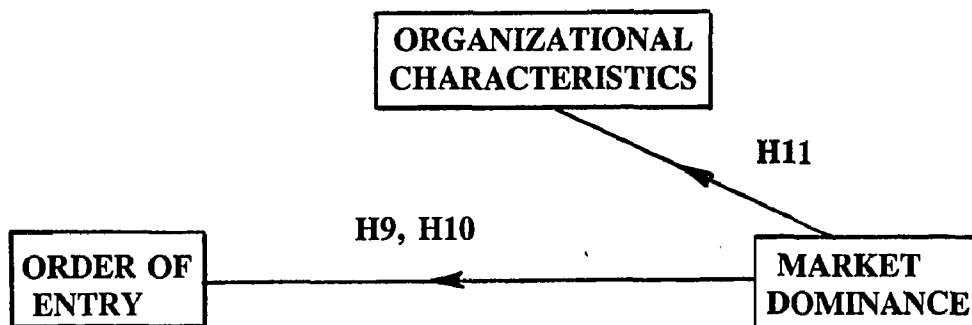
- H1:** In the early stage of product life cycle (period 1) a majority (50% or more) of first movers tend to dominate the product segment which they pioneer.
- H2:** As the product segment matures, the proportion of first movers that dominate the product segment declines.
- H2a:** As the product segment matures, the market share of first movers declines.
- H3:** First movers which introduce incremental innovations tend to be more successful in the new product segment than first movers which introduce radical innovations.
- H4:** First movers which introduce consumer products tend to be more successful in the new product segments than first movers which introduce industrial products.
- H5:** If the first mover is an industry incumbent, it is more likely to succeed in the new product segment than if the first mover is in an industry newcomer.
- H6:** If the first mover is a large firm it is more likely to succeed than if the first mover is a small firm.
- H7:** Firms that enter the market first tend to be small industry newcomers rather than large industry incumbents.
- H8:** A majority of innovations first introduced by industry incumbents would be of incremental nature, while innovations first introduced by industry newcomers would be radical innovations.

### Predictions About Dominant Firms (sample of dominant firms N=214 in 46 innovation categories)

- H9:** First movers and pioneers are less likely to dominate the market in the long-run than early followers.
- H10:** First movers and pioneers are more likely to dominate the market in the long run than late entrants.

## Entrant Type Prediction

**H11:** In the long run, the new product segment tends to be dominated by large industry incumbents rather than by new entrants or small incumbents.



**Figure 3.5** Hypothesized Relationship Between Market Dominance, Entry Order and Organizational Characteristics.

### Propositions - When Do First Entrants Succeed?

Conditions under which first entrants succeed are examined in the qualitative part of this research. Several propositions follow. First entrants may establish long run dominant position when:

- Prop. 1:** competitors enter late because initial market estimates were pessimistic and the market grew slowly
- Prop. 2:** the first version of product works and becomes the industry standard
- Prop. 3:** the initial innovation is not followed by rapid technological changes
- Prop. 4:** the innovation is protected by iron-clad patent(s) or it is a trade secret embedded in process or tacit knowledge (e.g. recipes, chemical formula)
- Prop. 5:** the innovation does not threaten incumbents' core products
- Prop. 6:** the innovation is introduced by a leading industry incumbent whose specialized assets (e.g. logistics and distribution, brand, production) retain their value from one product to another.

## II. METHODOLOGY

This is a study that uses a historical method to investigate the performance of first movers, the order of entry and organizational characteristics of dominant firms in 52 product categories introduced in the US market after World War II.

To avoid the definitional problems as to who is a first entrant, **only niche-opening innovations** are considered. In this study a niche-opening innovation is defined as one that creates a distinctly new product category or a subcategory with its own set of competitors and customers. The conceptual as well as operational definition of first mover used in this study, then, is the first firm to sell a commercial product in a new product category or a subcategory. All other firms are assigned in one of three other categories (pioneers, early followers or late entrants) depending on the time of entry.

The sampling unit is **corporate entry** into a particular innovation class in the US market. Analyses are conducted at parent-firm level rather than business unit or a brand level to facilitate the identification of firm's entry and exit dates and to capture multiple brand sales owned by the same firm. All the measurements are taken in calendar years for two time periods. Period 1 data captures the entrant's performance in the very early stage of product life cycle, period 2 reflects the performance in the later growth stage.

The above definition limits each product category to only one first entrant. The method of historical analysis of archival records going back to product's origin ensures that the "true first entrant" was identified even if it did not survive. In contrast, most earlier researchers relied on respondents' self-report and operationalized first entrant as "one of the pioneers", thus classified multiple firms as

first mover.

### **A. The Sample Selection**

The data covers 52 product categories through their life cycles. List of innovations and their market pioneers is provided in Table 5.1. To avoid selectivity bias that would overstate success of pioneering firms, both successful and unsuccessful innovations are included in the sample as recommended by Lieberman and Montgomery (1988) and Lambkin and Day (1989).

Each innovation is covered from the time when it was first introduced in the US market until late 1980's or early 1990's. For those innovations that failed and were not reintroduced by later entrants, the coverage period ends when the innovation was withdrawn from the market.

The sample includes a wide variety of products in consumer durable and nondurable industries, services, and industrial products. Though the sample is not random (list of population universe does not exist), the diversity of innovations increases generalizability of results. The innovations were selected on the following basis:

- The innovation was introduced in the U.S. market
- The innovation opened or attempted to open a new product category (i.e., personal computers) or a subcategory (i.e., portable computers)
- The market segment was well defined with its own set of competitors and customers
- The first entrant was clearly identifiable
- The information, such as order of entry, market share, length of participation, and the fate of the first mover was available.

The number of producers for the selected innovations ranged from one (mainly

among failed innovations or those with tight patent protection) to nearly a thousand. This heterogeneity in the number of entrants would confound comparison and sample selection for order of entry analysis. But that is not the main objective of this study.

The focus is on the first entrant and firms that dominated the new product category in early and later stages of the product life cycle. If the first mover did not dominate what was the order of those firms which became dominant? Of course, the issue is a moot point if the product failed. In previous studies, these questions were always obscured by the broader analysis of relationship between entry order and market performance.

With this objective in mind, the sample selection was much simpler. Since the hypotheses are divided into two sets - one, dealing with first movers (H1-H8), the other with dominant firms (H9-H11) - two samples were selected. Sample 1 contains data on first movers in 52 product categories while sample 2 is comprised of 214 firms that dominated 46 of the original 52 innovations in period 1 or period 2. Six innovations were not included in the sample of dominant firms because either the product was discontinued (supersonic commercial aircraft, cyclamate, and miraculin), the product had not moved beyond the embryonic stage (home videophone) or relevant information regarding dominant firms was conflicting or incomplete (saccharin, photocopier). Firms were included in sample 2 if they ranked among the top three firms in terms of market share in either of the observed time periods. However, in several product categories, only one or two firms controlled over 90 % of the market. In those cases, only one or two firms were categorized as dominant. Thus, in first period - the early dominant sample - only 117 firms (rather than  $46 \times 3 = 138$ ) and in second period - current dominant - 131 firms were labeled as

dominant. The numbers do not add to 214 (total dominant sample) because 34 firms dominated the markets in both time periods.

### **1. Sources of Data**

Qualitative and statistical data for this research were gathered primarily from archival sources, such as business periodicals, trade journals, books, stock brokerage reports, company annual reports, and product or industry case studies. The purpose of using multiple sources was to gain broader perspective, to resolve inconsistencies and to cross-validate the accuracy of individual sources.

The largest sources of information were the general business periodicals, trade journals and newspapers. In all, more than 2000 articles from over 150 different periodicals were collected, but at least twice as many were examined. Additional information was collected from around 50 books that covered individual product categories or industries, and some 60 strategic management or marketing textbooks that contained product, industry or company case studies. These proved invaluable in identifying key references going back to innovation launch. Periodicals and books were the primary sources of entry and exit dates, historical events that shaped the development of particular product categories and fate of individual firms.

Statistical data on historical and current market shares, product category sales and company financial data come mainly from the brokerage industry "Corporate and Industry Research Reports" (CIRR), market research firms and trade journals. The bulk of the data on fourteen computer hardware, software and semiconductor product categories come from International Data Corporation, Dataquest, Gartner Group, and In-Stat Services. These firms compile the most extensive data, are considered among the most reliable in the field, and are widely quoted in trade journals and business

publications. Data regarding eleven beverage and sweetener product categories were sourced primarily from Beverage Industry Annual Manual, Impact, Chemical Week, Chemical Engineering, Advertising Age, and Wheat First Security brokerage firm. Sales volumes and market shares for six consumer electronics categories are mostly from Electronic Industries Association and Appliance Manufacturer. Statistical data for the remaining 21 product categories were compiled from trade journals, newspaper articles, brokerage firms and trade associations. When information was not available from secondary sources or further clarifications were necessary, telephone interviews with company executives were conducted.

Special effort was made to find articles and documents that were written around the time of the (purported) introduction of each product category. However, to my surprise, in many instances, articles referred to earlier failed attempts or to other firms already in the market. Hence, the search continued. With this method, I found that in 52 innovations under study, the firm generally credited with pioneering the product category was incorrectly identified in 24 cases. The time differential was as little as three months for DRAM and as much as 23 years for light beer category. This subject is addressed in the discussion of findings and the case studies of individual innovations.

## **B. Variables**

For the statistical analysis, information on 18 variables for each entrant was collected. These variables include the name of parent company, entry order, date of entry and exit, entry lag, innovation newness, product type, firm's industry status and size, early and current market share, market share ranking, firm's home country, stage of product life cycle at the time of entry, and product category sales volume.

Additional information on related events, changing market conditions, barriers to entry and exit, industry concentration, and leadership reversals was also collected and used in the qualitative part of data analysis.

In the literature review, I identified three key sets of contingency variables that influence the performance of an entrant: (1) order of entry, (2) entrant characteristics, and (3) innovation characteristics.

**Performance.** Firm's market performance was measured in two time periods with two complementary variables: (1) Market share and (2) Dominance. **Market share** was defined as percentage share of the product category in the US market accounted for by the company. For the firms that offered multiple brands in the same product category, brands' sales were aggregated. The percentage was calculated from dollar sales or unit sales depending on the norm in the industry. The second measure of performance is a dichotomous variable called **dominance**. Entrant was defined as dominant if it ranked among top three firms in terms of market share during the observed year. Two other requirements also had to be met for the entrant to be classified as a success: (1) the innovation was not withdrawn from the market and (2) the firm remained an independent producer of the innovations from the time of entry through the year when the market share was measured. If otherwise, the company is coded as not dominant.

**The order of entry** is measured by number of preceding entrants (failures included) and stage of life cycle at the time of entry. The entrants are classified into four categories - first mover, pioneer, early follower, and late entrant. This scheme facilitates comparison of entries across innovations with widely varying number of participant firms, yet it does not bury the first entrant. The first category includes

only one entrant for each innovation. The number of firms in the remaining three categories vary from innovation to innovation and some may have no entry in one or all three categories. Typically, the early follower was the largest group which reflects the relatively low risk of this window for entry, potential for rapid growth, and fear of being preempted. These unequal categories greatly limit the choice of statistical analysis, but attempts to equalize them would compromise the validity of findings.

**Lag.** In the descriptive statistics, entry order is supplemented by entry lag. The lag variable measures entry time delay of followers. Lag is defined as the number of years between the entry of first mover and the  $n^{\text{th}}$  follower in the corresponding product category.

Organizational characteristics is represented by two variables - firm's industry status and firm size. **Industry status** variable is dichotomized into incumbent and new entrant. A firm is classified as an incumbent if it offered an earlier version or a related product prior to new subfield entry. Otherwise, the firm was classified as new entrant.

**Size.** Based on corporate sales volume (millions of \$'s) one year prior to entry, firms are classified as small (sales  $\leq$  \$250 million) or large (sales  $>$  \$250 million). The small category also includes what strategy literature would consider medium size firms. Strategy researchers usually use \$200 to \$300 million revenue as upper limit to define medium size firms. To be consistent with the past practice \$250 million cutoff point was selected to separate small and medium size firms from large firms. This cutoff point is very robust because over 90 % of the firms in sample fell in the range of less than \$100 million and more than \$400 million in annual sales.

Innovation characteristics includes two variables - innovation newness and product type. The degree of **innovation newness** is dichotomized - radical vs. incremental. The decision where to classify the innovation is based on degree of new knowledge necessary to develop the innovation, departure from existing products, and technological complexity (see definitions). "Incremental" class has somewhat different meaning in this study than what is typically used in marketing textbooks. It does not mean that the innovation was a minor improvement in an existing product category. All innovations in the sample opened or attempted to open a new product category or a subcategory.

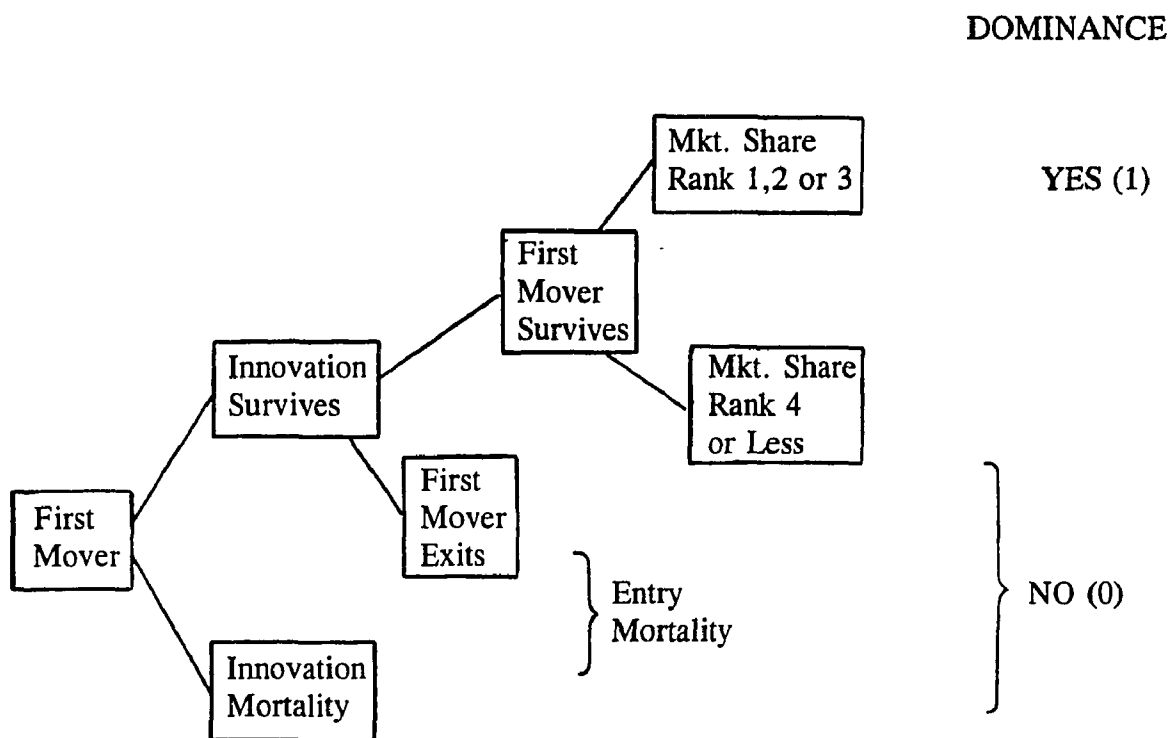
Likewise, **product type** is a dichotomous variable that classifies products as consumer or industrial. Several products, such as personal computers and software were sold to both markets. In those situations the product was classified in the category with the larger proportion of sales.

### **C. Design and Method of Analysis**

#### **1. Quantitative Analysis**

To observe performance of the first-movers and dominant firms over time, this study uses longitudinal design with measurements in two time periods. Period one reflects firm's performance around the end of the introductory stage of product life cycle, while period two captures current performance. Since the hypotheses are divided into two sets - one dealing with first movers (H1 to H8), the other with dominant firms (H9 to H11) - two separate data sets were used for the analysis. Sample one contains only first movers in each of the 52 product categories, whereas, sample two includes 214 firms that dominated 46 of the original 52 products during one of the two observed periods. To determine whether an entrant is classified as

dominant the logic of decision tree in Figure 3.6 was used.



**Figure 3.6 Decision Tree for Determining Market Dominance.**

Legend:

DOMINANT (1) = if first mover ranked among top 3 firms in market share  
 NOT DOMINANT (0) = otherwise

#### **a. Sample of First Movers**

Hypothesis H1. First mover advantage theory proposes that first entrants maintain market leadership of products which they pioneer. If the theory were supported, we would expect that majority (at least 50%) of first entrants did so. In the short run (introductory stage), such success may be observed because first entrant faces few competitors and viability of the innovation still remains unresolved. The hypothesis that the proportion of first movers which dominate the market in the short

run is greater than 50% ( $p > .5$ ) is tested against the null hypothesis that the proportion is less than or equal to 50% ( $p \leq .5$ ). The statistics is one-tail test of proportions (one sample) using normal distribution to calculate Z and p values (Berenson and Levine, 1992, p. 376). The procedure and the decision rule for rejecting the null hypothesis is outlined in Table 3.2.

**Table 3.2 H1 - Proportion of First Movers that Dominated the Market in Period 1: Test for Equality of Proportions.**

	Period 1 Dominance		
	Yes (D)	No (N)	Sample Size
First Mover	$Y_D$	$Y_N$	n

$$H_0: p \leq 0.5$$

$$H_1: p > 0.5$$

Decision rule: at  $\alpha = 0.01$  reject  $H_0$  if  $Z > 2.33$

where

$$p_D = \frac{Y_D}{n} = \frac{\text{number of dominant first movers}}{\text{sample size}}$$

$p$  = proportion of dominant firms from the null hypothesis

Hypothesis 2. In the long run, we expect the proportion of first movers which dominate the market to decline because either the innovation fails, the first mover exits or becomes a minor player in an increasingly competitive market. To test this hypothesis, a 2 x 2 contingency table was set up in Table 3.3, and a McNemar test of proportions was performed (Berenson and Levine, 1992, p. 475).

**Table 3.3 H2 - Number of Dominant First Movers in Period 1 vs. Period 2: McNamar Test of Proportions.**

		Dominance Period 2	
		Yes	No
Dominance Period 1	Yes	A	B
	No	C	D

$$H_0: p_{D1} \leq p_{D2}$$

$$H_1: p_{D1} > p_{D2}$$

Decision rule: at one-tail  $\alpha = 0.01$  reject  $H_0$  if  $Z > 2.33$

The sample proportions in Table 3.3 are:

$$p_{D1} = \frac{A+B}{n} \text{ proportion of first movers that dominated the market in period 1}$$

$$p_{D2} = \frac{A+C}{n} \text{ proportion of first movers that dominated the market in period 2}$$

Hypothesis H2a states that as the product matures, the market share of first movers declines. This is the same hypothesis as H2 but the performance variable is market share rather than market dominance. To compare market share difference between the two time periods one-tail t test was performed as outlined in Table 3.4.

**Table 3.4 H2a - First Movers' Market Share in Period 1 and Period 2: Test for Difference between Means.**

			Average Market Share	
			Period 1	Period 2
First Mover		$\mu_1$	$\mu_2$	

$$H_0: \mu_1 \leq \mu_2$$

$$H_1: \mu_1 > \mu_2$$

Decision rule: at  $\alpha = 0.01$  reject  $H_0$  if  $t_{51} > 2.4017$

### Hypotheses H3 - H6.

In these four hypotheses the aim is to uncover whether contingency variables have a significant influence on performance of first movers. Four contingency variables - product newness, product type, firm's industry status, and firm size - were used. In each hypothesis the sample of first entrants is subdivided according to dichotomy of respective contingency variable. For example, in H3, the contingency variable "product newness" splits the sample of first movers into radical and incremental subsamples. Since each hypothesis is tested for dominance and market share in two time periods, four test results are reported for each.

**Table 3.5 H3 - Influence of Product Newness on First Mover Success Rate: Fisher's Exact Test for Difference between Proportions.**

		Product Newness		
		Radical (R)	Incremental (IC)	
Market Dominance	Yes (D)	$Y_{D,R}$	$Y_{D,IC}$	$n_N$
	No (N)	$Y_{N,R}$	$Y_{N,IC}$	$n_N$
		$n_R$	$n_{IC}$	$n$

$$H_0: p_{IC} \leq p_R$$

$$H_1: p_{IC} > p_R$$

Decision rule: reject  $H_0$  if Fisher's exact test one-tail  $p < .01$

$$p_{IC} = \frac{Y_{D,IC}}{n_{IC}} \text{ proportion of incremental first movers that dominated the market}$$

$$p_R = \frac{Y_{D,R}}{n_R} \text{ proportion of radical first movers that dominated the market}$$

The design for comparing success rate and market share of radical against incremental innovators (H3) is shown in Table 3.5 and 3.6, respectively. To test if

there is a significant difference in success rate (dominance) between the radical and incremental subsamples, the 2 x 2 contingency Table 3.5 is subjected to one-tail Fisher's exact test (Berenson and Levine, 1992, pp. 455-458).

The hypothesis that incremental first movers are more likely to dominate their respective markets than radical first movers ( $P_{IC} > P_R$ ) is accepted if Fisher's one-tail p is smaller than  $\alpha = 0.01$ . Fisher's exact test rather than Chi-square test was used because expected cell frequencies in some of the 2 x 2 contingency tables were less than five. Fisher's test calculates the probability of observing a table that gives at least as much evidence of association as the one actually observed, given that the null hypothesis is true. The test assumes that the row and column marginals are fixed (SAS/STAT User's Guide, 1988, p. 530).

**Table 3.6 H3 - Influence of Product Newness on First Mover's Market Share: Test for Difference between Means.**

		Product Newness	
		Radical (R)	Incremental (IC)
Market Share	$\mu_R$	$\mu_{IC}$	

$$H_0: \mu_{IC} \leq \mu_R$$

$$H_1: \mu_{IC} > \mu_R$$

where

$\mu_R$  = average market share of first entrants which pioneered radically new product categories

$\mu_{IC}$  = average market share of first entrants which pioneered incrementally new product categories

The difference between the mean market shares of incremental and radical subsamples is tested using two sample t-test assuming unequal variances (Berenson

and Levine, 1992, pp. 431-433) as outlined in Table 3.6.

Test of hypotheses H4 to H6 where the sample of first movers is split according to product type, industry status and entrant size, respectively, follows the same design as hypothesis H3. Therefore, the procedure is not needlessly reiterated.

Hypothesis H7. At the beginning of this chapter I argued that entrant characteristics predispose firms to either pioneer or follow. In particular, it is expected that new product categories are more likely to be pioneered by small industry newcomers than either large newcomers or incumbents. To test whether there is a relationship between firm size, industry status and first movership, one-tail Fisher's exact test was performed. The cell frequencies in contingency Table 3.7 represent number of first entrants with particular organizational characteristics. The null hypothesis that the variables are independent is rejected if Fisher's one-tail p is less than  $\alpha = 0.01$ .

**Table 3.7 H7 - Influence of Company Size and Industry Status on Being First in the Market: Fisher's Exact Test.**

Company Size	Industry Status		
	Incumbent (I)	New Entry (NE)	
Large (L)	$Y_{L,I}$	$Y_{L,NE}$	$n_L$
Small (S)	$Y_{S,I}$	$Y_{S,NE}$	$n_S$
	$n_I$	$n_{NE}$	$n$

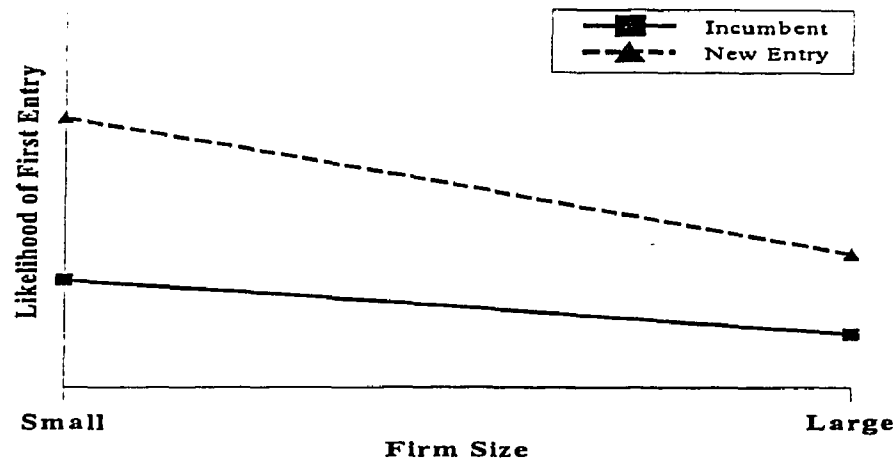
$$H_0: p_{S,NE} \leq (p_{L,I} + p_{S,I} + p_{L,NE})/3$$

$$H_1: p_{S,NE} > (p_{L,I} + p_{S,I} + p_{L,NE})/3$$

where

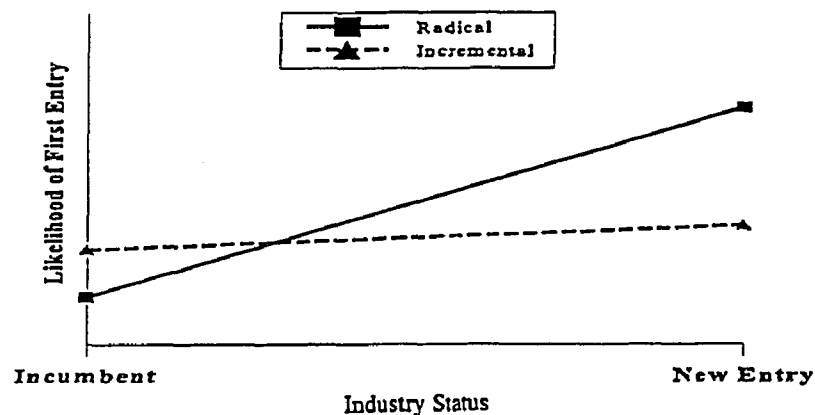
$p_{ij}$  = proportion of first mover sample with the particular organizational characteristics

The expected influence of firm size and industry status in the context of first entry is shown in Figure 3.7.



**Figure 3.7 H7 - Expected Influence of Size and Industry Status on First Movership.**

Hypothesis 8. Given that the firm is a first mover organizational characteristics also influence whether the firm introduces a radical or an incremental innovation. Specifically, hypothesis H8 sets forth that industry newcomers are more likely to pioneer radical innovations, while incumbents are more likely to introduce incremental innovations. In other words, we want to test if there is dependency between firm's industry status and the degree of innovation newness that the firm pioneers. The hypothesized interaction is show in Figure 3.8.



**Figure 3.8 H8 - Expected Influence of Industry Status on Likelihood of Pioneering a Radical or an Incremental Innovation**

To examine whether significant interaction exists, Fisher's exact test of the 2x2 contingency Table 3.8 is performed.

**Table 3.8 H8 - Relationship between Firm's Industry Status and Innovation Newness: Test of Independence.**

Innovation Newness		Industry Status		
		Incumbent (I)	New Entrant (NE)	
Radical (R)	$Y_{R,I}$	$Y_{R,NE}$	$n_R$	
Incremental (IC)	$Y_{IC,I}$	$Y_{IC,NE}$	$n_{IC}$	
	$n_I$	$n_{NE}$	$n$	

$$H_0: P_{R,NE} \leq P_{R,I}$$

$$H_1: P_{R,NE} > P_{R,I}$$

where

$$P_{R,NE} = \frac{Y_{R,NE}}{n_{NE}} \text{ proportion of industry newcomers which introduced radical innovations}$$

$$P_{R,I} = \frac{Y_{R,I}}{n_I} \text{ proportion of industry incumbents which introduced radical innovations}$$

#### b. Sample of Dominant Firms

To answer the research questions regarding the order of entry and organizational characteristics of the firms that established dominant market position (success), a sample of 214 firms in 46 product categories was used in the analysis. Dominance was earlier defined as firms which ranked among the top three in terms of market share in their respective product category. A schematic diagram relating the variables in hypotheses H9 to H11 is shown in Figure 3.5.

Hypotheses H9 and H10 propose that, among dominant firms the largest proportion is the early entrant group, followed by first entrant and pioneer group, followed by late entrants ( $p_{F+P} > p_E > p_L$ ). See Table 3.9.

**Table 3.9 H9, H10 - Order of Entry among Dominant Firms: Test for Equality of Proportions.**

Dominance Period 2	Entry Order			
	First Mover & Pioneer (F+P)	Early Follower (E)	Late Entry (T)	
No (N)	$Y_{N,F+P}$	$Y_{N,E}$	$Y_{N,T}$	$n_N$
Yes (D)	$Y_{D,F+P}$	$Y_{D,E}$	$Y_{D,T}$	$n_D$
	$n_{F+P}$	$n_E$	$n_T$	$n$

$$H9: p_{F+P} \leq p_E$$

$$H10: p_{F+P} > p_T$$

Decision rule: accept hypothesis if Fisher's one-tail  $p < 0.01$

To examine whether the proportions are significantly different, one-tail Fisher's exact test was performed. Hypothesis H9 compares the proportions of dominant first movers and pioneers against early followers, whereas H10 compares first entrant and pioneers against the group of late entrants. The null hypothesis that the proportions are not different is rejected if Fisher's one-tail  $p < 0.01$ .

Since there is only one first mover in each product category, but up to three firms may be classified as dominant, the maximum possible proportion of first movers in the dominant sample is 1/3. On the other hand, each of the three follower categories can have multiple firms. Thus, it is possible to have all dominant firms classified in one of the three follower categories. To eliminate this bias, first movers and pioneers were combined into one group.

The last hypothesis H11 proposes that firms which end up dominating the new product category tend to be large industry incumbents, irrespective of their order of entry, rather than industry newcomers or small incumbents. To see if organizational

size and industry status affect firm's performance, chi-square test for difference between proportions of Table 3.10 was performed (Berenson et al., 1992, p. 455).

**Table 3.10 H11 - Organizational Characteristics of Firms which Dominate the Market in the Long - run: (46 Product Categories).**

Company Size	Industry Status		
	Incumbent (I)	New Entry (NE)	
Large (L)	$Y_{L,I}$	$Y_{L,NE}$	$n_L$
Small (S)	$Y_{S,I}$	$Y_{S,NE}$	$n_L$
	$n_I$	$n_{NE}$	$n$

$$H_0: p_{L,I} = (p_{S,NE} + p_{L,NE} + p_{S,I})/3$$

$$H_1: p_{L,I} > (p_{S,NE} + p_{L,NE} + p_{S,I})/3$$

The null hypothesis that the proportions are equal is rejected if  $X^2 \geq 6.6635$  ( $\alpha = 0.01$ ,  $df=1$ ).

## 2. Qualitative Analysis

The qualitative portion of this study is based on historical review of individual innovations from the time of their commercialization to the present. The aim is to cross-validate, clarify and supplement the findings of the empirical part of this study.

Chapter 6 covers the product categories where the first entrant or the first brand succeeded. The primary focus is on the competitive dynamics, environmental conditions, situational factors and firms' strategies that lead to sustainable competitive advantage. The conditions under which the first mover is expected to succeed are summarized in Propositions 1 through 6 earlier in this chapter. The more conditions are met, the higher the chance of the first entrant to retain market dominance.

Chapter 7 focuses on products where first movers did not succeed and explores the common factors that contributed to their demise. These include:

- inability to gain pioneering advantage
- problems with first generation products
- rate of product acceptance by customers
- lack of resources, and
- effect of competition.

### III. DEFINITIONS

<u>Variable:</u>	<u>Level and Description:</u>
<b>Dominance:</b>	the firm ranked among top three firms in market share during the observed year. (Dominance=1 if yes, 0 otherwise)
<b>Market share:</b>	percentage share of the product category accounted for by the company during the observed year. Percentage will be calculated from dollar sales or unit sales depending on the norm in the industry. (U.S. market)
<b>Order:</b>	<p><b>First Mover</b> - company that was first to sell a commercial product in a new product category or a subcategory. If the first entrant failed and the product was later reintroduced by another firm, the firm will be classified as pioneer or early follower, depending on how many entry attempts preceded the firm (ORDER=1)</p> <p><b>Pioneer</b> - firm that was not the first to enter the market, but was among a small group of firms that entered during the embryonic stage and was instrumental for getting the market started. Some innovations may have no pioneers (ORDER=2)</p> <p><b>Early Follower</b> - firm that enters the market after the pioneers but before the decline in a growth stage (ORDER=3).</p> <p><b>Late Entrant</b> - firm that enters an established market, or is among last to enter (ORDER=4)</p>
<b>Lag</b>	measures entry delay of followers. Lag is defined as the number of years between the entry of first mover and the n <sup>th</sup> follower in the corresponding product category.

**Industry  
Status:**

**New Entrant** - a firm is classified as new entrant if it sold no products to the industry prior to the subfield entry (Tuschman and Anderson, 1986). New entrants can be an emerging start-up or an established firm in an unrelated product market (INDSTAT=1).

**Incumbent** - a firm is classified as incumbent if it offered an earlier version of the product or related products prior to the subfield entry (Mitchell, 1989), e.g., minicomputer manufacturer entering personal computer market (INDSTAT=0).

**Entrant Size:**

measured as corporate sales (millions of \$'s) during the year before firm's entry into the new product category. The variable is dichotomized: **Small** - when sales are < \$250 million (SIZE=1), **Large** -when sales are > \$250 million (SIZE=0).

**Innovation  
Newness:**

**Radical Innovations** - go beyond the existing technical know-how, draw on development of new knowledge or scientific breakthroughs (Abernathy and Utterback, 1978; Schoonhoven et al., 1990; Anderson and Tushman, 1990) and require the establishment of new behavior patterns (Schiffman and Kanuk, 1987). (NEWNESS=0)

**Incremental Innovations** - are based on unique combination of existing knowledge and are less disruptive than radical innovations (Schoonhoven et al., 1990). In this study, it has the same meaning as dynamically continuous innovation often used in marketing textbooks. (NEWNESS=1)

**Product  
Type:**

**Industrial Product** - those goods or services that are used in process of producing other goods or services (PRDTYPE=0).

**Consumer Product** - goods or services offered to public for ultimate use or consumption (PRDTYPE=1).

**Period 1:**

first year for which data was collected (end of introductory or beginning of growth stage) -calendar year

**Period 2:** second year for which data was collected (end of growth or beginning of mature stage) - calendar year

**Other Definitions:**

**Rank market share:** company market share ranking vis-a-vis other entrants (1, 2,...n).

**Entrant survival:** if the firm remained an independent producer of the product from time of entry through the year when the market share was measured (given that innovation survived)

**Entrant mortality:** exit of the firm from the given product/market via discontinuation of the operation, plant closure, or sale to an unrelated firm.

**Innovation Survival:** innovation remained in the U.S. market through the end of the observed period.

**Innovation Mortality:** exit from the U.S. market because of poor sales or government mandate.

**Entry time:** is recorded in the year when a firm first introduced the product under study.

**Exit time:** is recorded in the year when a firm ceased offering the product or a firm ceased operating as an independent entity.

**Niche opening innovations:** create a new product class or a product subcategory with its own set of competitors and customers (Tushman and Anderson, 1986). Can be radical or incremental. Only niche opening innovations are considered in this study.

## CHAPTER 4

## RESULTS OF EMPIRICAL ANALYSIS

## I. MARKET PERFORMANCE OF FIRST MOVERS (H1 to H7)

## A. Dominance in Early Stage of Product Life Cycle (H1)

Hypothesis 1, that the majority (over 50%) of the firms that enter the market first dominate the market segment in the early stage of the product life cycle, can not be accepted.

**Table 4.1 H1 - Proportion of First Movers that Dominated the Market in Period 1: Test for Equality of Proportions.**

		Period 1 Dominance		Sample Size
		Yes	No	
First Mover		28	24	52

H1 that  $p > 0.5$  is not supported,  $Z = 0.555$ , one-tail  $p = 0.287$ .

Although 28 of 52 first movers dominated the market in the introductory stage, the proportion barely makes it a majority (53.8%). In the test for equality of proportions (Table 4.1) the computed  $Z = .555$  with  $p = .287$ , indicates that there is a 28.7% chance that the proportion of dominant first movers is less than or equal to 50%. Thus, the null hypothesis that  $p \leq 0.5$  cannot be rejected.

These results are surprising. In this sample of 52 product categories, 24 (46.2%) first movers lost their dominant market position even before the market took off. Twelve firms either withdrew from the market or went bankrupt, and another twelve became only minor players with average market share equal to only 3% of a

very small initial market. However, the 28 first movers (53.8%) that remained market leaders during the introductory period had average market share of 57.3% which is nearly double the 33.7% share for the overall sample.

Since none of the reviewed studies examined short-run success rate of first entrants, these results cannot be compared with earlier studies. However, these findings provide evidence that survivor bias of past studies may be a serious problem even in the introductory stage of life cycle.

### **B. Long-Run Performance (Hypotheses H2 and H2a)**

To answer the research question, whether the first movers remain market leaders in the long run, two measures of performance - (1) dominance and (2) market share - were used. Hypotheses H2 and H2a proposed that as the product segment matures the number of dominant first movers and first mover's market share, respectively, will decline.

#### **1. Dominance**

To test hypothesis H2, the ratio ( $p_1$ ) of dominant first movers in period 1 was compared with the ratio ( $p_2$ ) in the period 2. Based on McNemar's test for differences between proportions from the two related populations (Berenson and Levine, 1992, p. 475), the hypothesis H2 was accepted with  $Z = 4.9$  and one-tail probability  $p = 5.0 \times 10^{-7}$ . As Table 4.2 shows for only four of twenty-eight innovations did the first mover which dominated the market in the first period also maintain leadership position in the later stage of the life cycle. However, it appears these innovating firms (Intel in two products, Bausch and Lomb, and Sony in one product) remained market leaders not because they were first in the market but

**Table 4.2 Test for Difference Between Proportions: Proportion of Dominant First Movers in Period 1 and Period 2 (Hypotheses H2 to H6).**

VARIABLE	LEVEL	N <sub>i</sub>	HYPOTHESIS	PERIOD 1		PERIOD 2	
				SUCCESS RATE [%]	ONE TAIL p	SUCCESS RATE [%]	ONE TAIL p
All First Movers	-	52	H2: * P <sub>D1</sub> > P <sub>D2</sub>	53.8		7.7	.000
Innovation Newness	Radical (R)	35	H3: †	57.1	.348	11.4	.193
	Incremental (IC)	17	P <sub>IC</sub> > P <sub>R</sub>	47.0		0.0	
Product Type	Consumer (C)	26	H4: †	53.8	.609	7.7	.695
	Industrial (IN)	26	P <sub>C</sub> > P <sub>IN</sub>	53.8		7.7	
Industry Status	Incumbent (I)	21	H5: †	47.6	.323	9.5	.535
	New Entry (NE)	31	P <sub>I</sub> > P <sub>NE</sub>	58.1		6.5	
Company Size	Large (L)	21	H6: †	61.9	.250	9.5	.535
	Small (S)	31	P <sub>L</sub> > P <sub>S</sub>	48.4		6.5	

p<sub>i</sub> = percentage of dominant first movers in group i

\* McNemar's Test for difference between proportions from two related populations

† Fisher's Exact Test for difference between proportions from two unrelated populations

N<sub>i</sub> = Number of first movers in the sample

because they were very strong competitors to begin with. All three firms were market leaders in several other products which they did not pioneer. This subject is discussed in greater depth in the qualitative portion of this study.

Interesting to note that none of the twenty-four innovators that lost their leadership in the introductory stage of the product life cycle (period 1) ever regained their leadership position again.

## **2. Market Share**

In hypothesis H2a the first entrants' market shares in period 1 ( $\mu_1$ ) and period 2 ( $\mu_2$ ) were compared. The results of the t-test for differences between the means from two related populations (Berenson and Levine, 1992, p. 418) in Table 4.3 showed support for the hypothesis that first movers' market share declines ( $\mu_1 > \mu_2$ ) as the innovation matures ( $t = 5.41$  and one-tail  $p = 8.7 \times 10^{-7}$ ). The average first entrants' market share in 52 product categories dropped from 33.7% in period 1 to only 4.3% in period 2.

The second period market share was so low because of high failure rate. Thirty-eight innovators had 0% market share and ten other firms that remained but did not dominate the market had average market share of only 3.2%. The four innovators that remained market leaders had an average market share of 46.5%.

## **C. Innovation Newness (H3)**

Hypothesis H3 posits that first movers which introduce radical innovations tend to be less successful than those which introduce incremental innovations. Success was measured in two time periods in terms of number of dominant firms in each group and in terms of market share. The results of a one-tail Fisher's exact test

**Table 4.3 Test for Difference between Means: Market Share of First Movers in Period 1 and Period 2. (Hypotheses H2a to H6)**

VARIABLE	LEVEL	N <sub>i</sub>	HYPOTHESES	PERIOD 1		PERIOD 2	
				MARKET SHARE [%]	ONE-TAIL T-TEST p	MARKET SHARE [%]	ONE-TAIL T-TEST p
All First Movers		52	H2a: $\mu_1 > \mu_2$	33.7	-	4.3	.000
Innovation Newness	Radical (R)	35	H3: $\mu_{IC} > \mu_R$	34.5	.583	6.1	.911
	Incremental (IC)	17		32.0		0.6	
Product Type	Consumer (C)	26	H4: $\mu_C > \mu_{IN}$	30.9	.693	2.9	.774
	Industrial (IN)	26		36.5		5.8	
Industry Status	Incumbent (I)	21	H5: $\mu_I > \mu_{NR}$	30.4	.687	6.5	.182
	New Entry (NE)	31		35.9		2.9	
Company Size	Large (L)	21	H6: $\mu_L > \mu_S$	34.8	.435	6.2	.208
	Small (S)	31		33.0		3.0	

N<sub>i</sub> = Number of first movers in the sample

for proportions shown in Table 4.2 do not support the hypothesis. In both time periods the success rate was actually higher for first entrants with radical innovations, but the difference was not statistically significant (one-tail Fisher's exact test  $p = 0.19$  in period 1 and  $p = 0.35$  in period 2). In the introductory stage 57.1% of radical innovators and 47.1% of incremental innovators dominated the market. However, as the products matured (period 2) all incremental innovators lost their leadership position and only four (11.4%) of the radical innovators remained dominant.

Likewise, comparison of radical and incremental first movers' market share showed no statistically significant difference between the two groups (Table 4.3). In period 1 the radical innovators had 2.5% higher market share (34.5% vs. 32%) than the incremental innovators. In period 2 the market shares dropped sharply to 6.1% for radical innovators and to only 0.6% for the incremental innovators. The greater difference between the two groups in the second period was because all four first movers that remained market leaders were in the group of radical innovators.

#### **D. Product Type (H4)**

Hypothesis H4, that first movers in consumer products would be more successful than first movers in industrial products, was not supported. The test for difference between proportions in Table 4.2 shows that first movers' success rates in consumer and industrial products were exactly the same in both time periods. In the first period, 53.8% and in the second period, 7.7% of first entrants in each product type dominated the market. Also, the test for market share differential between consumer and industrial first movers (Table 4.3) revealed no significant difference,

albeit, the direction of relationship was opposite the hypothesized one. In both time periods the industrial first movers actually had higher market share. The difference was 5.6% in period 1 and 2.9% in period 2 (Table 4.3).

As in hypothesis H3 the most interesting finding was not that the direction of relationship was contrary to the hypothesis but how much the performance of both groups deteriorated from period 1 to period 2. In both groups, the proportion of first movers that were dominant dropped six-fold between period 1 and period 2 to mere 7.7% success rate. For consumer products, these results are in line with the recent findings of Golder and Tellis (1993) who report that only 11% of first movers remained long-run market leaders. None of the reviewed studies reported long-run success rate of industrial first movers.

The long-run average market shares of 2.9% and 5.8% for first movers in consumer and industrial products respectively, found in this study, are a stark contrast to 30% market shares reported by Robinson and Fornell (1985) and Urban et al. (1986) in consumer industries, and Robinson (1988) in industrial products. However, a study of first entrants in consumer products by Golder and Tellis (1993) found average market share to be only 10%.

#### **E. Industry Status (H5)**

Hypothesis 5 argued that when the first mover is an industry incumbent, it is more likely to succeed than if the first mover is an industry newcomer. Both, the test of proportions and the comparison of market share means, showed no support for the hypothesis. In period 1 (Table 4.2) industry newcomers were actually more successful than incumbents (58.1% vs. 47.6% success rate), but the difference was

not statistically significant (Fisher's one-tail  $p = 0.323$ ). In period 2, the direction of relationship was as hypothesized but the difference between success rates (9.5% for incumbents vs. 6.5% for new entrants) was insignificant (Fisher's one-tail  $p = .535$ ).

Market share comparison in Table 4.3 also revealed that in period 1 new entrants actually had higher market share (35.9% vs. 30.4%) but the difference was not significant ( $t = .490$ , one-tail  $p = .687$ ). In period 2, again, the relationship reversed but incumbents' 6.5% market share was not significantly different ( $t = .914$ , one-tail  $p = .182$ ) from new entrants' 2.9% share.

While none of the empirical studies dealt with the issue of industry status in the context of first mover, Mitchell (1991) found that incumbents survived longer and had higher market share irrespective of entry order.

#### **F. Company Size (H6)**

Hypothesis H6, which posits that large first mover firms outperform small first mover firms, was not supported. Although, in both time periods large first-movers were more likely to dominate (Table 4.2) and had higher market share (Table 4.3), the differences were insignificant. In the first period, 61.9% of large and 48.9% of small first movers dominated the market (Fisher's one-tail  $p = .250$ ). Those fractions dropped to 9.5% and 6.5% respectively in period 2 (Fisher's one-tail  $p = .535$ ).

Market shares were 34.8% for large and 33.0% for small first-movers ( $t = .161$ , one tail  $p = .435$ ) in the first period, and 6.2% versus 3.0% ( $t = .208$ , one-tail  $p = .208$ ) in the second period. Again, none of the empirical studies investigated the influence of firm size on first mover performance. However, Mitchell (1991) found that for all entrants, corporate size affected neither market share nor survival.

### G. Organizational Characteristics and Predisposition to Enter the Market First (H7)

Hypothesis H7 proposed that firms that entered the market first tend to be small industry newcomers. Fisher's exact test in Table 4.4 is highly significant ( $p = 0.0018$  one-tail). The results reveal strong main effects and a significant disordinal interaction between company size and company industry status.

Industry status as a main effect shows that:

- new product categories are 1.5 times more likely to be pioneered by industry newcomers rather than by incumbents.

Organizational size as a main effect shows that:

- new product categories are 1.5 times more likely to be pioneered by small firms rather than by large firms.

**Table 4.4 H7 - Influence of Firm Size and Industry Status on First Entry (Sample of 52 Innovation Categories).**

Company Size	Industry Status		Row Total
	Incumbent (I)	New Entry (NE)	
Large (L)	14 (26.9)	7 (13.5)	21 (40.4)
Small (S)	7 (13.5)	24 (46.1)	31 (59.6)
Column Total	21 (40.4)	31 (59.6)	52 (100.0)

# frequency  
( ) table percentage

H7 that  $p_{S,NE} > (p_{L,I} + p_{S,I} + p_{L,NE})/3$  is supported; Fisher's one-tail  $p = .0018$

The disordinal interaction between size and industry status indicates that the two variables are not independent when it comes to market pioneering. With respect to interaction the results in Figure 4.1 can be interpreted in the following manner:

- Small size has strong positive effect on new entrants pioneering new product categories but a strong negative effect on industry incumbents.
- Large size seems to have no positive effect on incumbents pioneering new product categories but a strong negative effect on new entrants.

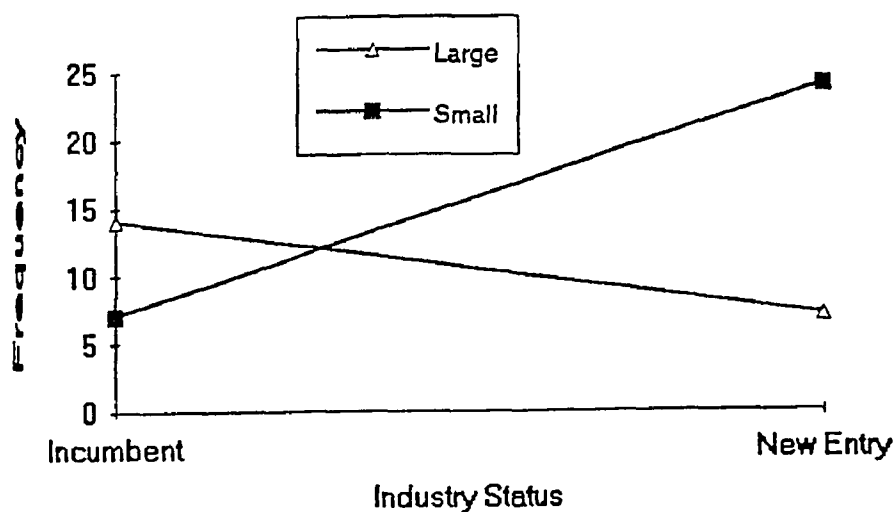


Figure 4.1 H7 - Influence of Firm Size and Industry Status on First Entry.

Expressing the relationship in numbers, 46% of the innovations were pioneered by small industry newcomers, 27% by large incumbents, 13.5% by small incumbents and 13.5% by large newcomers. The main effect results corroborate Mansfield's et al. (1977) findings that large firms accounted for fewer innovations than their small counterparts, and Mitchell's (1989, 1991) conclusion that incumbents are less likely to enter new markets first. However, the interaction of industry status and firm size had not been investigated.

## H. Industry Status and Innovation Newness (H8)

Hypothesis H8 posits that the majority of innovations introduced by industry incumbents would be incremental in nature while innovations introduced by industry newcomers would be mostly radical innovations. The expected disordinal interaction between a firm's industry status and its tendency to pioneer either radical or incremental innovation was not observed. Fisher's exact test ( $p = .4157$  one-tail) of the contingency Table 4.5 shows that the two variables are independent.

**Table 4.5 H8 - Relationship between Firm's Industry Status and Innovation Newness (sample of 52 first movers).**

Innovation Newness	Industry Status		Row Total
	Incumbent (I)	New Entry (NE)	
Radical (R)	15 (71.4)	20 (64.5)	35 (67.3)
Incremental (IC)	6 (28.6)	11 (35.5)	17 (32.7)
Column Total	21 (40.4)	31 (59.6)	52 (100.0)

Hypothesis H8 that incumbents introduce incremental innovations and newcomers introduce radical innovations was not supported ( $\chi^2 = 0.2718$  and  $p = 0.6021$ ).

In absolute terms, as expected, industry newcomers introduced more radical and incremental innovations. However, contrary to expectation, incumbents, if first, were as likely to pioneer radical innovations as new entrants. The ratio of radical to incremental innovations was actually higher for incumbents than for new entrants. This finding is unexpected and receives further analysis in the qualitative portion of this study.

## II. Dominant Firms (H9 to H11)

The results of the previous section confirm the main contention that first entrants do not establish long-run dominant market position. In fact, the success was so rare that neither the product characteristics nor the organizational characteristics made a statistically significant difference in performance of the various first mover subcategories.

### A. Entry order of Dominant Firms (H9 and H10)

If first movers do not dominate the market the question remains as to the order of entry of the firms which become dominant. The hypotheses H9 and H10 address this question.

**Table 4.6 H9 - Entry Order of the Long-run Dominant Firms: Test of Equality of Proportions (First Movers & Pioneers vs. Early Followers).**

Dominance Period 2	Entry Order		
	First & Pioneer (F+P)	Early Follower (E)	
No	56 (67.5)	27 (32.5)	83 (48.8)
Yes	13 (14.9)	74 (85.1)	87 (51.20)
	69 (40.6)	101 (59.4)	170 (100)

( ) row percentage

H9 that  $p_{F+P} < p_E$  is supported, Fisher one-tail  $p = 1.26 \times 10^{-12}$

There is strong support for hypothesis H9 that first movers and pioneers are less likely than early followers to dominate the new product category in the long run (Fisher's one-tail  $p = 1.26 \times 10^{-12}$ ). Early followers outnumbered first movers and

pioneers 5.7 to 1 (Table 4.6). The early entrant group accounted for 56.5% and first movers and pioneers only for 9.9% of the 131 firms that dominated the markets in the second period (Figure 4.2). The first mover and pioneer group was composed of four first movers and nine pioneers. These findings contradict the first mover advantage theory and the result of earlier empirical studies (Lambkin, 1988; Whitten, 1979).

Hypothesis 10, which posits that in the long-run, first movers are more likely to dominate the market than late entrants, was not supported. The Fisher exact test is significant ( $p = 4.99 \times 10^{-20}$ ) but the relationship is opposite of that predicted (Table 4.7). Surprisingly, late entrants were 3.4 times more likely to be among long-run dominant firms than first entrants and pioneers combined. In fact, the 44 late entrants accounted for one third of the dominant firms in period 2.

**Table No. 4.7 H10 - Entry Order of the Long-run Dominant Firms: Test of Equality of Proportions (First Movers & Pioneers vs. Late Entrants).**

Dominance Period 2	Entry Order		
	First & Pioneer (F+P)	Late Entrant (L)	
No	56 (100.0)	0 (0.0)	56 (49.5)
Yes	13 (22.8)	44 (77.2)	57 (50.5)
	69 (61.1)	44 (38.9)	113 (100)

# number of firms

( ) row percentage

H10 is not supported; Fisher one-tail  $p = 4.99 \times 10^{-20}$  is significant but the relationship is in opposite direction.

Combining the results of hypotheses H9 and H10 leads to the conclusion that the relationship between entry order and market performance is curvilinear. As illustrated in Figure 4.2, the odds of market dominance improve with later entry, peak with the firms which enter in the early growth stage and decline somewhat (but not below the level of first movers and pioneers) with late entry.

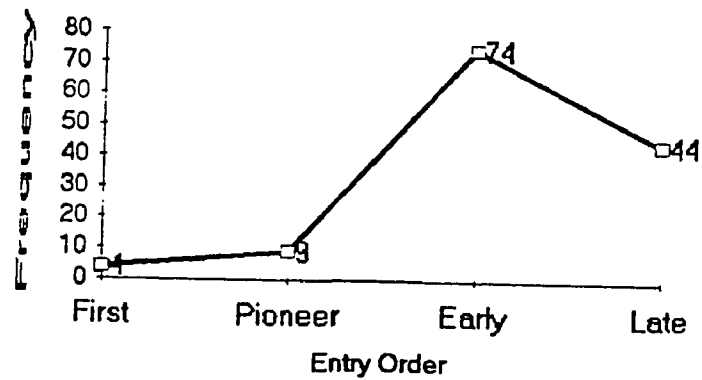


Figure 4.2 H9 and H10 Entry Order of Firms that Dominated the Market in Period 2 (N = 131).

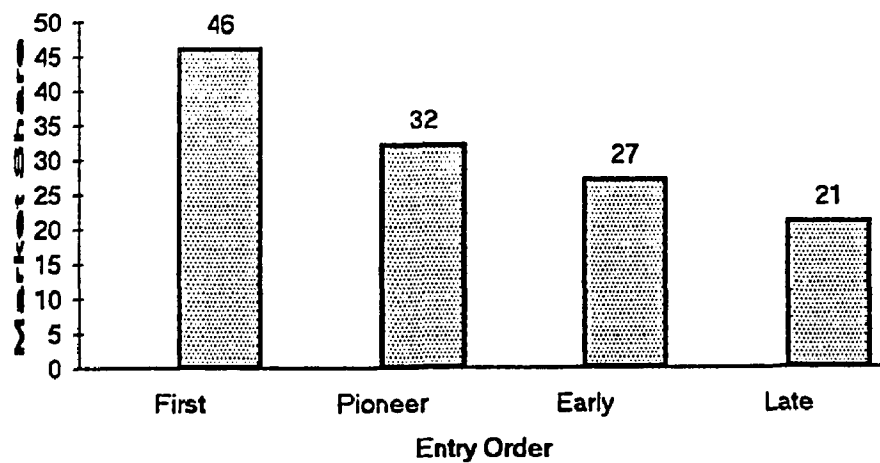


Figure 4.3 Average Market Share of the Firms that Dominated the Market in Period 2 (N = 131).

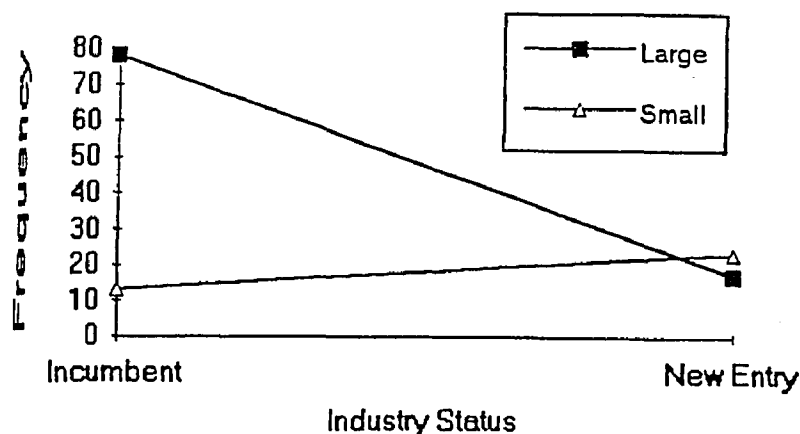
The results of hypotheses 9 and 10 run contrary to the past empirical studies that indicate decreasing performance with later entry. The market share results in Figure 4.3, on the other hand, show the same pattern of decreasing share with later entry as those observed by Robinson et al. (1985), Lambkin (1988), and Urban et al. (1986). Yet, it is no evidence that first entrants perform better than followers because the shares are subject to success and survival in the market. As Figure 4.2 shows, only four first movers and five pioneers, but 74 early followers and 44 late entrants dominated the market in the second period.

#### **B. Organizational Characteristics and Long Run Market Dominance (H 11)**

Hypothesis 11 argues that in the long-run, the market tends to be dominated by large industry incumbents rather than new entrants or small incumbents. The result of  $\chi^2$  test in Table 4.8 strongly support the hypotheses ( $\chi^2 = 26.0$ ,  $p = 3.3 \times 10^{-7}$  and Pearson R = .445). The table reveals strong main effects and a significant disordinal interaction between company size and industry status.

In the sample of 46 product innovations large firms were 2.6 times more likely dominate the new segment than the small firms. Also incumbents were 2.3 times more likely to dominate than new entrants. However, the interaction of size and industry status have a disordinal effect on market dominance (Figure 4.4).

- Large size has a strong positive effect on industry incumbents to dominate the market and strong negative effect on new entrants.
- Small size, on the other hand, has positive effect on new entrants to dominate the market and a negative effect on incumbents.



**Figure 4.4** Interaction of Firm's Industry Status and Size; Sample of firms that Dominated the Market in Period 2.

Clearly, large incumbents were the biggest group (59.5%) among the firms which dominated the new markets in the long-run. This finding contradicts the prevalent view that innovations, especially those pioneered outside the industry, destroy leading incumbents' established competencies and initiate change over in industry leadership (Reinganum, 1983; Levitt, 1960).

**Table 4.8** H11 Effect of Organizational Characteristics on Long-run Dominance in 46 Product Innovation Categories.

Company Size	Industry Status		Row Total
	Incumbent (I)	New Entry (NE)	
Large (L)	78 (59.5)	17 (13.0)	95 (72.5)
Small (S)	13 (10.0)	23 (17.5)	36 (27.5)
Column Total	91 (69.5)	40 (30.5)	131 (100.0)

H11 that  $p_{L,I} > (p_{S,NE} + p_{L,NE} + p_{S,I})/3$  is supported;  $\chi^2 = 26.037$ ,  $df=1$ ,  $p = 3.3 \times 10^{-7}$ .

Surprisingly, small new entrants, albeit only 17.5% of long-run dominant firms, outperformed the better endowed large new entrants (13%) and small incumbents (9%). The notable fact, however, is that 21 of the 23 dominant, small new entrants were imitators that entered the market, on an average 9.7 years after the innovation was first introduced. This discovery, again, disputes the given view in the strategy literature that small industry newcomers, to have any chance of success in the market, must innovate, not imitate.

The results of hypothesis H11 support Mitchell's (1991) findings that in the long-run, leading incumbents tend to dominate new market segments although they are rarely first in the market.

### **III. SUMMARY**

As evident in Table 4.9 only 5 of the 12 hypotheses were supported. However, this does not mean that the arguments developed earlier in Chapters 2 and 3 are incorrect. On the contrary, the basic premise that first entry does not lead to sustainable competitive advantage is actually strengthened. In fact, the results suggest that being first results in substantial competitive disadvantage, which even well-endowed and otherwise strong firms find difficult to overcome. It did not matter whether the firm was large or small, incumbent or industry newcomer, nor if the innovation was radical or incremental, consumer or industrial; first entrant failed (to dominate) indiscriminately. Among the failed first movers, lie some of the best endowed, most admired firms in the world, including AT&T, Adidas, Raytheon, 3M, Johnson & Johnson, and Kodak.

**Table 4.9 Summary of Hypotheses Tests; (S= Supported, NS = Not Supported)**

Hypothesis	Part	Variable	Performance	Result
H1		All first	Dominance P1	NS
H2		All first	Dominance (P1-P2)	S
H2a		All first	Market share (P1-P2)	S
H3	a	Product newness	Dominance P1	NS
	b	Product newness	Dominance P2	NS
	c	Product newness	Market share P1	NS
	d	Product newness	Market share P2	NS
H4	a	Product type	Dominance P1	NS
	b	Product type	Dominance P2	NS
	c	Product type	Market share P1	NS
	d	Product type	Market share P2	NS
H5	a	Industry status	Dominance P1	NS
	b	Industry status	Dominance P2	NS
	c	Industry status	Market share P1	NS
	d	Industry status	Market share P2	NS
H6	a	Firm size	Dominance P1	NS
	b	Firm size	Dominance P2	NS
	c	Firm size	Market share P1	NS
	d	Firm size	Market share P2	NS
H7		Size vs. status	First entry	S
H8		Status vs. newness	First entry	NS
H9		Entry order (F+P)/E	Dominance P2	S
H10		Entry order (F+P)/L	Dominance P2	NS
H11		Size vs. status	Dominance P2	S

**Note:**

In hypotheses that were not supported the direction of relationship was:

- as expected but insignificant in H1, H5 b,d and H6 a-d;
- opposite the expectation but insignificant in H3 a-d, H4 c,d, H5 a,c and H8;
- opposite the expectation and significant in H10.

The results of hypothesis H1 show that even in the very early stage (period 1), 46% of first movers were not able to hold on to their market. Either the product failed very early on (videophone, light beers), competitors entered almost immediately (wine cooler, PC, MRI, among others), a product remained in a prolonged "twilight zone" (parallel computer, disposable diaper, videotext, facsimile machines, etc.), or innovation was leapfrogged with an improved product or technology a short time after market introduction (compact autofocus camera, DRAM, computer workstation, and others). In most cases, however, it was a multitude of factors that ended the first entrant's reign over the market.

Hypothesis H2 revealed that of the 52 first entrants only 4 dominated the market through the later stage of the product life cycle. Therefore, given the sample size, this success rate was too low to detect statistically significant differences between the subsamples of first entrants in Hypotheses H3 to H6, even when all dominant first movers fell in one subcategory.

Measuring first movers' performance in terms of market share rather than frequency of success led to the same conclusions. In the second period (hypothesis H2a), the average share of first movers dropped to only 4.3%. The market share differences of the first mover subsamples in hypotheses H3d to H6d came out insignificant because the means were very low and close to one another. In order to detect significant results with such low means the sample size would have to be several times larger.

The second major argument, that organizational characteristics predispose a firm to pioneer a new product category (hypothesis H7), was also supported. As

expected, small industry newcomers were more likely to pioneer new products than either the large firms or small industry incumbents.

However, the expectation that industry status predisposes the firm to pioneer either a radical or an incremental innovation (hypothesis H8) was not supported. The ratio of radical to incremental innovations pioneered by the incumbents was actually higher than that of the industry newcomers.

The research questions regarding the entry order of the firms which dominated the new product categories in the long-run, and their organizational characteristics were addressed in hypotheses H9 to H11. The results of H9 and H10 show that the relationship between entry order and market dominance is not that of decline with later entry as reported in earlier studies (Miller, et. al., 1989; Robinson, 1988; Urban, et. al. 1986), but curvilinear - lowest for first entrants and pioneers, highest for early followers and somewhat lower for late entrants.

Last, the contention that organizational characteristics influence the firm's success in the new product category was supported. As predicted in H11, the large industry incumbents were most likely to dominate although they rarely entered the market first.

The next chapter discusses and compares results of the hypotheses with earlier studies. Also, it provides additional descriptive statistics about the samples of first entrants and the firms that dominated the market in the long run.

## CHAPTER 5

### DISCUSSION OF EMPIRICAL RESULTS

#### I. INTRODUCTION

This chapter addresses some of the important and unexpected results enumerated in the previous chapter. Results are compared with previous studies where relevant. Furthermore, the chapter presents and interprets additional descriptive statistics regarding survival rate, length of survival and duration of market leadership of the first entrants. Summary statistics on entry lag of dominant firms and market leaders are also provided and compared with earlier studies.

The discussion proceeds in the following order:

- section II deals with the performance and characteristics of first entrants
- section III views dominant firms and market leaders, and
- section IV compares first mover sample against the dominant sample.

#### II. PERFORMANCE OF FIRST MOVERS

##### A. Survival of First Entrants

In this study, survival means that the firm remained an independent seller in the product category from time of entry through 1992. Survival of first entrants was not part of the hypothesis testing but a summary of the statistics are included here as evidence that exclusion of non-survivors seriously biased the results of past studies in favor of pioneering. In the past, researchers stated that exclusion did not compromise their findings (Robinson, 1988; Lambkin, 1988) or that in their sample of products pioneers did not fail (Urban et al. 1986).

Table 5.1: First Entrants versus Market Leaders in 52 Product Categories.

<b>PR. ID</b>	<b>PRODUCT CATEGORY</b>	<b>FIRST MOVER</b>	<b>PERIOD 1 LEADER</b>	<b>PERIOD 2 LEADER</b>
1	Athletic shoe	Adidas (1968)	Adidas (1968)	Nike (1972)
2	Light beer	Piel Brothers (1951)	PM/Miller (1972)	Anheuser Busch (1976)
3	Wine cooler	Bianchi (1979)	Calif. Cooler (1981)	Seagram (1985)
4	Diet soft drink	Kirsch's No-cal (1952)	Royal Crown (1962)	Coca Cola (1963)
5	Decaffeinated cola	Canada Dry (1967)	Royal Crown (1980)	Coca Cola (1983)
6	Sport drink	Stokely Van Camp (1967)	Stokely Van Camp (1967)	Quaker Oats (1983)
7	Disposable diaper	J&J (1950)	P&G (1966)	P&G (1966)
8	In-line skate	Chicago Roller (1968)	Rollerblade (1980)	Rollerblade (1980)
9	Sailboard	Windsurfer Int. (1970)	Windsurfer Int. (1970)	Bic Sport (1982)
10	Mountain bike	Fisher (1979)	Murray (1981)	Huffy (1985)
11	Video game	Nutting Asoc. (1970)	Magnavox (1972)	Nintendo (1985)
12	Videodisc player	Philips (1979)	RCA (1981)	Pioneer (1979)
13	CD player	Sony (1983)	Sony (1983)	Sony (1983)
14	VCR - home market	Ampex (1963)	RCA (1971)	Thompson (1988)
15	Videotext	Telecomputing (1979)	Compuserve (1985)	Prodigy (1988)
16	TV shopping	Tempo (1979)	HSN (1985)	HSN (1985)
17	Pocket calculator	Bowmar (1971)	Texas Instrument (1972)	Sharp (1972)
18	Microwave oven	Amana/Raytheon (1966)	Litton (1971)	Matsushita (1970)

Table 5.1 - (cont.)

<b>PR. ID</b>	<b>PRODUCT CATEGORY</b>	<b>FIRST MOVER</b>	<b>PERIOD 1 LEADER</b>	<b>PERIOD 2 LEADER</b>
19	Videophone	AT&T (1964)	product failed	AT&T reentry (1992)
20	35 mm camera compact AF	Konica (1978)	Canon (1980)	Olympus (1983)
21	Credit card	Diners Club (1950)	Diners Club (1950)	Visa (1965)
22	Superpremium ice cream	Senator (1961)	Senator (1961)	Grand Met. (1989)
23	Soft contact lens	Bausch & Lomb (1971)	Bausch & Lomb (1971)	Bausch & Lomb (1971)
24	Stainless steel razor blade	Wilkinson (1961)	Wilkinson (1961)	Gillette (1963)
25	Low calorie sweetener/Home	Abbott Labs (1950)	Cumberland (1958)	Monsanto/Searle (1981)
26	Camcorder	Kodak (1984)	RCA/GE (1985)	Sony (1985)
27	ATM	Docutel (1969)	Docutel (1969)	Diebold (1974)
28	Jet aircraft	DeHaviland (1952)	Boeing (1958)	Boeing (1958)
29	Supersonic com. jet	B.A./Aerospatiale (1976)	B.A./Aerospatiale (1976)	product failed
30	HFCS	Stnd. B./Clinton (1970)	Staley (1972)	ADM (1975)
31	Aspartame	Searle (1981)	Searle (1981)	Monsanto/Searle (1985)
32	Saccharin	Monsanto (1900)	Monsanto (1900)	imports
33	Cyclamate	Abbott Labs (1950)	Abbott Labs (1950)	product banned 1969
34	Miraculin	Miralin Inc. (1973)	1974 product withdrawn	
35	MRI	Fonar (1980)	J&J/Technicare (1981)	GE (1982)
36	CT Scanner	EMI (1972)	EMI (1972)	GE (1975)

Table 5.1 - (cont.)

<b>PR. ID</b>	<b>PRODUCT CATEGORY</b>	<b>FIRST MOVER</b>	<b>PERIOD 1 LEADER</b>	<b>PERIOD 2 LEADER</b>
37	Photocopier	3M (1950)	Xerox (1959)	Canon (1974)
38	Fax machine	Magnavox (1966)	Magnavox (1966)	Sharp (1980)
39	PC Fax board	Gammalink (1985)	Gammalink (1985)	Hayes/Practical (1988)
40	PC	Scelbi (1974)	MIT (1975)	IBM (1981)
41	Transportable PC	STM Systems (1976)	Compaq (1983)	specialty market
42	Notebook computer	Epson (1981)	Tandy (1983)	Toshiba (1982)
43	Workstation	3 Rivers (Perq) (1980)	Apollo (1981)	Sun (1983)
44	Minicomputer	Burroughs (1956)	Digital (1960)	IBM (1976)
45	Mainframe computer	Remington Rand (1951)	IBM (1953)	IBM (1953)
46	Supercomputer	Control Data (1960)	Control Data (1960)	Cray Research (1976)
47	Mass. parallel supercomputer	Burroughs (1972)	Floating Point (1981)	Thinking Machine (1986)
48	Wordprocessing software-PC	Electric Pencil (1976)	MicroPro/WS (1979)	WordPerfect (1982)
49	Spreadsheet software-PC	VisiCorp (1979)	Lotus (1983)	Lotus (1983)
50	DRAM	Advanced Mem. Systems (1970)	Intel (1970)	Toshiba (1978)
51	Microprocessor	Intel (1971)	Intel (1971)	Intel (1971)
52	Flash memory	Intel (1988)	Intel (1988)	Intel (1988)

( ) year of firm's market entry

The survival rate of 27% (Table 5.2) which was observed in this study shows otherwise. This figure is only one half of the 53% survival rate found by Golder and Tellis (1993) but this difference is easily explained. Their study measured survival of brand whereas this study measures survival of the firm. In general, brands survive longer than the firms which introduce them. If the same definitions were used, the brand survival in this study also would be about 50%. For example, Senator Ice Cream Co., the pioneer of Häagen Dazs, no longer exists but the brand lives on and has changed ownership five times. Other pioneering brands under different ownerships include Diners Club, Gatorade, deHaviland, Univac and NutraSweet.

**Table 5.2 Survival Rate of First Entrants**

<b>First entrant category</b>	<b>No. of cases</b>	<b>No. of survivors</b>	<b>Survival rate [%]</b>
Total	52	14	27
Radical	35	11	31
Incremental	17	3	18
Consumer	26	7	27
Industrial	26	7	27
Incumbent	21	9	43
New entry	31	5	16
Large	21	9	43
Small	31	5	16

Table 5.2 compares the survival rates across the various first mover categories. Notable but not unexpected, differences were found in comparing incumbents versus new entrants and, large versus small firms. The survival rate was nearly three times as high for incumbents and large firms than for new entrants and

small firms. This result corroborates Mitchell's (1991) finding that incumbents are more likely to survive longer than industry newcomers.

Contrary to expectations survival among radical innovators was actually higher than among incremental innovators. However, seven of the eleven radical survivors were well endowed multinational firms (Sony, Intel, Phillips, Epson, Burroughs, Raytheon, and Konica). Only one incremental innovation was pioneered by a large incumbent; it survived. The difference in survival between radical and incremental first movers thus has more to do with company resources than innovation characteristics. Considering only firm characteristics, large incumbents were 3.5 times more likely to survive than small incumbents or new entrants (57% vs 16% survival rate). No difference in survival rate between consumer and industrial product categories was found.

In conclusion, 27% survival rate of first entrants is very low, but it is in line with the up to 90% failure rates of new products (Miller, 1993; Crawford, 1979). This finding indicates that survival bias in past studies strongly exaggerate the benefits of pioneering and is perhaps the main reason why pioneer advantages were observed. Furthermore, results show that survival of first entrants is influenced by organizational characteristics favoring large incumbents. No such relationship was observed in when market dominance as the measure of performance was used.

#### **B. Market Share of First Entrants**

The market share of first entrants is presented in Table 5.3. The mean market share of all first entrants in the early stage at product life cycle was 33.7%. This figure is nearly 10% higher than the 24% share in the start-up sample reported by

Lambkin (1988). Notable, the share of new entrants was 5.5% higher than that of industry incumbents. One plausible explanation may be that pioneering by an incumbent triggers earlier and stronger competitive response than if the first entrant is an industry newcomer. The other surprise is the 5.5% higher market share for industrial than for consumer products. Past studies show marginal, but consistently higher performance in consumer industries. Although differences between classes of first movers exist none are statistically significant because of the relatively small sample size.

**Table 5.3 Market Share of First Entrants**

First entrant category	No. of cases	Period 1 share [%]	Period 2 share [%]
Total	52	33.7	4.3
Radical	35	34.5	6.1
Incremental	17	32.0	0.6
Consumer	26	30.9	2.9
Industrial	26	36.5	5.8
Incumbent	21	30.4	6.5
New entry	31	35.9	2.9
Large	21	34.8	6.2
Small	31	33.0	3.0

The most revealing finding, however, is the 4.3% mean share of first entrants in period 2. The only other researchers who found pioneers share as low as 6% were Golder and Tellis (1993). In contrast, Lambkin's (1988) results show pioneers' market share actually rising from 24% to 32.6% as the products matured (see Table 2.1 in Chapter 2). That is rather curious since pioneers start off with 100% share and

as competitors enter their share drops. For example, Urban et al. (1986) points out that with six competitors present, the first mover still remains a market leader but its share will drop to 27% (see Table 2.2 in Chapter 2). On an average, studies that used PIMS data found long term market share of pioneers to be around 30%. Even the average 10% share of the worst performing group (late entrants) reported in earlier studies is more than twice the 4.3% share of first movers found in this study.

The radical innovators' market share was 10 times higher than that of the incremental innovators. This is because the incremental group had one of the lowest survival rates (Table 5.2) and all four successful first entrants introduced radical innovations. In the other three subsamples the market leaders were evenly split (see Table 5.4).

Another notable finding is that the first movers' long term market share is not normal but bimodal. That is, first entrants do either extremely well or extremely poorly. Only four remained market leaders with shares ranging from 20% to 75%, 38 had zero % share and the remaining 10 had shares ranging from 0.4% to 6%.

In conclusion, neither the low survival rate nor the low market shares in this data support the prevalent view that pioneering leads to sustainable competitive advantage. Rather, the results show that pioneers pay a heavy penalty for being first.

### **C. Market Leadership**

The market leader is defined as the firm with the highest market share. Dominance or success used in this study is a less stringent definition of performance and means that the firm ranked among top three firms in terms of market share. In this data no first entrant ranked second or third, all those that succeeded were market

leaders. No other empirical study measured performance in terms of dominance but Buzzell and Gale (1987) and Golder and Tellis (1993) discuss market leadership. So, for the purpose of comparison the leader definition is used in this section.

**Table 5.4 Market Leadership of First Entrants**

<b>First entrant category</b>	<b>No. of cases</b>	<b>No. of leaders</b>	<b>Percentage leaders [%]</b>
Total	52	4	7.7
Radical	35	4	11.4
Incremental	17	0	0
Consumer	26	2	7.7
Industrial	26	2	7.7
Incumbent	21	2	9.5
New entry	31	2	6.5
Large	21	2	9.5
Small	31	2	6.5

Of the 52 first movers only 4 or 7.7% remained market leaders (Table 5.4). Contrary to expectations, the incremental group underperformed the radical group. However, as mentioned earlier, the difference had more to do with who pioneered rather than what they pioneered. These results are comparable to Golder et al. (1993) findings where only 11% of pioneers were current market leaders. In the 16 post-WWII product categories, only 6% of brands retained a leading position. This finding underscores the survival bias in both the PIMS and Urban's ASSESSOR data bases. Buzzell and Gale (1987) report that nearly 50% of pioneers remain market leaders. In Urban's sample of 36 consumer non-durables 15 first entrants (42%) remained market leaders.

Again, using leadership as a measure of performance, the results in Table 5.4 contradict the first-mover advantage model and the empirical evidence that supports it.

#### **D. Duration of Market Leadership**

By virtue of being first to the market, a firm becomes a market leader. How long does this leadership last? In this sample of 52 products, the first movers remained category leaders for an average of 6.6 years. Even this figure is artificially high because of a few outliers. Just removing a single product, saccharin, where Monsanto lead the market for 73 years, reduces the average to 5.3 years. Moreover, in 6 of 10 products where the first mover remained a leader for 10 years or more, the category experienced a long gestation period of low sales and attracted few competitors. A representative example of this group is Johnson and Johnson which pioneered a disposable diaper in 1950. During its 15 year tenure the market grew to only \$10 million in annual sales. From 1966 to 1970 the sales increased to \$130 million but Procter and Gamble fifth to enter 16 years after J&J, took over 92% of the market (Porter, 1980a). Currently, P&G still controls 44% of the \$4 billion US diaper market, while J&J withdrew in 1981 after costly but unsuccessful attempts to become a major competitor.

If J&J was less than fortunate, others fared even worse. For example, Advanced Memory Systems (AMS), the firm that pioneered the dynamic random access memory chip (DRAM) in 1970, was a market leader for about 4 months. Of some dozen firms that entered after AMS, Intel captured over 50% of the market by the year-end (Business Week, 1970, p.60). As a bonus, Intel got the title of first entrant. In 17 product categories (1/3 of the sample), the first entrant remained a

leader for one year or less. To put this in a perspective, the average time for the market to accept an innovation was about 8.5 years. By the time products entered the growth stage about 70% of first movers were no longer in number one position.

The length of the first entrant leadership found in this study in only one half the 12 years observed by Golder and Tellis (1993). But the authors also note the average was pushed upwards by only a few product categories. The median of 5 years was more representative of the sample. They also point out that leadership was lost in the early stage of the product life cycle. Since most other studies are cross-sectional, the duration of leadership was not measured. However, the authors' underlying assumptions are that few pioneers fail (Urban et al., 1986) and about half remain leaders through the life cycle of the product (Buzzell and Gale, 1987). Apparently, that rarely is the case.

#### **E. Who Enters First**

The main thesis of hypotheses 7, that new product categories tend to be pioneered by small industry newcomers was confirmed. That was the case in 24 of the 52 products (46%). The surprising finding was that the large incumbents were the second largest group and pioneered 14 product categories (27%). As discussed in chapters 2 and 3, because of their superior resources and an ability to come from behind, large incumbents have the least incentive to pioneer new product categories.

Several factors explain this result. First, the definition of size is a dichotomy classifying firms as "large" if the firm's sales for the year prior to the entry exceeded \$250 million. But size is relative to who else is in the industry. Of the 14 firms classified as large incumbents only 5 were industry leaders (Adidas, AT&T, Sony,

J&J, and Intel). The other 9 firms were relatively small compared to major industry competitors. Typical of this group are Canada Dry in decaffeinated cola, Konica in autofocus cameras, and deHaviland in jet aircraft, (see Table 5.1).

Second, outside of United State a majority of innovations are introduced by large established firms (OECD, 1982). Half of the fourteen large incumbents which pioneered the product categories in the U.S. were foreign multinationals.

Third, in 6 of the remaining 7 product categories pioneered by large U.S. incumbents, the first entrant was not a product pioneer. For example, the first commercial computer UNIVAC was developed by a small start-up named Eckert-Mauchly Electronic Control Company in late 1940s. Lack of capital forced Eckert and Mauchly to sell out to Remington Rand in 1950. Remington delivered the first UNIVAC computer in June of 1951 (Fisher et al., 1983, p.8). Likewise, the flash memory chip was invented by Toshiba. But Intel, seeing the product beat Toshiba to the market. The disposable diaper was invented and pioneered by a Swedish firm - Molnlycke in late 1940s. Johnson & Johnson introduced a similar diaper in the U.S. in 1950. In that sense, these firms actually enjoyed a "free-ride".

Last, all products introduced by large incumbents (such as CD player, videophone, jet aircraft, camcorder etc.) required lots of up front capital, de-facto eliminating the small firms from the possibility of pioneering these products.

These results are in agreement with the existing body of literature on innovation and new product development showing that new product are likely to be pioneered by small industry newcomers. Even when a product was pioneered by a large incumbent, the firm was not a major industry competitor. The findings

contradict the endogeneity argument (Moore et al., 1991) that pioneers may be more successful because they started with superior skills and resources.

#### **F. Who Pioneers Radical Innovations**

In absolute terms, as expected, industry newcomers pioneered more of both, radically new and incrementally new product categories. However, when industry incumbents were first, they were even more likely to pioneer radical innovations, than the industry newcomers (see Table 4.5). What explains this behavior? The rationale put forth in the previous section applies here too.

To begin with, all fifteen radical innovations pioneered by the incumbents were capital intensive projects and some required over ten years of intensive product development (jet aircraft, videodisc, and microwave oven among others). Therefore, the product had to be developed by a large firm. And indeed, except for Ampex in videotape recorders, all the firms were large incumbents. Most, however, were not among the major players within their industry. They saw the product as an opportunity to carve a profitable niche (Amana, Konica, Clinton, Burroughs) or even to leapfrog the leaders and establish market dominance (deHaviland, British Aircraft/Aerospatiale). Furthermore, in each case, the firm's established competencies and complementary assets in R&D, production, distribution, service, and organizational skills were directly transferable to the new product. In summary, the radical innovations pioneered by large incumbents required great financial resources, technical know-how, and other complementary competencies that resided primarily with the large incumbents.

In contrast, only one (Aspartame) of the 20 radically new product categories

introduced by industry newcomers required very large up-front capital outlays. For about one half of the products the cost of initial entry was under one million dollars. Intel developed the first microprocessor for mere \$60,000 (Intel, 1988). A number of these industry newcomers were firms established by hobbyists (Seelbi, STM) ex-employees of large firms whose product ideas were ignored (Intel, AMS, Control Data), or university researchers (3 Rivers, Fonar, Visicorp). Only five new entrants which introduced radical innovations were large established firms.

### **III. WHO SUCCEEDS IN THE MARKET**

The results described in the previous section provide strong evidence against pioneering advantages. Even by the loosest standard of performance - simply surviving in the market - first entrants did not do well. If the first to market loose, what is the timing of entry of those firms that win? That was the subject matter of hypotheses H9 and H10.

Section 'A' interprets the results of hypotheses H9 and H10 dealing with entry timing of dominant firms, and compares the results with earlier studies. Section 'B' provides descriptive statistics for market leaders presented in Table 5.1 and interprets the findings in the context of earlier studies.

#### **A. Market Dominance**

In review, dominance and market leadership is often used interchangeably, in this study dominance means that the firm ranked among the top three firms in terms of market share, whereas, the leader has the highest share. Although, no other study on entry order measured performance in terms of dominance as defined here, 76% of businesses in PIMS data bank rank among top 3 competitors and only 9% ranked

sixth or lower. Hence, comparison of results from the dominant sample in this study with the studies that used PIMS data is very relevant.

### 1. Entry Order of Dominant Firms

The most significant and revealing results came in comparing the entry order of dominant firms (hypotheses H9 and H10). The frequencies and percentages of dominant firms by entry order in both time periods are summarized in Table 5.5.

Even in the very early stage of product life cycle the first entrant was no longer among top the top three firms for 21 of the 46 product categories. In addition, in 10 of the remaining 25 product categories the first firm either had no competition or its market share was so high that there were no other dominant firms in the category. Yet, the early followers were already the largest group (43.6%) of the dominant sample. By definition, there were no late entrants in period 1 sample.

**Table 5.5 Entry Order of Dominant Firms in 46 Products**

Entry category	Period 1		Period No.2	
	n	Percentage dominant [%]	n	Percentage dominant [%]
Total	117	100	131	100
First movers	25	21.4	4	3.1
Pioneers	41	35.0	9	6.9
Early followers	51	43.6	74	56.5
Late entrants	--	--	44	33.5

The most surprising discovery is that as the products matured, one third of the firms that dominated had been late entrants. The expectation was that late entrants

would be more likely to survive than either the first movers or pioneers, seldom would they capture dominant positions. Those coveted spots were to be pre-empted by early followers and a few successful firsts and pioneers. Apparently that is not the case.

As expected, the largest proportion of the long run dominant firms were the early followers (56.5%), but firsts and pioneers combined, accounted for mere 10% of the sample.

In contrast, Buzzell and Gale (1987, p.259) report that in PIMS data (where 76% of firms rank in top 3 firms in their respective markets), 52% were pioneers, 31% were early followers and 17% late entrants. 70% of the firms that ranked fourth or lower were early or late followers. Likewise Urban et al. (1986, p.655) conclude that:

"... later entrants should plan on achieving less share than the pioneering brand if they enter with a parity product ... the sixth firm would not find it profitable to spend at the level of pioneer who has almost 2.5 times as much share. For example, if the advertising spending is 40% of the pioneer's spending level, share potential ... drops from 11.2 to 8.7 share points. In many cases this may not make entry attractive."

In this study, however, in almost half the product categories, firms that entered tenth or earlier did not even survive. For example, in 1994 the five firms with highest market share in personal computers were Compaq, Apple, Packard Bell, IBM, and Gateway. Of the group, Apple is the earliest entrant with entry rank of over 50, IBM's and Compaq's entry orders were around 150, and Gateway and Packard Bell's about 400. Where are the first, second, third, fourth, etc.? They all failed. To my knowledge, except for Apple, Commodore and Hewlett Packard and a hand-full of others, all firms that preceded IBM are now out of the PC business.

In conclusion, the results indicate that the relationship between entry order and market dominance is not that of decline with later entry, but curvilinear. The success rate was lowest for first movers (3.1%) and pioneers (6.9%), highest for early followers (56.5%) and somewhat lower for late entrants (36.5%) (see Figure 4.2). 97% of the firms that dominate the market were followers. In addition, only 29% of the firms in the early dominant sample remained dominant through the second period. The exit rates for first movers, pioneers, and early followers which dominated the markets in period 1 were 84%, 85%, and 53%, respectively.

## **2. Market Share by Entry Order**

If market share is used as a measure of performance of dominant firms the results are far different than if success (dominance) rate is used. Market shares of dominant firms by their entry order is presented in Table 5.6. Column 3 lists the share of the early dominant sample (period 1), column 5 captures shares of the firms that currently dominate (period 2), and column 7 list period 2 market share of all firms that dominated the markets either in first or second time period.

In both samples market share declines with later entry and resemble the patterns observed by researchers that used PIMS or ASSESSOR data of Urban et al. (1986). In this study, the market share is higher for all entry categories because the sample includes only top three firms, whereas in PIMS 24% of businesses ranked fourth or lower. In the early period the market share penalty for delay in entry was 16% for pioneers and 25% for early followers. In period 2, the share penalties were 14% for pioneers, 19% for early followers and 25% for late entrants.

These results would indicate very strong support for first mover advantage.

However, market share is subject to entrant's remaining dominant in the long run. In period 2, only 4 of the 25 first movers from the early sample remained dominant. That is an 84% drop-out rate. Also, all four firms were market leaders in highly concentrated product segments. Likewise, only 15% of the pioneers dominated the market in both time periods. On the other hand, 47% of the early followers from period 1 dominated in both time periods. In addition, 50 early followers gained prominence after the first period. The increase of market share for pioneers was due to exit of the weaker ones from the sample. The higher market share of early followers in period 2, in contrast, was due to gain at the expense of first movers and pioneers. Furthermore, in 33 of 46 product categories there were no first movers or pioneers among dominant firms.

**Table 5.6 Market Share of Dominant Firms by Entry Order**

Entry category	Period No.1		Period No.2		All dominant	
	n	Market share [%]	n	Market share [%]	n	Market share [%]
Total	117	31.5	131	25.6	214	16.3
First movers	25	56.3	4	46.0	25	8.2
Pioneers	41	29.1	9	32.1	44	7.4
Early followers	51	21.3	74	26.8	101	20.3
Late entrants	--	--	44	20.6	44	20.6

The survival bias in the sample of currently dominant firms (column 5) is evident from column 7 of Table 5.6. The second period market shares also include the early dominant firms that were no longer dominant in the second time period.

The average market share of early and late followers are 2.8 times higher than those of first movers and pioneers.

In conclusion, delayed entry has a negative effect on market share, subject to the firm remaining dominant. However, early followers and late entrants are 9 times more likely to dominate the market than are first movers and pioneers. These results highlight the effect of survival bias which was present in nearly all earlier studies on first mover advantage. The researchers infer that pioneers succeed analyzing only surviving pioneers and other successful firms that may claim to be pioneers.

### **3. Entry Lag of Dominant Firms**

The entry lag of dominant firms in table 5.7 offers some very valuable insight on the timing of entry of the successful firms. The average entry lag of the firms that dominated the market in the early stage of product life cycle was 4 years. However, the average entry lag of the firms that succeeded in the long run, was 9.3 years. Note that pioneers which followed the first entrant too closely were more likely to be unsuccessful than those at the tail end of the pioneering group.

The firms that were most likely to succeed in the long run entered about 7 years after the product was first introduced. The average time for the product categories in this sample to begin rapid growth stage was about 8.5 years.

The second best time to enter was during or immediately after the major industry shakeout occurred. This is how a number of the late entrants gained an inexpensive entry and quick market prominence. During and immediately after the shakeout even the major players were weakened or even dropped out of the market. Often, firms were available at fire sales prices. This was also true of technical staff

and managers who had been laid off and were eager to get a job. Firms that had money, courage, and some foresight took an advantage of the situation. This kind of behavior was observed case after case. The best examples of late entrants gaining market dominance in this manner is Nintendo in video games.

**Table 5.7 Entry Lag of Dominant Firms**

<b>Entry category</b>	<b>Period 1 Lag [years] n = 117</b>	<b>Period 2 Lag [years] n = 131</b>
Sample mean	4.0	9.3
First movers	0	0
Pioneers	2.5	5.9
Early followers	7.1	7.0
Late entrants	--	14.8

Nintendo entered the U.S. market in November 1985 after video game experienced the quickest and worst blood bath of any U.S. product in history. Sales collapsed from over \$3.5 billion in 1983 to only \$100 million by 1985 (Mandese, 1989) and were still sinking fast. Most industry observers including Time Warner's Atari - the sole survivor - thought Nintendo irrational. Nintendo had no difficulty negotiating very favorable contracts with game designers and took tight control over the industry. Single handedly, Nintendo staged an industry turn-around. In 2 years (by the end of 1987) its sales had reached \$750 million (Mandese, 1989) and by the end of 1990, \$3.4 billion. Nintendo's timing and execution were perfect.

## B. Market Leaders

The list of early and current market leaders and the years of entry are provided in Table 5.1. Market leaders were discussed in the context of first mover in sections II-C and II-D of this chapter. In this part leaders in 46 product categories are analyzed in terms of their entry order, market share and entry lag.

### 1. Entry Order of Leaders

The entry order of firms that led the markets is summarized in Table 5.8. The early leaders were almost evenly distributed among the first three entry categories. Early followers were leaders in 16 of 46 product categories during an early stage of the life cycle. Several actually gained this position in the same year they entered the market. As the products matured, followers assumed market leadership. First

**Table 5.8 Entry Order of Market Leaders in 46 Products**

Entry category	Period 1		Period No.2		Drop-out rate of early leaders [%]
	n	Percentage leaders [%]	n	Percentage leaders [%]	
Total	46	100	46	100	74.0
First movers	16	34.8	4	8.7	75.0
Pioneers	14	30.4	5	10.9	78.6
Early followers	16	34.8	25	54.3	68.8
Late entrants	--	--	12	26.1	--

entrants were the smallest group accounting for only 8.7% of leaders. By far the largest group were the early followers leading in 25 of 46 product categories. However, the biggest surprise were the late entrants tallying 26% of all current

leaders - more than first entrants and pioneers combined.

How do these results compare with earlier studies? Unfortunately, most researchers do not provide data on entry order of market leaders, but in PIMS data (Buzzell and Gale, 1987, p.185) on an average, 71% of market leaders were pioneers, 22% early followers and only 7% late entrants. Golder et al. (1993), on the other hand found, that 89% of current leaders were followers.

Golder and Tellis also found that in 53% of the product categories, the early leader still heads the category. In the pre-WWII categories, 60% and in the post-WWII categories 44%, remained leaders. They also note that only 8% of the early leaders did not survive. In this study only 26% of early leaders are current leaders of their category and 43% did not even survive. The differences in results arise because Golder measured early leadership later in the product life cycle and surveyed brand survival rather than firm survival.

## **2. Market Share of Leaders**

The leaders' average market shares by entry category are shown in table 5.9. For the sample of early leaders market share declines sharply with later entry. However, these figures are somewhat misleading because in a number of categories where first movers and pioneers were still the leaders, there were few or no competitors. Also, while the market shares of the first movers and pioneers were declining early follower's was still rising. The shares of current leaders were about equal for the three groups, but the late entrants had only 35.5% share. Mitchell (1991) also found that late entrants trade off lower market share for higher rate of survival.

In comparison, among the PIMS businesses, the leader's share ranged from less than 10% to 75%, averaging around 40% (Buzzell et al., 1987, p.184). Leaders had high market share in situations where the leader was a pioneer, the product was standardized, and customers were concentrated. Findings of Golder et al. (1993) show an average 28% market share for all early leaders. No other study provides market shares of leaders by their entry order.

**Table 5.9 Market Share of Market Leaders by Entry Order**

Entry category	Period No.1		Period No.2	
	n	Market share [%]	n	Market share [%]
Total	46	57.2	46	43.6
First movers	16	79.5	4	46.0
Pioneers	14	52.5	5	47.7
Early followers	16	39.8	25	45.0
Late entrants	--	--	12	35.5

### 3. Entry Lag of Leaders

The delayed entry of market leaders (Table 5.10) is very similar to that of dominant firms. On an average the early leaders entered 3.5 years after the product was first introduced. The current leaders' average entry lag was 7.2 years. Pioneers which are current leaders entered more mature market than those who were early leaders. The delay in entry for pioneers and early followers who are current leaders were nearly identical (6.4 vs 6.9 years).

Only Golder et al. (1993) provide statistics on entry lag of early and current

leaders. For the early leaders the average delay was 13 years, but in the sample of post-WWII products the leaders lagged only 5 years. Hence, the lag of 3.5 years is comparable to Golder's result because all 46 products in this study were also introduced after the war. For current leaders the delay was 20 years and in the post-WWII sample the delay was 11 years (Golder et al., 1993).

**Table 5.10 Entry Lag of Market Leaders**

<b>Entry category</b>	<b>Period 1 Lag [years] n = 46</b>	<b>Period 2 Lag [years] n = 46</b>
Sample mean	3.5	7.2
First movers	0	0
Pioneers	3.9	6.4
Early followers	6.5	6.9
Late entrants	--	15.4

In summary, analysis of market leaders showed no evidence that first movers remain leaders, nor that they enjoy higher market share than leaders which enter as followers. On an average, the leaders entered about 7.2 years after the product was first introduced and about the time the products began rapid growth stage. Only 8.7% of first movers remained leaders in second period.

#### **IV. WHO PIONEERS AND WHO DOMINATES**

The results of hypotheses H7 and H11 in Table 5.11 shed some light on how organizational characteristics are related to market pioneering and competitive performance. The firms with fewer resource (the small firms) and less market access

(the new entrants) are more likely to be first in the market than their counterparts. According to *Business Week* (Byrne, 1989, p.86) the top 500 US firms in the US account for 30% of the US GNP and employ 80% of scientists and engineers who work in the industry. Yet, in this sample the large firms were responsible for only 40% of innovations, the small firms pioneered 60% of the innovations. Similarly, the industry incumbents, the ones with market access were first in 40% of products compared to newcomers 60%.

**Table 5.11 Comparison of First Movers with Dominant Firms of Period 2.**

<b>Firm characteristic</b>	<b>First movers (%) n=52</b>	<b>Currently dominant (%) n=131</b>
Large	40.4	72.5
Small	59.6	27.5
Incumbent	40.4	69.5
New entrant	59.6	30.5

When it comes to who benefits from the innovation the relationship reverses (column 3 in Table 5.11). Nearly three quarters of the firms which dominated the market in the long-run were large firms, 69.5% were incumbents. The results become even more revealing when we consider that 90% of the dominant firms were early and late followers. This data provides further support for the earlier argument that the large firms are less likely to pioneer a new product category, but are the most likely to gain the greatest benefit from pioneers' innovations.

In general, the value of leading incumbents' specialized assets, such as

distribution, brand recognition, production capabilities, service, and organizational skills carried over from one product to another even when the innovation was discontinuous. The long time gap between introduction and market acceptance allowed the incumbents to evaluate the market and acquire the necessary technological know-how to be competitive in the new product category. The market position of large incumbents was only affected by other large incumbents entering earlier. Typically, the large incumbents played a game of wait and see but when one entered others quickly followed, not to be pre-empted. Such behavior was observed in about 75% of the product categories in this study (light beer, soft drinks, nearly all consumer electronics, computers and software, medical equipment etc.). This sudden and aggressive surge of major players and the intense competition that ensued may very well explain why the products took off at the time of their entry. These firms legitimized the product in the eyes of the consumers as well as, other potential entrants. The large incumbents also brought in mass-production, targeted the product at broader spectrum of customers and supported it with heavy promotion.

The results of this study support the conceptual works of Teece (1986) and Wernerfelt and Karnani (1987), and parallel the findings of Mitchell (1991), Chandler (1990), and Golder et al. (1993) that winners in the market are not the small, beautiful and first, but those who are willing and able to deploy large resources in production, distribution, and marketing when the market is ready. The true pioneers ended with arrows in the back. The ones who brought the cavalry were able to pan the streams of gold.

## V. SUMMARY OF RESULTS

Performance of first entrants in 52 product categories and firms which succeeded in 46 product categories (dominant sample) were analyzed in terms of:

- frequency of market dominance
- frequency of market leadership
- market share
- frequency of survival (only first movers) and
- length of survival in the product category (only first movers)

None of the performance measures support the first mover advantage model. Rather, results show that pioneering carries substantial competitive disadvantage that even well-established firms find difficult to overcome. In 48 of 52 product categories, either the product failed, the first entrant exited, or it remained in the market but only with a very minor market share (under 6%). One third of the first entrants remained market leaders for one year or less. In contrast, in the PIMS data bank (Buzzell and Gale, 1987), about 50% of pioneers remained long-run market leaders and 70% of all leaders entered as market pioneers. Earlier studies also report that first entrants rarely withdraw from the market (Urban et al., 1986), but in this study only 27% survived. The results also show that neither the organizational characteristics of first entrants nor the type of innovation pioneered made a difference - first entrants did not succeed.

The second part of the analysis sought the answer to the question: what are the organizational characteristics and the entry order of the firms that succeed in the new product category? The findings show that 93% of the firms that succeeded were

followers and entered the market on an average 9.3 years after the first mover. The biggest surprise of the empirical analysis was that 33.5% of firms that dominated the market in the long-run entered late, on an average 14.8 years after the first entrant. Previous studies found that late entrants have the smallest market share and have virtually no chance of dominating the product category.

The findings also show that firms most likely to pioneer a new product category are the small industry newcomers (46.1%) but the firms most likely to dominate the category are the large industry incumbents (59.5%). This result, again, contradicts the established view that pioneering by industry newcomers leads to leadership turnover in favor of the pioneering newcomers.

## CHAPTER 6

### QUALITATIVE ANALYSIS OF SUCCESSFUL FIRST MOVERS

#### I. INTRODUCTION

Chapters 6 and 7 discuss the results of the qualitative analysis of the products included in the empirical part of this research. Chapter 6 covers the common factors and market conditions which contributed to the success of first entrants. Chapter 7, on the other hand, explores when and under what conditions did the first entrants fail.

However, because of rarity of occurrence, the extrapolations in this chapter are very tentative, based on only three successful first movers in four product categories, and three other firms that would have been classified as successful first entrants had they not been acquired. In all three cases, acquisition by a large firm materially altered the competitive situation and ensured the long-term success of the brands (Häagen-Dazs, Gatorade, NutraSweet). Häagen Dazs and Gatorade probably would not have withstood the competitive pressure from large incumbents. Searle's existence was threatened by government investigation related to drug testing and financial improprieties.

The general implications of the findings are further complicated because two of the successful first movers are Sony and Intel. Both possess the rare combination of superior entrepreneurship, resources and tenacious competitiveness. Luck, too, had been on their side. They belong to a handful of "corporate super decathletes of the world". Not only do they manage repeatedly to get out of the starting block first, but also they remain the leaders throughout the race. To suggest that, for a first mover to succeed, it should behave like Sony or Intel would be rather unrealistic.

## II. WHEN DO FIRST MOVERS SUCCEED?

The four products where the first entrant succeeded are CD player (Sony), soft contact lens (Bausch & Lomb), microprocessor and flash memory chip (Intel). The three other categories where brands are still dominant but under different ownership are sports drinks (Gatorade), superpremium ice cream (Häagen Dazs) and Aspartame (NutraSweet).

### A. Qualitative Propositions

In Chapter 3, it was proposed that first movers may dominate the market if one or more conditions described in Propositions 1 through 6 were met. For convenience, the propositions are restated here :

- Proposition 1:** competitors enter late because initial market estimates were pessimistic or the market grew slowly
- Proposition 2:** the first version of the product works well and becomes the industry standard
- Proposition 3:** the initial innovation is not followed by rapid technological changes (assuming first version worked well)
- Proposition 4:** the innovation is protected by iron-clad patent(s) or it is a trade secret embedded in process or tacit knowledge (e.g. recipis, chemical formula)
- Proposition 5:** the innovation does not threaten incumbents' core products
- Proposition 6:** the innovation is introduced by a leading industry incumbent whose specialized assets (e.g. logistics and distribution, production, brand) retain their value from one product to another

Tables 6.1 (a) and (b) show which of the six propositions were supported. In each product category, at least two proposed conditions for success existed.

However, as shown in Table 6.2, some of those conditions also existed in the product categories where the first entrant did not succeed. This indicates that the conditions outlined in Propositions 1 through 6 are helpful or even necessary to achieve entry-related advantages but not sufficient to sustain them. The major factors that distinguished the firms that sustained their leading market positions from those that did not are listed in Table 6.3 a and b.

### **1. Competitors Enter Late (P1)**

The first proposition was supported in three of seven products. The first mover benefitted because followers entered late in soft contact lenses, sports drink and superpremium ice cream. Häagen Dazs and Gatorade enjoyed virtual monopolies for 16 years before the competition noticed the market.

The initial sales of superpremium ice cream and sports drinks were too slow to attract the attention of major competitors, but large enough for a small firm to stay in it. Neither product category actually even had a name. Ice cream got the "superpremium" label in the mid 1970s. Gatorade was classified under "other" until the late 1980s. It was not until sales of Gatorade reached around one-half billion dollars that beverage analysts labeled the "other" category as "Sports Drinks" and "Isotonics."

Häagen Dazs owed its success to an odd position that went against the market trend. While the country was going low calorie, low fat, low cholesterol, Senator Ice Cream Company introduced Häagen Dazs, which was double the calorie, fat and cholesterol, and triple the price of premium ice cream. Häagen Dazs was not an overnight success but it developed a loyal following, oddly enough, with the health

conscious, physically active baby boomers. By the time other small firms began to enter in late 1970s, Häagen Dazs was already synonymous with superpremium ice cream and had preempted the freezers of grocery stores and supermarkets in the eastern United States.

**Tables 6.1 a & b Support for Propositions 1 to 6 in Product Categories where First Movers or First Brands Succeeded**

Product	First Mover	P1	P2	P3	P4	P5	P6
Contact lens	Bausch & Lomb	X	X	X	X		
CD player	Sony		X	X		X	X
Micro-processor	Intel		X			X	
Flash memory	Intel		X			X	X

**a. Successful Firms**

Product	First brand	P1	P2	P3	P4	P5	P6
Sport drink	Gatorade	X	X	X		X	
Ice cream	Häagen Dazs	X	X	X		X	
Aspartame	NutraSweet		X	X	X		

**b. Successful Brands**

Gatorade, too, developed a "cult" status among amateur and professional sports teams, which later broadened to include athletes in all sport. It was not until Quaker Oats acquired Stokely in 1983 that Gatorade was aggressively promoted to the

physically active general population. In six years, sales increased to \$625 million (Therrien, 1990, p.56).

**Tables 6.2 Support for Propositions 1 to 6 in Product Categories where First Movers did not Succeeded**

Product	First brand	P1	P2	P3	P4	P5	P6
Athletic shoe	Adidas		X	X			X
wine cooler	Bianci			X		X	
VCR	Ampex					X	
Videophone	AT&T			X		X	X
Saccharin	Monsanto			X			
Cyclamates	Abbott		X	X	X		
HFCS	Clinton			X			

Bausch & Lomb accomplished more in four years than Stokely and Senator Ice Cream had in sixteen years. Bausch & Lomb's lead time stemmed from gaining FDA approval for soft contact lenses four years ahead of the competition. Initial demand was not high, but soft contact lenses carried 500% premium over hard lenses and B&L enjoyed 90% profit margins. In the four years, B&L established strong national distribution and established the soft lens as the industry standard.

## **2. Industry Standard (P2)**

Proposition 2 suggests that first entrant may establish a long-run dominant market position if the first version of the product works well and eventually becomes the industry standard. This proposition was supported in all seven product categories and turned out to be the most important factor that contributed to the success of the first mover (or brand). In all product categories, the first generation product was

well thought-out and noticeably superior to the product that it replaced. All commanded a high premium over existing products. Although five were radically new products, except for aspartame, they did not require major changes in behavior or use on the part of the customer. This explains the relative ease with which the products were accepted in the market.

The advantage of a CD player over cassette tape and a record player is the absolute clarity of sound, instant random access to any song, and the quality of the CD does not deteriorate with repeated play. Soft lenses *raison d'être* can be easily summed up in one word: comfort. Most people could not get accustomed to hard contact lenses, so market penetration was less than 1% after 30 years of being on the market. The advantages of Aspartame over sugar and saccharin are: excellent taste (as good as sugar), no calories, all natural, and it is not linked to cancer or other diseases. Because of these properties Searle was able to charge about 40 times the price of saccharin, on a sugar equivalency basis. Since use of Aspartame requires complete reformulation of the product, Searle helped customers to develop new product and production processes. All seven products eventually became the industry standards.

### **3. Technological Change (P3)**

Another important factor common to five product categories was that the initial innovation was not followed by rapid changes that would make the initial product obsolete. This was partly because the first generation of the product was so robust. NutraSweet, Gatorade and Häagen Dazs remain the same as the original product except that Gatorade and Häagen Dazs added more flavors. The original formulation

of NutraSweet has not changed since its introduction in 1981. Barring added features, smaller size and lower cost, the basic design and performance of CD players had not changed either, however, it has undergone numerous but continuous improvements.

The microprocessor and flash memory have undergone the most rapid changes but all improvements were continuous. Both products became more powerful, faster, cheaper and found a wider range of applications. Unlike its competitors, Intel made fewer mistakes and its cutting edge technology did not turn into bleeding edge technology. Usually, Intel was able to keep ahead of its competitors and charge premium prices before competition caught up.

#### **4. Patents (P4)**

Patent protection was not a major factor except for Aspartame. Cyclamate's problem remaining a commodity had not escaped Searle when it prepared Aspartame for the market launch. Searle enjoyed 11 years of monopoly in the US market and five year protection in the rest of the world. During this monopoly period, sales of Aspartame reached \$900 million in annual revenue. Gross margins were nearly 50%.

Although Philips and Sony had patents on the CD player, they decided to license the technology to all other consumer electronic firms in order to gain rapid market acceptance and establish the industry standard. Both Sony and Philips had bad experience in VCRs trying to establish their own proprietary designs as the industry standard.

Bausch & Lomb obtained its patent rights from National Patent Development Corporation but the competition was able to get around and bring similar soft contact lenses within four years. However, B&L had a secret production process that

followers were not able to replicate for over 16 years. This proprietary production know-how gave B&L an overwhelming cost and quality advantage over its rivals (Menzies, 1981; Business Week, 1984, p.78). Microprocessor and flash memory chip and had patents and copyrights but it is a common practice in the semiconductor industry to license another firm as a second source. Some firms continued to clone Intel's chips, even after the license agreements were terminated. Lawsuits are still pending on several infringements. In the semiconductor industry there is very fast industry-wide learning, so no firms stays ahead of its competitors too long based purely on the design of the chip. Efficient proprietary manufacturing provides more durable protection against competition.

#### **5. Threat to Incumbents (P5)**

Industry participants may perceive a new product as an opportunity for growth, threat to sales of existing products or they may ignore the product altogether. None of the seven products faced opposition from industry incumbents.

Only Aspartame and, to a much lesser extent, soft contact lenses were a threat to industry incumbents' products. But in 30 years since its introduction, the sales of hard contact lenses went nowhere, so soft contact lenses offered an opportunity for renewed growth and small incumbents opted to enter the market rather than hinder its growth. In addition, since the industry was fragmented, incumbents had no power to challenge B&L.

Sugar producers viewed Aspartame as a major threat, but except for Tate and Lyle (a British firm) none were willing to satisfy the need for low calorie sweetener. They defined their business domain as sugar refining. Tate and Lyle's Sucralose was

still in the development stage and was not expected to obtain FDA approval prior to the early 1990s (Sfiligoj, 1990).

Gatorade and Häagen Dazs attracted no attention of the industry incumbents because of their initial anonymity. Both were niche products with no defined category and virtually no advertising. They gained customers by word of mouth.

The CD player, microprocessor and flash memory chip met with an overwhelming support from the incumbents because they were "competence enhancing" innovations with an enormous market potential. In order to gain fast market acceptance and establish the CD as the industry standard, Philips licensed the laser technology very inexpensively to all consumer audio electronics firms. Because of this concerted effort, the CD player had the fastest market acceptance of any consumer audio/video products in US history. Within four years market penetration reached 5% and a year later it stood at an astounding 18%. In contrast, 12 years after its introduction, the home VCR was only in 0.03% of US households (Quinn et al., 1988, p.738). The incumbents also benefitted because the sales of CD players spurred the sales of audio receivers, speakers and other related audio gear.

The microprocessor spawned numerous new product categories including electronic calculators, digital watches, video games and, of course, the PC. With the introduction of microprocessor the demand for all sorts of semiconductors increased so the whole industry benefitted. In 1970 and 1971 the US semiconductor industry experienced the worst slump with sale dropping 11% and additional 8% respectively. Following the microprocessor launch sales rose 30% in 1972 and 58% in 1973 (In-Stat Electronic Report, 1991, p.4).

In conclusion, Proposition 5 is strongly supported. None of the products triggered negative competitive response that would hinder the innovations' market acceptance. Three product categories had an overwhelming support of all industry participants.

#### **6. Industry Leader Enters First (P6)**

If first, incumbent industry leaders have a better chance of maintaining market dominance because they possess the resources to survive the initial period of market and technological uncertainty and have the superior complementary assets to be competitive in a growing market. Furthermore, the industry leader is more likely to introduce the first version of the product that is not a "work in process" but a usable product.

Five product categories were pioneered by leading incumbents (Adidas, J&J, AT&T, Sony, Intel) -- two triumphed. This 40% success rate is 20 times higher than that of non-leader first movers.

When CD player and Flash memory chips were introduced, Sony and Intel were industry leaders in their respective fields with immense market clout, production capabilities, financial resources and ability to improve on the original products. For example, Sony began a concerted effort to ensure the success of the CD player years before the product was launched. First, it promoted itself as the product inventor (Pfaff, 1986; Browning, 1986). It used its expertise in creating markets in such products as the transistor radio, VCR and walkman. Facing a resistance from the recording industry which feared that retailers would not be able to carry both records and CD's, Sony hooked the musical artists on the technology so that they would put

pressure on the recording studios. It also struck a deal with CBS records (the industry leader which it later acquired) to release CDs concurrently with the CD player. The rest of the recording industry had to follow. Sony also relied on its expertise in product miniaturization and within two years of the CD player launch, it introduced a portable disc player and incorporated CDs in car radios and boom boxes (Pfaff, 1986). Sony offered the broadest product line with prices ranging from the middle to the high end, but avoided the price battle in the low end not to cheapen its audio reputation for high quality products. In spite of over 60 competitors in the CD market Sony still maintains 30% of the market.

## **B. Additional Factors**

### **1. Low Cost of Entry**

Another contributing factor to the success of this group of first movers was the relative ease and low cost of development and entry into the market. The pioneers did not burn out before the market took off. Except for Searle, their cost and ease of entry resembled more those of a follower than a pioneer. Three products -- the microprocessor, Häagen Dazs, and Gatorade were started on a shoe string budget. The first microprocessor, the Intel 4004, cost only \$60,000 to develop (Intel, 1988). The MOS technology, production process and manufacturing plants were readily transferable from Intel's thriving DRAM chip business (Quinn et al., 1988). Likewise, Senator Ice Cream Company merely reformulated its existing line of ice cream by doubling the amount of butter, reducing the amount of overrun (the amount of air bubbles in the mixture) and using only natural ingredients. It used its established distribution in the New York area and as the word of mouth of the

delicious, foreign sounding ice cream spread, Senator added distributors (Brown, et al., 1986). It spent virtually no money on advertising and promotion. Stokely Van-Camp purchased the rights to Gatorade in 1967 from its inventor, Dr. Cade at the University of Florida, for an undisclosed but low amount of money. Like, Senator Company, Stokely used existing distribution channels and advertised the product only sporadically (Therrien, 1990).

The soft contact lens was invented by a Czechoslovakian chemist, Otto Wichterle, in 1962. Bausch & Lomb acquired the patent rights to the lens and the process for making it from National Patent Development Corporation based in New York (Menzies, 1981). In that sense, B&L avoided most of the costs related to the basic R & D and product development.

Even Intel and Sony enjoyed partial saving in entering the markets. The brunt of the cost of the CD player was incurred by Philips which spent nearly two decades and hundreds of millions of dollars to develop the laser disk technology. Sony obtained it from Philips in exchange for help in "design for manufacturability" and support in establishing the technology as the industry standard (Browning, 1986). Toshiba invented the flash chip, Intel copied it and beat Toshiba to the market.

In contrast, the majority of first movers that did not succeed were strapped for capital resulting from pioneering the category.

## **2. Luck**

Luck played a role in success of first movers in four product categories -- aspartame, CD player, microprocessor and Flash chip. Searle's 1965 accidental discovery of aspartame while developing an anti-ulcer drug was very timely.

Relatively dormant, the demand for dietary products began to take off in the early 1960's as the nation became more health and calorie conscious. At that time, only saccharin and cyclamate were on the market. While Aspartame's taste was vastly superior to that of saccharin, its advantage over cyclamate was not as pronounced. However, Aspartame was not cost competitive with either one (Teitelman, 1984). The extremely high cost of production (as high as \$40 per pound) put the otherwise

**Tables 6.3 a & b Factors that Contributed to the Success of First Movers or First Brands (NX - pertains to new owner)**

Product	First Mover	Low cost of entry	Luck	Product improv.	Market power	Production capability	Aggres-sive
Contact lens	B&L	X			X	X	X
CD player	Sony		X	X	X	X	X
Micro-processor	Intel	X	X	X		X	X
Flash memory	Intel		X	X	X		X

**a. Successful Firms**

Product	First brand	Low cost of entry	Luck	Product improve.	Market power	Production capability	Aggres-sive
Sport drink	Gatorade	X			NX	NX	NX
Ice cream	Häagen Dazs	X			NX	NX	NX
Aspartame	Nutra Sweet		X	X	X	X	X

**b. Successful Brands**

promising future of aspartame in doubt. But again, Searle was in luck when the FDA banned cyclamates, in 1969 (Ross, 1985).

Because of its lingering aftertaste, saccharin did little to fill the void left by the cyclamate ban, and, itself came under attack from the sugar lobby. Saccharin, too, had been linked to cancer but not banned.

By 1981, when Aspartame was finally reapproved for the market, diet-consciousness of Americans was not rising anymore, it was there in full bloom. Sales of dietary products were booming, yet food and beverage producers had no suitable, good tasting low-calorie sweetener. So, when the superior tasting aspartame reached the market, demand far exceeded its supply. While several companies were developing low-calorie sweeteners, none were near market approval. These market conditions created a monopoly for Searle.

After several setbacks Sony abandoned laser disk research in early 1970's, but lucked out when in 1979 Philips of Netherlands invited it to popularize the new audio technology. Sony negotiated a status of co-inventor. Sony lucked out again and took the title of pioneer when Philips failed to launch its CD player concurrently on an agreed upon date in October of 1982 (Browning, 1986).

Intel was lucky with both the microprocessor and flash chip. On their visit to Toshiba's labs, Intel executives saw the flash chip. Toshiba was at loss figuring out its application. Intel realized its potential as a data storage device in notebook computers and other hand held electronic gadgets and beat Toshiba to the market (Intel, 1988). Intel still holds over 60% of the market.

Intel's biggest break came in 1980 when IBM selected the Intel microprocessor

for its personal computer. Eventually, success of the IBM PC and its clones established the Intel X86 architecture as the de facto industry standard and propelled Intel into the world's number one producer of semiconductors in 1992 (Soat and Vecchion, 1993).

Serendipity, or being at the right time at the right place may at times have as much to do with company's success as other factors controllable by the management. It contributed to the success of the pioneering firm in four of seven product categories.

### **3. Continual Product Improvement**

Typically, new products and especially radical innovations enter market crude costly and unreliable. To make a commercial success out of an original innovation, and to remain competitive the first entrant needs to continually refine the product, make it more reliable and, add features, lower cost, or modify it to broaden use.

As mentioned earlier, the first generation in 7 product categories began their life as fully functional and high quality products. Gatorade, Häagen Dazs and aspartame remained virtually unchanged since their inception.

Searle's strategy was to accelerate the diffusion of aspartame and establish the brand name NutraSweet in the market before the patent expiration. A potential deterrent to a speedy acceptance of aspartame was that product formulation with it cannot be accomplished by simple substitution for sugar. Rather, it requires complete reformulation including gaining FDA approval, laboratory and market testing. Often, the production process needs to be modified or even completely changed. This switching cost may run from a few hundred thousand to several million dollars per

product.

In order to overcome this substantial switching cost from sugar to aspartame, NutraSweet set up the most extensive customer support services and R&D of any ingredient supplier in the world (Shapiro, R., 1989). Its application technology group develops new uses for aspartame, files petitions with the FDA, and helps customers to formulate new products and production processes. The strategy worked well. By the end of 1991 nearly 5000 products were sweetened with NutraSweet and the brand became the largest in the world (Shapiro, 1992).

Continuous product improvement was critical in four product categories - contact lenses, CD player, microprocessor, and flash chip. While Intel and Sony chose to remain innovation leaders, Bausch & Lomb's strategy was to be an imitator. Both strategies worked.

After being first with the original soft lens, Bausch & Lomb let its competitors pioneer new segments, then captured the market with a superior version and lower price. It used the competitor's product as a benchmark to improve on. Also, while Bausch & Lomb was developing the product, the early firms got the new segment off the ground, so Bausch & Lomb would step into a growing market. Bausch & Lomb's president Gill expressed his strategy that "the goal is to capture at least 50% of every segment of the lens market." (Business Week, 1984, p. 79).

To maintain market leadership in CD players, Sony relied on its expertise in product miniaturization. It opened new market segments when it introduced the first portable disc player and incorporated CD in car stereos and boom boxes. Sony was also among the earliest to transfer the CD laser technology into data storage media -

CD ROM (compact disc read only memory) which is becoming a standard equipment in new personal computers. The market potential for CD ROM is even greater than the CD audio player and Sony is the market share leader.

Like Sony, Intel is a master of continual improvement and manages to stay ahead of its competitors. Gordon Moore, a co-founder of Intel, postulated that semiconductor chip capacity would double every 18 months. This phenomenon, known as Moore's Law, has held relatively constant for the past 25 years and serves as a guideline for Intel's designers (Intel, 1988). Moore was in a position to make sure it applies.

Between 1971 and 1981, among 38 firms competing in the microprocessor market, Intel ranked first, introducing 12 of 69 original microprocessor designs (Swan, 1985). Since Intel's X86 microprocessor became the PC industry standard, Intel introduces a new generation of chips every three years. Having a unique product allows Intel quick recovery of development cost through high price. When cloners (AMD, Cyrix, and Chips and Technologies) catch up, Intel drops the price on the old processor and begins to push a new generation processor at premium price (Soat et al, 1993).

#### **4. Market Power**

Market power, not first to the market, usually determines who ultimately gains the greatest benefit from the innovation. Firms' market power is rooted in:

- established brand name
- established distribution and service facilities
- established relationship with customers
- bargaining power with suppliers and intermediaries and regulatory agencies
- financial resources to undertake extensive advertising and promotion campaigns

So, if the first mover is to succeed it had better possess superior market power, develop it before stronger competitors enter, or join up with a partner that has market clout. These three alternate strategies were observed in seven product categories where the first entrant or brand succeeded.

When CD players and flash memory chips were launched, Sony and Intel were the industry leaders in consumer audio components and semiconductors respectively. Sony's market power is only surpassed by Matsushita, but Sony is nimbler. Intel's market clout is surpassed by none. It is The world's largest semiconductor firm.

In the microprocessor market Intel gained market power as the market grew (Swan, 1985; Quin et al., 1988). Also, Intel's founding fathers were among the foremost figures in the semiconductor industry with a proven record and a long list of accomplishments. Moore and Noyce were co-founders of Fairchild. With their prestige, Intel had no difficulty attracting venture capital at very favorable terms or getting through to its customers.

While Bausch & Lomb (B&L) was a small firm (\$150 million in sales) when it launched soft contact lenses, its initial competitors were much smaller fry. So, it had little difficulty to maintain market leadership. By the time large competitors entered the market nearly a decade later, B&L grew into a \$500 million company. In terms of resources, B&L was still much smaller than its new competitors (Ciba, Revlon, Schering Plough, or Johnson & Johnson). But B&L's market power is vested in the largest sales force, the largest distribution numbering 12,000 professional eye care outlets, the broadest product line, the oldest franchise, the largest R&D department and, most of all, the proprietary lowest manufacturing cost. For example, in 1981,

Cooper Vision and Revlon's Barnes Hind introduced extended-wear lenses which could be worn up to a month without removal and cleaning. For two years, they dominated the market until B&L introduced its own extended wear lenses in April 1983. Within four months B&L became number one in extended-wear market, capturing 37% of the share. "We are like IBM. We don't have to be first to become first," commented Gill, the President of Bausch & Lomb. (Business Week, 1984, p. 78).

Senator Ice Cream Company and Stokely established a strong position in small but growing markets. When the markets started to grow rapidly and attracted the attention of industry giants, both sold out to firms with much greater resources which ensured their success. Senator sold Häagen Dazs to Pillsbury for \$76 million in 1983 (Brown et al., 1986, p. 60). Senator took 22 years to build Häagen Dazs into a \$100 million brand, but within six years of the acquisition, Pillsbury more than tripled the sales to \$320 million by increasing advertising and using its national distribution. The last owner, Britain's Grand Metropolitan PLC, which acquired Häagen Dazs in 1989, exploited its international potential and increased the sales to \$500 million by the end of 1991 (Maremont, 1991, p.121). Similarly in 16 years Gatorade sales reached \$84 million under Stokely-Van Camp ownership. After the acquisition of Stokely in 1983, Quaker Oats took the moderately successful Gatorade to \$625 million in just six years. In 1993, Gatorade still held 86% of the \$900 million sports drink segment, in spite of some two dozen competitors, including Coca Cola and Pepsi. Again, key to its success was Quaker Oats aggressive national promotion and distribution and market sufficient financial resources to fend off competition.

## 5. Superior Production Capabilities

To outperform competitors Porter (1980) recommends that firms select one of the three generic competitive strategies - cost leadership, differentiation or focus - because pursuing more than one results in succeeding in none.

Among the seven successful first movers/brands, six have accomplished both being superior differentiators and low cost producers. Being a low cost producer was critical in maintaining market leadership in contact lenses, CD players, microprocessors and aspartame.

Although neither Gatorade nor Häagen Dazs compete on price both enjoy economies of scale from sheer sales volume. For Häagen Dazs, especially, the combination of very high price and low cost of production generates high profit margins which finance extensive advertising and promotion and geographic expansion.

By being first, delivering a superior product that worked and maintaining over 65% market share Intel established de facto industry standard in flash memory chips. Whether it will remain a leader is still a question. Unlike in microprocessors, Intel farmed out most of the flash chip production to its Japanese partner NMB Semiconductor Co., owned by Minebea, a ball bearing manufacturer. Subsequent NMB's financial problems and inexperience in mass production of semiconductors resulted in shortage of chips and market share loss. So in late 1992 Intel formed a joint venture with Sharp. Intel provides design and production technology and Sharp produces the chip.

It is rare that the market leader is also a price leader. Bausch & Lomb's strongest asset was its proprietary production process. The spin-cast production

method as opposed to lathing used by the rest of the industry yielded better fitting uniform higher-quality lenses at one-fifth to one-third the cost of its competitors. So, when challenged even by much larger firms, Bausch and Lomb could use this proprietary production method to lower the price and drive challengers out of the market (Menzies, 1981; Business Week, 1980).

In microprocessors, Intel, too, relies on efficient production methods to fend off competitors. In an interview with *Fortune*, Andy Grove, the CEO of Intel, said:

You can have the best product in the world, but if you fail to invest in enough plant and equipment to satisfy demand for it, all your efforts are wasted. All you've done is create an opportunity for someone else. A leading-edge product requires leading-edge manufacturing capability, and you can't buy it. What is available from others is usually yesterday's technology.

(Hadjian, 1993, pp. 57-58)

Being an efficient manufacturer paid off for Intel. A combination of high initial prices of microprocessors and low cost gives Intel huge profit margins. Industry observers commented that for Intel, making microprocessors is more profitable than printing money. Once volume production is achieved, the cost of making a microprocessor may be as low as \$10, yet Intel was getting \$300-\$500 per microprocessor. To stay competitive in microprocessors, Intel invested \$2.4 billion in new production facilities for the pentium chip (Byrness, 1994). Such huge investments are warranted because of the huge sales volumes each generation of chips achieves. Since no other firm has a pentium clone on the market yet, Intel was able to get \$900 per pentium chip.

In aspartame, NutraSweet had problems scaling up for mass production. Therefore, in 1970, Searle entered into a joint venture with Ajinomoto Company, a

large Japanese food and amino acid producer. Ajinomoto provided the production technology, and in turn obtained the right to produce and market aspartame in Japan and several Asian countries. Rather than rely on Ajinomoto to supply aspartame, Searle learned the technology and invested \$300 million in plant and process improvement. Likewise, early on, the company developed its own expertise in manufacturing key raw materials and dropped its suppliers (Rhein, 1985). The proprietary manufacturing know-how offer longer lasting protection than patents.

Since 1981, when aspartame was introduced, the production cost dropped over 70% and NutraSweet Co. is the lowest cost producer (Shapiro, R., 1989). Cost advantage and willingness to slash prices already forced five aspartame producers out of the market in Europe (Shapiro, E., 1989). Holland Sweetener Co., a joint venture between Toyo Soda Manufacturing Co. of Japan and Dutch States Mines (DSM) of Netherlands (both large chemical producers) - is the only remaining competitor.

## **6. Aggressive Competitors**

In product categories the first entrants were very aggressive competitors and pursued the pioneering advantages relentlessly. For example, Searle used its monopoly power to require its customers to display the NutraSweet logo and trademark on their own packages and advertise it. In the first three years, Searle's customers spent over \$600 million on ads that featured the NutraSweet logo and brand (Shapiro, 1986). As Robert Shapiro, Chairman of Searle at that time, commented "the branded strategy was not immediately understood or loved by some of our customers" (Rosenberg, 1986, p.25).

Stokely and Senator entered their respective markets very quietly and

maintained a low profile. That situation, however, had quickly changed after the new owners took over the brands.

### III. SUMMARY

The seven first entrants owe their success to multiple factors. The most important factor was that they all began with a well thought-out product that was noticeably superior to what was then on the market. Therefore, the product found a receptive market that was willing to pay a premium for it. Except for aspartame, the cost of development and marketing entry was low. Unlike many other pioneers these firms did not burn out in the introductory stage. The innovation did not drain firm's resources. The combination of low entry cost, premium price and a latent demand made for a very short payback period. For example, even Searle, which spent over \$100 million getting aspartame to market, recouped its initial investment in the second year.

Furthermore, none of the first movers faced an opposition from industry incumbents that would hinder the diffusion of the innovations. There was either no response by competition (3 products) or the product received support (4 products).

In four categories the first mover was a superior competitor at the time of entry. In microprocessors, Intel acquired complementary competencies as the market evolved. Stokely and Senator Ice Cream Company had no competition for an extended period of time and sold out to much larger companies just when large incumbents were about to come in. Using their market power, the acquiring companies positioned the brands in the mass markets and ensured their long-term success.

## CHAPTER 7

### UNSUCCESSFUL FIRST MOVERS

#### I. INTRODUCTION

Several researchers (Robinson et al., 1992; Buzzell et al., 1987; Vanhonerker and Day, 1987; Moore et al., 1991) raise the issue that perhaps pioneers are more successful because firms with superior skills and resources choose to pioneer new markets (endogeneity assumption), rather than because the lead-time causes structural changes in the market in favor of pioneers (exogeneity assumption). The authors developed models treating entry order and performance as endogenous variables and firms' skills and resources as exogenous. Vanhonacker et al. (1987) and Moore et al. (1991) found that, indeed, stronger competitors enter earlier and, therefore, better performance of pioneers is due to their superior resources and skills and not simply from earlier entry. The results of Robinson, Fornell and Sullivan (1992) show that pioneers' skills and resources are different, but not superior to those of followers.

To test the propositions that firms with superior skills and resources enter first, Vanhonacker et al. and Moore et al. used the same PIMS database in which others found that pioneers are more successful than followers. If PIMS contains only large survivors in which the more successful ones claim to have been pioneers, no matter how the data is analyzed pioneers outperform followers, hence, the data supports both models.

Neither the exogeneity nor the endogeneity arguments are correct. In both cases, the researchers assume that pioneers outperform followers. But according to the empirical findings of this study, as well as the findings of Mitchell (1989, 1991)

and Golder et al. (1993), first entrants underperform followers by a substantial margin.

Furthermore, the findings indicate that new products tend to be pioneered by small entrepreneurial firms which may be good at identifying new opportunities, but lack the resources, skills and market power to get the product of the ground and to be competitive in the later stages of the product life cycle (Mitchell, 1989, 1991; Teece, 1986; OECD, 1982). This accounts for a good portion why pioneers fail in the long run. Yet, neither the failed nor small pioneers were included in the earlier studies of first mover advantage.

The first part of this chapter examines whether first entrants gain any of the eight advantages associated with first movership. This discussion evaluates the exogeneity point of view (center box of Figure 7.1). The second part of this chapter analyzes the skills and resources (or lack of them) and other competitive factors that contributed to the demise of first entrants. This addresses some of the endogeneity issues related to the first mover advantage (first box of Figure 7.2).

First Entry	Gain First Mover Advantages	Better Performance
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**Figure 7.1 Exogenous Model of First Mover Advantage**

Superior Skills and Resources	First Entry	Better Performance
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**Figure 7.2 Endogenous Model of First Mover Advantage**

## II. DO FIRST ENTRANTS GAIN FIRST-MOVER-ADVANTAGES?

First entrants are said to gain sustainable first mover advantages and erect barriers to entry for followers because of the head start. This competitive advantage results in long-term market dominance. The most commonly quoted pioneering advantages include:

1. enhanced company reputation
2. proprietary learning
3. define industry standards
4. patent protection
5. preemption of market position
6. preemption of distribution channels
7. preemption of scarce inputs
8. establishment of buyer switching cost

The empirical findings in this study indicate that first entry does not result in better performance but the issue of whether first entrants in this sample gained any of the first mover advantages was not addressed. Detailed qualitative analysis of each product's history over its life cycle produced the list of all products was the source of Table 7.1, in which the first entrant gained at least one first-mover-advantage. Products where first mover achieved no advantages are not included in the table. Based on the extent to which the advantage was achieved, products were classified in one of four categories as follows:

- Y (yes) the firm gained the advantage fully and in the long term.
- S (short term) the advantage was gained fully, but for a short term, usually only during the introductory stage of the product life cycle.
- P (partial) the firm achieved the advantage only partially. This classification is used with patent protection and switching cost only.
- ( ) (blank space) indicates that firm did not achieve that advantage.

**Table 7.1: Products where First Entrants Gained First Mover Advantages.**

PR. ID	PRODUCT CATEGORY	FIRST MOVER	First Mover Advantage							
			1	2	3	4	5	6	7	8
1	Athletic shoe	Adidas	S		S					
6 *	Sport drink	Stokely	Y		Y		Y	Y		P
9	Sailboard	Windsurfer	S		S	P	S			
10	Mountain bike	Fisher	S		Y					
13 †	CD player	Sony	Y		Y					
18	Microwave oven	Amana	Y	S	Y					
21	Credit card	Diners Club	S							
22 *	Superpremium ice cream	Senator	Y		Y		Y	Y		Y
23 †	Soft contact lens	Bausch & Lomb	Y	Y	Y		Y	Y		Y
24	Stainless steel razor blade	Wilkinson	S		S					
27	ATM	Docutel	S		S		S			S
30	HFCS	Clinton			S					
31 *	Aspartame	Searle	Y	Y	Y	Y	Y			Y
33	Cyclamate	Abbott			Y	Y				
36	CT Scanner	EMI	S		S	P				
26	Supercomputer	Control Data	S	S	S		S			S
48	Wordprocessing software-PC	Electric Pencil	S		S					
49	Spreadsheet software-PC	VisiCorp	S		S		S			S
51 †	Microprocessor	Intel	Y	Y	Y	P	Y			Y
52 †	Flash memory	Intel	Y		Y					P

Legend:

Y = Yes, S = Short term, P = Partial

\* first brand current leader; † first firm current leader

The frequency of occurrence of each first mover advantage is tabulated in Table 7.2. Several very strong patterns emanate from this analysis.

First, the majority of first entrants (32 of 52) did not gain even one first mover advantage. None of these firms succeed in the long run and only six still participate in the product category but have very small market shares. This finding contradicts the established view ( Schmalensee, 1982; Robinson et al., 1985; Lambkin, 1988; Kardes et al., 1992; Urban et al., 1986) that first entry causes structural changes in the market demonstrated in pioneering advantages, which result in market dominance.

Second, with the exception of Sony with the CD player and Intel with flash memory, firms or brands that still lead their market segments were able to gain and maintain at least five of the eight advantages. Sony and Intel had little lead-time because competition entered within few months. In that sense both Sony and Intel entered on par with followers, but because of superior skills, resources, and market power they were able to hold on to their leadership position. Gatorade and Häagen Dazs, on the other hand, had virtually no followers for nearly 16 years. When serious competition was about to enter, both were acquired by large firms (Quaker Oats and Pillsbury, respectively). Patents on aspartame kept competition at bay for 11 years. Baush & Lomb had almost a 4 year monopoly before the first competitor obtained an FDA approval for soft contact lenses. In all seven product categories the first entrants or the new owners (Quaker Oats, Pillsbury) were very aggressive competitors and pursued and defended the pioneering advantages relentlessly.

**Table 7.2 Frequency and Type of Advantages Gained by First Entrants**

<b>First mover advantage</b>	<b>Yes</b>	<b>Short term</b>	<b>Partial</b>	<b>No</b>
1 Enhanced reputation	8	11	0	33
2 Proprietary learning	3	2	0	47
3 Define standard	10	9	0	33
4 Patent protection	2	0	3	47
5 Market preemption	5	4	0	43
6 Channel preemption	3	0	0	49
7 Scarce inputs preemption	0	0	0	52
8 Switching cost	4	3	2	43

# - Number of First movers

Third, in six other product categories (sailboards, microwave ovens, ATMs, CT scanners, supercomputers, and spreadsheet software) the first entrants gained 3 to 5 pioneering advantages but these lasted only for a short time period. Common to all categories was the fact that the first entrant was very visible and had high market share in an attractive, rapidly growing market segment. All became natural targets of aggressive followers. Japanese firms seized the microwave oven technology and, by mid 1970s flooded the US market with low priced ovens. While Amana and other U.S. firms pursued the upscale customers with feature-laden, expensive models, the

Japanese firms targeted a larger, lower income segment which was much more price sensitive. First, the Japanese firms gained foothold in the U.S. market by supplying store brands of mass merchandisers (Sears, Montgomery Ward etc), than established their own brands and a broad distribution network (Lele, 1992; Magaziner and Patinkin, 1989). Amana's market share plunged from over 60% in 1970 to about 18% by 1975 (Lele, 1992). A decade later, Korean firms, Samsung and Goldstar displaced the Japanese firms with even lower cost ovens and reduced Amana's share to only 5%.

Control Data's proprietary learning in supercomputers ended with the departure of its key designer, Seymour Cray, who formed his own supercomputer company, Cray Research, in 1972. Control Data never recovered from Cray's challenge and eventually withdrew from the supercomputer market in April of 1989 (Smaby, 1989). In spite of very strong initial market positions, Windsurfer, Docutel, EMI, VisiCalc, and Amana, lost the advantages in the early stages of the market development under the onslaught of numerous and large competitors.

Last, among the remaining eight firms that gained one or two advantages, only Adidas in athletic shoes and Abbott in cyclamates were in strong positions to retain leadership of their market segments. Prior to 1972, Adidas' position in the athletic shoe market was as strong as Coca Cola's in the soft drink market with one exception -- Adidas was more innovative. Yet, Adidas squandered its lead by ignoring the recreational and running boom that swept the US during 1970s and 80s. Its US market share dropped from over 50% in 1972 to 3% by 1990 (Ramirez, 1990, p.17).

With cyclamates, Abbott never pursued the branded ingredient strategy as Searle later did with NutraSweet (Aspartame). When the cyclamate patents expired in 1959, competitors drove down the price of cyclamates by 80%. Cyclamate became a commodity. Although sales rose rapidly and Abbott remained a leader, at its peak in 1968, the annual revenue from cyclamate was less than \$20 million. In contrast, annual sales of NutraSweet reached \$900 million in 1990 (Shapiro, 1992). Searle learned from Abbott's mistake, gave Aspartame a brand name, and made customers to promote it.

This finding suggests that first movers succeed only if they achieve majority of the advantages, and the advantages are sustained at least through the growth stage of the product life cycle. The firm must have these advantages with a large base of customers. Switching costs, reputation or any other advantage are useless if they pertain to only a small percentage of potential product adopters. The longer the first entrant is alone in the market, the greater its chance of gaining pioneering advantages (provided the product works).

#### **A. Preemption of Scarce Resources and Channels**

First entrants were least likely to gain an advantage from preemption of scarce resources, and channels of distribution. No first mover preempted scarce resources, but in seven product categories (sneakers, diet and decaffeinated colas, light beer, MRI, and personal computers) the several followers did so. For example, Nike, Reebok, Coke, Pepsi, Anheuser Busch, and Miller tied up the advertising slots for the most popular sporting events and signed up the most desirable spokesman to represent the firms's products. Similarly, only Gatorade (Stokely), Häagen Dazs (Senator), and

Bausch and Lomb preempted channels of distribution. For example, Bausch & Lomb distributed the soft contact lenses through over 90% of the 12,000 professional eye-care outlets in the United States (Business Week, 1984, p. 78) and used this leverage. Häagen Dazs and Gatorade's channels were strengthened when Pillsbury and Quaker Oats, respectively, acquired them. In most product categories, where distribution was critical, the later entrants either already had tight control over an extensive distribution network (e.g. P&G, Gillette, GE, Huffy, Seagrams) or used their leverage to establish one quickly (e.g., Home Shopping Network, QVC, Nintendo, Sun, Lotus, WordPerfect, Nike).

## **B. Patents**

Patents or copyrights also offered very little protection to the first entrants. More than half (29 that I was able to ascertain) had either patents or copyrights, but only in two product categories ( cyclamates and aspartame) did it prevent others from entering for the full duration of the patent. In the remaining cases patents or copyrights were bypassed or ignored with impunity. To illustrate, EMI Ltd. spent five years and over 12 million British Pounds (Barron, 1979) to develop a CAT scanner (computed axial tomography). In spite the wall of complex patents, to EMI's shock, within 18 months of 1972 introduction, Ohio Nuclear (a division of Technicare) introduced a competing machine, Delta Scan, that very much resembled EMI scanner but was more versatile and faster. Technicare's R&D budget showed that Delta Scan cost \$882,200 to develop. By the end of 1977, there were 18 competitors world-wide, all infringing on EMI's patents (Barron, 1979; Bartlett, 1983). After heavy losses, EMI pulled out of CAT scanner business in April of

1980. In a complex settlement EMI received over \$50 million from Technicare and General Electric but surrendered its scanner assets and agreed to drop all legal actions regarding the patent infringements. That was a small price to pay considering that without infringing on the patents imitators would have had no chance to enter the lucrative (over a billion dollar a year) scanner market.

### **C. Reputation Benefits**

The enhanced reputation of the pioneer and its brand is said to be the most robust and lasting of the first mover advantages because "the first brand tends to have a disproportionate effect on trial and preference ... much of the information pertaining to the second entrant will be perceived as redundant ..." (Kardes and Kalyanaram 1992, p. 1).

In the sample of 52 product categories, only 8 first-entrants gained lasting reputational benefits for pioneering the product. In addition, in eleven product categories first movers enjoyed short term reputation benefits which dissipated shortly after competition introduced better, second generation products.

In most product categories the first movers reputation was actually damaged. Its name was associated with inferior obsolete and unreliable product. For example deHaviland sales dried up after the Comet I experienced several crashes (Tece, 1986). The resulting financial problems forced the firm into a merger and out of the large commercial jet aircraft. Likewise, the British and French Governments faced enormous criticism and ridicule for undertaking the supersonic jet aircraft. Concord was a technological marvel but a financial disaster. Only 16 were produced but the cost of development was estimated to have been over \$4 billion (Cramer, 1991). The

politicians were shifting the blame to US environmentalist groups and cost overruns at British Aircraft and Aerospatiale.

In the low calorie sweetener market, Abbott made unwelcome headlines and suffered reputationally and financially when cyclamate was suddenly banned as a carcinogen by the FDA. Dr. Sveda, the inventor of cyclamate, was publicly humiliated, discredited, and ostracized by the scientific establishment when he tried to speak up in defense of cyclamate (Thomas, 1975). Although, it was later revealed that the studies sponsored by the Sugar Research Foundation that led to the ban of cyclamate were faulty, neither an apology nor lifting of the ban were forthcoming. As the director of the FDA put it, "Once a decision has been taken, it is extremely difficult to reverse it in the political climate of America" (Thomas, 1975, p.12).

The enhanced reputation and the title of pioneer was bestowed upon followers who survived and remained in the limelight longest. For example, the success of Nike is attributed to inventing the modern running shoe. In reality, Nike imitated the imitator. Adidas was first, but a Japanese firm, Tiger, copied Adidas design and distributed it in the US through Blue Ribbon Sports (BRS) -- the forerunner of Nike. After the relations with Tiger soured, BRS introduced its own brand, Nike. Nike's running shoe, the Cortez, was a replica of its namesake, the Tiger Cortez, which was a copy of Adidas. The imitator, Tiger, sued the latter imitator, Nike, for copying its copy. As success feeds legends, Nike, the imitator of an imitator became a pioneer.

Likewise, Apple's claim to fame is pioneering the personal computer industry. But Apple was preceded by several dozen other firms. The real pioneer was Scelbi Computer Consulting Co. which introduced the Scelbi-8H in March 1974 (Gray,

1984) more than 3 years ahead of Apple. Scelbi, and the rest of the crowd that preceded Apple, perished before the industry took off. Would Apple be called pioneer had it vanished along with Scelbi, MITS, Sphere, RGS, Martin, Hal, and dozens of other "nameless" forerunners? Does pioneering lead to success, or, does success bequeath a title of pioneer?

In summary, qualitative analysis of product categories do not support the notion that first entrants gain long lasting enhanced reputation. The opposite seems to be true. Except for the eight cases (and product categories that failed), the reputational benefits for pioneering accrued to followers that were successful in the market. Previous research that claimed such advantages is based on either laboratory experiments (Kardes and Kalyanaram, 1992; Carpenter and Nakamoto, 1989), which do not reflect the real life complexities of brand competition, or incidental examples of follower brands that are erroneously cited as pioneers.

#### **D. Proprietary Learning**

Market pioneering is said to result in direct cost saving from proprietary learning in R&D, production and distribution. This lower cost may be used to charge a lower price or may be translated into a more attractive marketing mix, thus first movers achieve higher market share.

The results in Tables 7.1 and 7.2 show no cost advantage from proprietary learning in 47 product categories. In the majority of products, first movers did not gain proprietary learning advantage because of low cumulative production in the introductory stage and frequent product changes. Most first entrants had substantial cost disadvantages and this was one of most frequent causes of firms' failures in the

market.

Only three first entrants maintained long-run proprietary learning and lower cost advantage over their competitors. Bausch's and Lomb's spin-casting production method of soft contact lenses yielded more uniform and higher quality products at one fifth to one third the cost of its competitors. It was not until 1987 that Johnson and Johnson, a late entrant, closed the cost gap. Intel's decisive advantage came about after IBM's accidental granting of microprocessor franchise for the personal computer in 1981 and invested \$250 million so that Intel could upgrade its production facilities. Searle, on the other hand, spent 14 years and over \$100 million to get NutraSweet to the market. Most of the money went to a pilot plant and developing an efficient production method with the help from the Japanese firm Ajinomoto. Early on, Searle developed its own expertise in key raw materials and dropped suppliers that might have become competitors after the patent expiration on Aspartame in 1992 (Rhein, 1985). By 1985 it invested \$300 million in plant and process improvement and reduced its cost by 70% (Shapiro, 1989).

In most cases learning was not proprietary. Later entrants were able to capitalize on the pioneers' investments, imitate, and improve the product, and employ efficient, mass manufacturing methods. Many already had established manufacturing and extensive distribution and service facilities in place and were able to take advantage of shared experience. For instance, Cray Research entered the massively parallel supercomputer business in 1992 by acquiring the assets of a bankrupt pioneer Floating Point Systems (FPS) for less than \$4 million. It also hired many of the former employees of FPS (Faulkners Data World, 1992, p. 15). Between 1984 and

1991 FPS had spent over \$80 million on R&D for massively parallel computers. Cray acquired that knowledge for 5 cents on a dollar and, introduced parallel computer based on FPS design in 1993 for fraction of that cost. In 1994 Cray was a leader with sales of the parallel T3D model topping \$100 (Bulkeley, 1995, p. B4).

In summary, sustainable competitive advantages were rarely captured by first entrants. The findings show that:

- in only 5 products the first mover gained five or more enduring pioneering advantages
- in 18 products the first mover gained fewer and mostly short term advantages
- in 29 products the first mover gained no pioneering advantages at all.

Furthermore, in all five product categories where the first mover gained five or more long-term advantages, the first entrant or the brand remained dominant. In the second group only 2 firms (Intel and Sony, both industry leaders at the time of entry) remained dominant and in the last group no firm dominated in the long run.

Furthermore, in four of five products where the first mover gained 5 or more long-run pioneering advantages, the first-mover had a lead-time of 4 to 15 years before competition began to enter. This leads to the conclusion that for a first mover to succeed it needs to:

- gain a majority of the advantages and retain them in the long run, or
- be the leading industry incumbent whose first version of the product worked.

The findings show no support for the exogeneity argument (Schmalensee, 1982; Carpenter and Nakamoto, 1989) that by virtue of being first, firm gains enduring competitive advantage over followers. The proponents of this argument

implicitly assume that:

- most potential customers are aware of the product upon its launch
- market penetration is instantaneous; that is, majority of potential adopters buy or try the product upon its introduction (simultaneous learning)
- most customers had positive experience with the first generation of the pioneer's product
- competition obliges the first mover to establish market presence.

Obviously, these assumptions are unrealistic and contradict the established knowledge about innovation diffusion.

### **III. WHY FIRST ENTRANTS FAILED**

In chapters 2 and 3 it was pointed out that pioneering has its advantages as well as disadvantages. In the earlier literature the perils of pioneering were either not considered or assumed to be outweighed by the advantages. The analysis described in the previous section, however, show that less than 10% of first movers actually gained lasting competitive advantages. So one reason first entrants do not succeed is because they fail to capitalize on their pioneering investments. Another reason for failure is that they face all the disadvantages and incur the cost of pioneering. A third reason for their failure is that different kind of skills and resources are required for success as the market evolves. For a first mover to succeed, it has to be a good entrepreneur and possess the managerial skills and resources to be competitive in the growth and maturity stage. Few firms are good at both. Followers, on the other hand, avoid the cost of pioneering and can focus on being strong competitors when the product takes off. Pioneers usually lack the requisite large-scale manufacturing, distribution, financial resources, brand recognition, and market power that followers

have.

In most cases first mover failure was due to not one but multiple factors.

These include:

- the product was crude, unreliable, costly, or improperly positioned
- long development stage and slow market acceptance
- pioneer lacked the resources and skill to stay in the early stage and to be competitive in growth stage.

#### **A. Product is Better the Next Time**

Bringing new products to the market, first entrants risk investing resources and time "in physical or knowledge-based assets that will have little value if the products do not work or no one will buy them" (Mithcell, 1989, p. 209). Rare is the case where the first generation of the product reaches the market in a finished form or is properly positioned to appeal to a wide market audience. The first entrant often rushes to the market with a semifinished product to establish cash flow or to beat the looming competitors to the market. This leaves the door wide open for imitators to come up with improved versions by identifying and solving the problems of the pioneer's product. The pioneer's product then becomes obsolete before the firm recoups its investment.

Invariably, innovations go through several generations of further refinements before they become a mainstream product. But, hardly ever does the first entrant remain in the forefront of the industry. Rather, the firm is caught in a catch up game often following dead-end leads that further drain the company resources. Products introduced later are better. The brand of the follower does not face the wrath of disgruntled early buyers who got stuck with an obsolete and often problem plagued

**Table 7.3 The First Generation Product Needs Improvement**

<b>PR. ID</b>	<b>Product category</b>	<b>Product improperly positioned</b>	<b>Product needed improvement</b>
2	Light beer	X	X
3	Wine cooler	X	
4	Diet cola	X	
7	Disposable diaper	X	X
8	In-line skate	X	X
10	Mountain bike		X
11	Video game		X
14	VCR - home		X
15	Videotex	X	X
16	TV shopping	X	
18	Microwave oven	X	X
19	Videophone	X	X
21	Credit card	X	
25	Low calorie sweetener/Home	X	X
26	Camcorder		X
27	ATM		X
28	Jet aircraft		X
30	HFCS		X
32	Saccharin		X
38	Fax machine		X
40	Personal Computer	X	X
41	Transportable PC		X
42	Notebook computer		X
43	Workstation	X	X
44	Minicomputer		X
45	Mainframe computer	X	X
47	Mass. parallel supercomputer	X	X

products. It is also one of the early successful followers which popularize the product that also receives the title of pioneer.

For instance, Johnson & Johnson, Kendall and Parke Davis marketed disposable diapers for over 15 years before Pampers were introduced. The early diapers were crudely made, leaky, and very expensive, intended primarily for use in traveling. It was a product going nowhere. Procter & Gamble (P&G) recognized the need for a good disposable diaper and foresaw an enormous potential in daily use if the price was low enough. P&G spent nearly a decade and over \$100 million on product and process development before it got the product right and the cost low enough to displace the commercial diaper cleaning services (Porter, 1980a). Pampers was the beginning of hundreds of millions of dollars of investment in innumerable minor improvements from Borden, Kimberly Clark, Playtex, J&J, Scott, P&G and several other major companies that made the disposable diaper a product of economic significance. Of all the challengers, only Kimberly Clark, which leapfrogged Pampers in 1978 with Huggies - a snugger fitting diaper - remained a lasting competitor of P&G.

P&G was not the first to introduce a disposable diaper but it succeeded because it was among the earliest to make the investment to turn a niche product to a product for the mass market.

Table 7.3 lists the products where the first generation did not work well or was not properly positioned and required a series of improvements to gain market acceptance. Because of their deficiencies, videodisc, videophone, massively parallel supercomputers and saccharin are still meeting with customer resistance. The

inherent deficiencies of saccharin - metallic aftertaste and a link to cancer - prevent it from ever being a major product category. The problems of parallel supercomputers include lack of industry standard, dearth of application software and field performance at a fraction of its theoretical capabilities.

### **B. Slow Market Acceptance**

Another major reason first movers fail is that progression from product idea to commercial introduction takes a long time, and then a long time, again, to gain market acceptance. Most innovations actually fail before they reach the market. The infamous 1980 Silicon Valley startup, Trilogy Systems, Inc., illustrates this situation. Thanks to their record as entrepreneurs, Gene and Carl Amdahl raised \$230 million to design a high performance computer that would outstrip IBM mainframe in price and performance. Their proposed key to success was to put the mainframe on a single silicon wafer. The product never materialized and Trilogy was liquidated in 1985. The problem was that the 2.5 inch superchip which was to replace 100 conventional chips, was dependent on too many breakthroughs in materials, production processes, and design (Gupta, 1988).

Given that the product reaches the market, the first mover usually has to wait for a long time for the market to take off. In the introductory stage, the costs are high and the revenues low. If the product is the sole source of revenue, it spells a problem of survival for the firm.

In this sample of products, the average time from commercial debut to the beginning of the growth stage was slightly over eight years, but 19 products listed in Table 7.4 took ten or more years to gain customer acceptance.

**Table 7.4 Products that Took 10 Years or More to Gain Market Acceptance**

PR. ID	Product category	First mover	Time to rapid growth [years]
2	Light beer	Piel Brothers (1951)	24
4	Diet cola	Kirsch's No-cal (1952)	11
5	Decaffeinated cola	Canada Dry (1967)	16
6	Sport drink	Stokely Van Camp (1967)	16
7	Disposable diaper	J&J (1950)	17
8	In-line skate	Chicago Roller (1968)	21
12	Videodisc player	Philips (1979)	Not yet
14	VCR - home market	Ampex (1963)	14
15	Videotex	Telecomputing (1979)	14
18	Microwave oven	Amana/Raytheon (1966)	11
19	Videophone	AT&T (1964)	Not yet
22	Superpremium ice cream	Senator (1961)	16
25	Low calorie sweetener/Home	Abbott Labs (1950)	15
32	Saccharin	Monsanto (1900)	50+
37	Photocopier	3M (1950)	12
38	Fax machine	Magnavox (1966)	19
44	Minicomputer	Burroughs (1956)	10
46	Supercomputer	Control Data (1960)	16
47	Mass. parallel supercomputer	Burroughs (1972)	Not yet

For instance, the home VCR market took fourteen years to enter the growth stage but, by then, Ampex, the inventor, and all the US firms were out of the market (Rosenbloom et al., 1987). Similarly, the fax machine, an American invention, took four generations and 19 years of improvements before it attracted customer interest.

Magnavox, the market pioneer, withdrew from the fray in 1972, six years after its entry. Of the US firms that entered in the first decade only Xerox is still in the market and has less than 4% market share. By 1988, virtually 100% of fax machines sold in the US were made in Japan. The top three firms, which together have about 50% of the US market, are Sharp, Murata and Canon. Sharp and Canon entered the US market in 1980 and Murata 1985, fourteen and nineteen years after the product was first introduced.

The in-line roller skate is a nearly 300 year-old invention. The most recent US reintroduction dates back to 1968 by Chicago Roller Skate Company, but the product did not gain market recognition until the late 1980s. The sales zoomed from \$7.7 million in 1988 to nearly half a billion dollars by the end of 1994. Chicago Roller Skate Company gave up on the product in 1980 and was liquidated in 1991 (Randle, 1992) partly because popularity of the in-line skates hurt the sales of its conventional roller skates.

Three products, videodisc player, videophone and massively parallel super-computers, are still struggling to establish presence in the market. Perhaps the most intriguing failure is that of the laser videodisc player which actually preceded the CD audio player by four years. Videodisc advantages and disadvantages relative to the VCR are the same as those of the CD relative to the audio cassette player, yet while the CD enjoys immense popularity and is the dominant design in the audio category, the sale of VCRs outstrips videodisc players 100 to 1 (Hall, 1991, p. 100).

The two major reasons for the videodisc failure are lack of industry backing and incompatible formats. The Japanese consumer electronic firms had little interest

in the videodisc because the VCR, after fifteen years, just began rapid growth. The major backers of videodisc were Philips and Pioneer, each pushing its own format and consumers stayed away.

In 1981, RCA introduced yet another format, a capacitance videodisc that did not catch on either. The future of videodisc still remains a question because a battle of new formats is looming again, with Philips and Sony in one camp, and Toshiba with Pioneer in another. This should confuse consumers and slow the product's acceptance. "Toshiba Corp. happily admits that its forthcoming digital-movie player will never earn back the investment poured into it." (Gross, Coy and Port ,1995, p. 84). Who will be the ultimate winner? Probably Matsushita, which has no format of its own and will enjoy a free ride in a winning camp. Matsushita's choice of format will actually determine which format wins.

In the mid-1960s AT&T spent over \$500 million on development of the videophone but the product failed. It required three telephone lines, cost \$8000, and a few minutes call cost about \$20. Regardless, AT&T projected sales into tens of thousands; only several hundred were sold before it was discontinued in 1973 (Noll, 1992, p. F13; McCaroll, 1991, p.46). In late 1980s Sony and Mitsubishi thought that the consumers were ready - both failed. In 1991 Mitsubishi liquidated its entire inventory of 38,000 Visi-Tel phones through Home Shopping Network for under \$70. Undaunted, in January 1992, AT&T unveiled its newest \$1500 Videophone 2500, projecting the sales to reach 400,000 within a year, and by the year 2000 it would be available in over 30 million homes across America (AT&T News Release, January 6, 1992). Consumers are rejecting it again. The third generation Videophone is still

expensive, grossly inadequate, and AT&T is finding out that, although people want to see others, they do not want to be seen. In the first 15 months, AT&T sold only 28,000 videophones; a mere 5% of original projections (Patton, 1994).

### **C. Followers are Superior Competitors**

The proponents of the endogeneity assumption (Buzzell and Gale, 1992; Robinson et al., 1992; Vanhonerker and Day, 1987; Moore et al., 1991) proposed that first movers are more successful than followers because they are stronger competitors to begin with. Because of superior R&D skills, they beat other firms to the market. They maintain market dominance because of more resources, market power, and well-established manufacturing and organizational skills.

The results of the current study contradict the endogeneity argument. A majority of the product categories were pioneered by small entrepreneurial firms and industry outsiders which either lacked resources or had no presence in the industry. Only five product categories were pioneered by leading industry incumbents and even then only two succeeded in the long run. In most cases, the large firms were willing to wait on the sidelines until some of the uncertainties about the market and technology were resolved. As the products evolved, the key factors to success shifted from entrepreneurship, flexibility and speed to mass manufacturing, distribution, improved quality, price and advertising and promotion. Most products went through several changes of leadership progressing from smaller to larger, and larger firms. Market shares remained volatile until one or several of the large industry incumbents or even a large outsider established clear leadership.

Table 7.5 summarizes the changeover of leadership in 40 product categories.

Only 40 products are considered because four first movers remained leaders, three products are no longer on the market (supersonic commercial jet, cyclamate and miraculin), three categories (videophone, videodisc and parallel supercomputers) are still in an embryonic stage and dominance had not yet been resolved, and two categories (saccharin and transportable computers) are in deep decline. Additional information on reversal of leadership for each product category can be seen in Table 5.1. The table does not capture intermediate leadership reversals.

**Table 7.5 Large Followers Displace Smaller First Entrants**

<b>Pattern of displacement</b>	<b>Product category</b>
small first displaced by large follower (24 products)	light beer, diet cola wine cooler, sport drink, sailboard, mountain bike, video games, VCR, videotex, TV shopping, pocket calculator, credit card, ice cream, stainless steel razor blade, low calorie sweetener - home use, ATM, MRI, fax machine, PC fax board, PC, workstation, word processing software - PC, spreadsheet - PC, DRAM
large first displaced by larger follower (12 products)	disposable diaper, microwave oven, decaffeinated cola, compact auto-focus camera, camcorder, high fructose corn syrup (HFCS), aspartame, CT scanner, notebook computer, minicomputer, mainframe
large first displaced by small follower (2 products)	athletic shoe, photocopier
small first displaced by small follower (2 products)	in-line roller skate, supercomputer

In 24 product categories the market dominance shifted from small to progressively larger firms. For instance, in the PC market the leadership was passed

on from MITS to Radio Shack to Commodore then to IBM. In electronic pocket calculators, in 1971, the small assemblers took the initiative and Bowmar was the leader. In a couple of years the assemblers were replaced by the U.S. semiconductor manufacturers such as Rockwell, National Semiconductor, and Texas Instruments which became the leader (Business Week, 1974, p. 34). By the early 1980s, the incumbent Japanese firms that dominated the electronic desktop calculators in the early 70s - Sharp, Casio and Canon - took the market. Currently, the market still belongs to the Japanese firms and Texas Instruments.

Similarly, the credit card was introduced in 1950 by Diners Club, started by Frank McNamara. Diners Club led the market through the 1950s, but within a few years of its entry in 1958, American Express moved ahead. The ultimate winners were Visa started by Bank of America in 1965, and Master Card formed by four large Chicago banks in 1966 (Camerford and Callghan, 1985).

In twelve categories, large firms were replaced by even larger firms. For example, Epson pioneered the notebook computer in November 1981, but the product did not catch on until Radio Shack brought an improved version in mid-1983 and became the early leader. Toshiba, Apple, and Compaq currently dominate the market.

Only in two product categories were large firms displaced by small firms. In athletic shoes, Adidas, Puma, and Tiger were displaced by industry newcomers Nike Reebok and L.A. Gear. In copying machines, Haloid (Xerox) took over the market from Minnesota Mining and Kodak in the early 1960s. In two product categories - supercomputers and rollerblades - the small pioneer was replaced by another small

firm.

In conclusion, company size matters when it comes to who ultimately obtains significant economic benefits from the innovation. When small firms pioneered new markets, larger firms moved in after the viability of the product was evident and overwhelmed the pioneers with their marketing and financial muscle. In cases where large firms pioneered the product, even larger firms supplanted them.

In business as in nature, guppies are eaten by small fish, small fish are eaten by large fish, and large fish are shark food. Rarely do guppies eat sharks.

#### IV. CONCLUSIONS

Entrant characteristics determine who pioneers and who succeeds in the market. The small industry newcomers were more adept at recognizing and seizing the opportunity, creating markets where there were none. The lack of competition, potential rewards from first-mover advantage as well as the dream of creating something new motivated them to take the risk. Most, however, paid heavy penalties for being first.

More often than not, the leading edge proved to be the bleeding edge. The uncertainty of the environment, lack of resources, and the competitive response once market proven, lead to their downfall. It was those who imitated that benefitted from their effort. The large incumbent firms were the most frequent and the largest gainers in the new markets provided they did not enter first.

Even when the first were large incumbents, seldom did they retain market dominance. Technology change, product obsolescence and long incubation before the market took off worked against the pioneers. The first generation product was not

ready for the mainstream customer, and the customer was not ready for the product.

Tomorrow's product here today was usually crude, unreliable and expensive to gain customers today, obsolete when tomorrow came. What caught the attention of the mainstream customer was a refined, more reliable, better quality, heavily promoted yesterday's product at lower cost preferably from a mainstream company.

## CHAPTER 8

### MANAGEMENT IMPLICATIONS AND FUTURE RESEARCH

#### I. SUMMARY OF FINDINGS

The findings of this study are rather disturbing for would-be pioneers especially in view of the fact that 43 of the 52 innovations examined evolved into "mega products" with sales from one billion to over thirty billion dollars a year. The first entrants were instrumental in getting the products off the ground and incurred the costs associated with it, yet an overwhelming majority failed to harvest any financial benefits.

To add insult to injury, the credit for pioneering usually went to successful followers. Even when, the credit was given to the pioneer, it came under the dubious distinction of the "rare failure" (i.e. Ampex, Bowmar, deHaviland, and EMI among others) as if pioneer success were the norm. Among first entrants failure, not success, is the norm but those few that succeed win big. The glory of the few, echoed endlessly, is sufficient to fuel the folklore that pioneering is a sure road to success and market dominance.

#### **Summary of Findings of Statistical Analysis (52 products)**

1. Only 7.7% of first movers remained long-term market leaders. PIMS data reports that 52% of pioneers remained leaders.
2. The 4.3% average market share of first entrants found in this study is well below the 30% share commonly reported in earlier studies.
3. Neither innovation nor organizational characteristics had a statistically significant influence on first mover's market share or chance of market dominance.
4. Organizational characteristics predispose firms to pioneer new product

categories. The firms most likely to enter first were the small industry newcomers (46%), then large incumbents (27%), then small incumbents and large newcomers (13.5% each).

5. 73% of first movers did not survive in the market. In contrast, other studies observed no failures among first movers or considered non-survival inconsequential.
6. When first, incumbents and large firms were almost three times more likely to survive than industry newcomers and small firms.
7. The mean length of survival for first movers was 14.1 years.
8. First movers remained market leaders for an average of 6.6 years, however one third of the sample remained leaders for one year or less. In PIMS data base, about 50% of first entrants remain leaders through the product life cycle.

#### **Dominant Firms and Market Leaders (46 product)**

9. 97% of firms that dominate the markets in the long run were followers. 33% were late entrants. In comparison, PIMS data shows that about half of dominant firms were pioneers.
10. The dominant firms entered the market, on an average, 9.3 years after the first mover.
11. Average market share of the dominant firms was 25.6%. Market share of dominant firms declined with later entry and resembled patterns observed in the PIMS and ASSESSOR studies. (Illustrates survival bias)
12. Only 8.7% of market leaders were first entrants. In contrast, PIMS data indicates that over 70% of leaders entered as pioneers (meaning first).
13. The 43.6% market share of the leaders is very close to the 40.5% share indicated in the PIMS data.

#### **Summary of Findings from Qualitative Analysis**

1. Over 60% of first movers gained no first mover advantages at all. None succeeded in the market. Only 5 firms gained majority of advantages attributed to first movership and in all five cases either the firm or the brand remained market leaders.
2. Two first movers remained market leaders although they gained only 2 and 3 pioneering advantages, respectively. Both were the largest industry

incumbents at the time of entry.

3. In over 80% of the product categories, the reputation of product pioneer went to one or several followers.
4. In over 90% of the product categories the first mover did not gain proprietary learning advantage. Because of industry-wide learning followers had lower cost.
5. Where patents existed, the first entrant was protected for their full duration only in 2 product categories.
6. First movers preempted the best market position only in 10% of the products. The most lucrative markets evolved in the growth stage of product life cycle.

## II. MANAGEMENT IMPLICATIONS

It is a common belief that new product development is the only way to make it big, improving existing products or manufacturing process is not. Therefore, the firms spend their R&D budgets accordingly. Most money goes for new product development, little money for continued improvement and process improvement. But look around, who is making the real money -- those who pioneer new products or those who imitate, improve and deliver at low price. If the pioneer does not have the competitive capabilities down-stream from the initial R&D, it has virtually no chance of success in the market.

Companies that race ahead on innovation usually do not win in the market places. This harsh message should be noticed by would be pioneers. If the only motive for pioneering is to make lots of money, the advice is not to do it. The firm has much better chance of success as a follower. For instance, the PC industry is one of the most competitive markets in the US. Yet, there are literally hundreds of small firms that are making more money as followers than any of the early pioneers ever

did. Gateways 1994 annual revenues of some \$2 billion is more than the combined revenues of all the firms in the first 6 years of the PC industry's existence.

Gateway has less than 4% of the market share and started in a barn of a South Dakota farm. Its key to success is being a follower but offering customers value for their money.

Having a good idea is not sufficient to succeed in the market. The product has to be also properly designed, positioned economically manufactured and effectively promoted. If the pioneer does not do it (and it usually does not) someone else will.

For those who still want to pioneer here are several things to consider.

- Undertake less ambitious projects which do not require creation of a high level of new knowledge or complex synthesis of existing knowledge.
- Avoid projects where technology is pursued for its own sake, that is, "a solution in search of problem." Good examples of such products are Videotext and Videophone -- both consumed billions of dollars but have met with little consumer acceptance.
- Successful innovations tend to be those that cost little to develop. Allocate the budget so that most money is available after the product launch.
- If the innovation is a real market success and attracts many large competitors consider selling out before being forced out. There is always the opportunity to reenter as a follower.
- Fully formed functional innovations gain much faster acceptance. Therefore, the pioneer should start with a cross functional team of experts from marketing, design, production and finance. It is a well known fact that 80% of the products cost is fixed during the first 15% of its development cycle - a faulty start is hard to overcome (Main, 1990, p. 56). The problem is that most new startup firms do not even have separate functional departments to assist with the development and add functions after the design is completed.
- The old competition based on advantages of one proprietary technology over another may still work in the introductory stage, but what works

in the long-run is providing basic value with a standard product.

- Counter to given view, firms fail less frequently in an environment where there are more competitors. Especially in the introductory stage if product requires major change in customer behavior more firms are better than few. Product gains faster acceptance and enters rapid growth faster. Therefore pioneer, especially small firms, should seek alliances with larger firms or license the technology. Good examples of such successful strategies are Dolby (hi-fi noise reduction system) and CD player.

### **The Implications For Country R&D Policy and International Competitiveness**

Many recommendations for the prospective innovator also apply to country trade policy. The countries that are growing rapidly and experience economic boom are those that spent very little on basic research and new product development but concentrate on incorporating technologies developed elsewhere into existing products. The bulk of their R&D budgets go into process improvement to keep their facilities current. These countries include Korea, Taiwan, Malaysia, Thailand, China, Singapore, Japan and to a certain extent Germany. These countries understand that efficient manufacturing processes determine the quality and price of the product and ensure long term competitive advantage. Their product strategies are imitate and improve.

The American and British business culture, on the other hand, had adopted the designer role thinking that the only way to stay ahead of the competition is to come up with new breakthrough products. By the time the competition catches up there will be another breakthrough. Without the prerequisite manufacturing base, ironically, more breakthroughs actually weaken the economy of the innovator and strengthen the economy of the imitator country.

The breakthroughs do not come cheap and offer only a short term advantage

before the technology diffuses. The innovator loses its advantage in the introductory stage and does not recoup its investment. During the growth and mature stages the profits flow to those with efficient manufacturing. Where does the money come from for the next breakthrough if this cycle repeats itself?

Yet over and over the current balance of payment deficit and economic malaise is blamed on lack of innovativeness. Firms are urged to use the good old Yankee ingenuity and come up with new revolutionary products; no more line extensions and "new improved" products.

But where does US have the greatest competitive advantage in Jet aircraft, diapers, CT scanners, High Fructose Corn Syrup -- products that were invented elsewhere but the U.S firms maintain an edge having superior manufacturing, service marketing and continual improvement.

### III. STUDY LIMITATIONS

The main purpose of this study is to examine how successful are first entrants in the market in the long run. The other major research question deals with entry order of most successful firms in each innovation. A large number of innovations are necessary so that statistical analysis of data can be performed. Of course, there is a trade off between large sample of innovations and the depth in which they can be covered. Since this study includes many small non-surviving firms, detailed archival information is often lacking. Furthermore, information on individual product classes is hardly ever available from public corporate records. Firms go to great lengths to disguise any information that could be deemed helpful to competitors or even

stockholders to evaluate how well the firm is doing.

Another limiting factor is that, with archival studies of corporate strategies, the variables and their measures are out of the control of the researcher. For example, to compare performance of entrants across innovations, there is no practical measure but the most rudimentary rank order market share. Relative market share to the first entrant is impossible if first entrant exits. Market share in percentage is a function of number of competitors in the product category. Whereas 20% share may be small if few firms enter, 5% share may be good enough to be an industry leader where there are 100 or more competitors. Therefore, the mean values of market shares have large standard deviations.

Furthermore the empirical part of this research does not consider the effect of the marketing mix (ie. price, promotion, product quality, distribution, market research capabilities), production capabilities, or managerial skills. Inclusion of these variables would facilitate separating the pioneering effect from marketing and managerial factors.

Another limiting factor is the definition of innovation. The study considers only those innovations that created distinctly new product categories and most were new to the world. These innovations are harder to pioneer because they involve behavioral change (on the part of the customer) and represent higher demand and technological uncertainty.

Finally, the measure of performance were market share and survival. Firms were classified as dominant if they ranked among top 3 firms in terms of market share. The relation between market share and profitability is still somewhat tenuous.

Firms with smaller market share may be more profitable than firms with large share. Likewise, firms that did not survive might have realized sizable return on their investment before they withdrew from the market (that hardly was the case in this sample). The point is though, followers made more money.

#### **IV. DIRECTIONS FOR FUTURE RESEARCH**

Several directions for future research arise from the evaluations of current state of knowledge on first mover advantage. In view of the limitations of PIMS and ASSESSOR data bases, researchers should develop their own longitudinal data that also includes non-survivors and failed innovations. To ensure accuracy, it will require the use of historical analysis of each product category rather than rely on self-reports of current survivors.

Additional empirical research is needed on the relationship between entry order and survival. In the past, researchers assumed that first entrants rarely fail, but results of this study show their survival to be only 27%. We know virtually nothing about the survival rate of followers.

Furthermore, first mover advantage and order of entry are dynamic models concerned with entries, exits and performance for firms over time. This requires longitudinal design and tracking of individual firms through the different stages of life cycle. Scarcity of longitudinal studies partly accounts for the current confusion and leaves many opportunities wide open.

Last, the issue of firm characteristics and optimum timing of entry had not been resolved. With few exceptions, the assumptions in earlier research were that firms are, either equally suited to pioneer or follow, or that stronger competitors enter

first. The findings in this study do not support either position. Some exploratory work had been done by Teece (1986), Lambkin (1988), and Wernerfelt and Karnani (1987) but had not been followed up.

In conclusion, pioneers end up with arrows in their backs. It is those who bring the cavalry that pan the rivers of gold.

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