Abandoning Innovation in Emerging Industries*

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Abstract

Existing models of industry evolution describe a smooth pattern of emergence over time in which the number of firms in an industry increases, hits a peak, decreases as a result of a shakeout, and then stabilizes as the industry reaches maturity. Although this model has been well-accepted and the basic empirical finding holds true across a range of industries, we propose that the finding is not as robust as is generally assumed. We introduce an alternative pattern of evolution in which, during the emergent stage, an industry experiences a sharp decrease in the number of firms – a "mini shakeout" – before increasing again, reaching a final peak and undergoing a major shakeout as described in the extant literature. Using panel data across multiple product innovations introduced in the 20th century, we first show the pervasiveness of the mini shakeout phenomena. We then examine why some industries are more likely to experience a mini shakeout. Finally, using detailed quantitative and qualitative data on the emergence of handheld computers and digital cameras, we investigate why some firms abandon innovation before the industry even develops while others stay committed. We propose a conceptual model that highlights the role of unmet expectations and the degree of importance of the emerging industry to the focal firm in determining its likelihood of exit from the industry.

Life cycle studies of industries that emerge from new product innovations have consistently documented a relatively smooth pattern in the number of firms: an initial increase during the growth stage, followed by a "shake-out" period, and a final mature period where the number of firms is roughly constant over time (e.g. Gort and Klepper, 1982; Hannan and Freeman, 1977; Klepper and Graddy, 1990). At the same time, scholars have acknowledged the high degree of technological and market uncertainty facing firms that enter emerging industries (Utterback and Abernathy, 1975; Tushman and Anderson, 1986; Rosenkopf and Tushman, 1994; Brown and Eisenhardt, 1997). Related literature on first mover (dis)advantages discusses the risks of pioneering and has documented significant failure rates for pioneering firms (Golder and Tellis, 1993). This work calls into question the smoothness of the initial increase in the number of firms. Do industries experience a smooth take-off in the number of firm, or is there considerable churn and turbulence experienced by early entrants? Is there evidence of a sharp decline in the number of firms during the emergence stage — a "mini shakeout" — and if so, how prevalent is the phenomenon? What distinguishes industries that experience a mini shakeout from those that don't? And finally, what might cause some firms to exit the industry even as it is evolving and becoming profitable?

To address these research questions, we undertake a study using both large sample quantitative methods and in-depth inductive case studies. Our study begins with an investigation of panel data on 24 new industries from their inception.. We focus on the emergence stage of the industry, the period prior to a take-off in sales, and examine the extent to which industries exhibit a significant exodus of firms – what we call a mini shakeout – in these formative years. We further use these data to investigate systematic factors that may explain what industries are more likely to experience a mini shakeout. We then turn to an inductive analysis of two emerging industries, digital cameras and handheld computers, to explore the firm exit decision at a deeper level. We examine industry, firm and intra-firm factors that influence firm decisions to abandon an emerging industry. In doing

so, we develop a conceptual model that highlights two related variables contributing to the exit decision: first, the level of the firm's unmet expectations – ie. the disparity between expected and actual development of the industry, and 2) the strategic importance of the industry to the firm. Finally, we examine the applicability of our conceptual model for one firm's decision to abandon innovations after a significant investment of resources.

Our study makes several important contributions. We contribute to the innovation diffusion and industry evolution literatures by examining the extent to which industries may deviate from stylized patterns. We find that a significant number of industries experience a mini shakeout early in their life cycle, as contrasted with the shake-out that occurs after the industry has experienced significant growth in both number of firms and sales. Thus, we propose that an alternative evolutionary path may apply in some contexts: rather than three distinct stages, with a clear increase, shakeout and decline in the number of firms, we propose two additional stages—a mini shakeout and subsequent increase in firms—that precede the final shakeout. Further, our study indicates that it may not be a single dominant driver per se, but the inter-play of multiple drivers that ultimately impact which firms survive, which firms exit, and the rate at which industries evolve.

We contribute to the technology strategy literature by developing a conceptual model regarding reasons firms choose to exit. While a great deal of work has focused on entry into an industry as a firm choice (Gort and Klepper, 1982; Mitchell, 1991; Helfat and Lieberman, 2002), the implicit assumption of most survival analyses is that "winners" survive and "losers" exit. In this literature, exit is not a choice, but a necessity that plays out as competition intensifies and the industry matures (e.g. Baum and Oliver, 1991; Suarez and Utterback, 1995). Thus the focus of much research has been on understanding why some firms outperform others in adapting to new technology that results in a new industry (Rothaermel, 2001; Benner and Tushman, 2002). In contrast, a budding literature stream has begun to focus on proactive exit and firm decisions related to inter-temporal economies of

scope (Helfat and Eisenhardt, 2004). This is also consistent with work on firm exploration and subsequent abandonment in the vein of real options (Adner and Levinthal, 2004; McGrath, 1997). We add to this literature stream by examining exit at a point in the emerging industry when sales have not yet developed and it's not clear who the winners and losers are. We integrate across multiple levels of analysis to show that these factors are highly interdependent, thus furthering our knowledge beyond what a single level of analysis study would predict. Our paper also provides insights into how firms interpret signals as they navigate an uncertain environment and react to unmet expectations. In doing so, we enhance our understanding of why firms abandon particular industries early in the life-cycle.

1. Background

In a seminal paper, Gort and Klepper (1982) depict the diffusion of product innovations in terms of the number of firms that exist in the new industries over time. Since then, an impressive body of research, spanning across technology management, organizational ecology and evolutionary economics has documented evidence of an inverted U-shaped relationship of number of firms over time (Carroll and Hannan, 1989; Klepper and Graddy, 1990; Utterback and Suarez, 1993; Murmann, 2003). The literature on technology and industry evolution divides the industry life cycle into three evolutionary stages: growth, shakeout, and maturity (see Klepper, 1997; Baum and McGahan, 2004 for reviews of this literature). These stages have alternatively been labeled as variation, selection and retention (Van de Ven and Garud, 1993), fluid, transitional and specific (Utterback and Abernathy, 1975), era of ferment, dominant design, and era of incremental change (Tushman and Anderson, 1986) and growth, shakeout, and stabilization (Klepper and Graddy, 1990).

Figure 1 provides a stylized depiction of entry, exit and the total number of firms over the course of the industry life cycle. The earliest stage is characterized by significant growth in the number of firms in the industry since entry exceeds exit. For example, Agarwal and Gort (1996) find that, on average, annual entry rates in the early years are at

least four times higher than the annual exit rates. In direct contrast, the shake-out stage is characterized by a sharp decline in the number of firms, with annual exit rates on average three times higher than annual entry rates. Researchers have attributed the shake-out phenomenon in industry life cycles to an increased emphasis on process vs. product innovation, economies of scale and production efficiencies, and standardization on a dominant design (Abernathy and Utterback, 1978; Gort and Klepper, 1982; Jovanovic and MacDonald, 1994; Klepper, 1996). The final mature stage occurs when an "equilibrium" number of firms is reached, representing relatively stable technological activity, with entry rates roughly equal to exit rates.

The smooth inverted U-shaped depiction of the number of firms over time, however, masks significant turnover in the firms operating in the industry. A related body of literature has identified multiple technological generations that may result in new waves of firm entry and exit, and the development of multiple markets as industries progress towards maturity (Christensen, 1997; Mitchell, 1991; King and Tucci, 2002). However, the deviations from the smooth industry evolution curves emphasized in these papers occur after the legitimacy of the industry when both demand and supply in the market are well established. In fact, Abernathy, et al. (1983) use the term "de-maturity" to describe such changes in the automobile industry. In contrast to these studies, our interest is in examining the degree to which there may be a systematic deviation in the observed patterns of the number of firms *before* such legitimacy occurs, i.e. during the emergence stage of the industry.

While most industry evolution studies identify one stage that combines both emergence and growth, we break them out and define the emergence stage as the period between the first commercial introduction of an innovation and a take off in its sales. Studies in marketing that focus on sales diffusion have identified sales take-off, a sharp increase in sales that follows an initial period of slow growth, as a key turning point (Golder and Tellis, 1997; Mahajan, Muller and Bass, 1990; Rogers, 1995) and Agarwal and Bayus (2002) showed

that firm take-off systematically preceded sales take-off in all the industries in their study. Firm take-off represents legitimacy of the industry on the supply side, while sales take-off represents legitimacy of the industry on the demand side. We therefore choose sales take-off as the defining moment for the end of the emergence stage since at that point both supply and demand uncertainty has been addressed.

2. Data and Methods

We use panel data for 24 industries, as well as in-depth case studies of two industries, to better understand the mini shakeout phenomenon. We have two main goals: (1) to document the pervasiveness of and drivers of the phenomenon and (2) to gain insights into why some firms exit during the mini shakeout and others don't. To accomplish the first goal, we use the Agarwal and Bayus (2002, 2004) sample of 22 industries, and add two recent industries— digital cameras and the handheld computing. The industries in our study represent major product innovations that were introduced starting with the late nineteenth century and extending to 1984. These industries are largely a subset of the 46 industries in the Gort and Klepper (1982) sample; lack of consistent data for both firms and sales precluded the other 24 industries from being added to our analysis. The data were compiled mainly from the *Thomas Register of American Manufacturers*. Supplementary information was obtained from the Census of Manufactures and a variety of trade publications (e.g., *Merchandising Week*). Greater details of the data are in Agarwal and Bayus (2002).

It is important to note that these data were originally developed for research that did NOT focus on exit in the emergence stage of a new industry. The initial list of product innovations was created by consulting various technical sources, scientific journals, chronologies and encyclopedias of new innovations. To be included in the sample, a product innovation had to be deemed significant by experts in the field, result in entirely new industries or be based on discontinuous technologies rather than represent improvements or sub-sections of existing industries (Gort and Klepper, 1982). Thus, the choice of industries

was made in the absence of any prior knowledge or expectation about the length of either the take-off times, or the amount of exit that occurred during the emergence stage.

To accomplish our second goal—an exploration of factors that influence firms to abandon innovations—we use inductive theory building through case studies (Eisenhardt, 1989; Yin, 1994). We compiled quantitative and qualitative data on the digital camera and handheld computer industries from company press releases, annual reports, SEC filings, web sites, media articles, industry research reports (e.g. IDC, Gartner), Wall Street analyst reports as well as private company archives. For each industry, we gathered data on the entire population of firms including the timing of firm entry and/or exit, firm size and, if applicable, the industries in which they operated in prior to entry into the focal industry. We focused on the period surrounding entry into the focal industry and if applicable, surrounding exit, examining reactions about entry and/or exit.

In analyzing this data, we began by categorizing each firm based on its prior affiliation. Digital camera firms were categorized as either start-ups, photography, consumer electronics, computing or graphic arts firms, and handheld computing firms were categorized as start-ups, telecommunications, personal computer or consumer electronics firms. We then compared firms that exited and those that didn't in order to identify patterns based on prior industry. We next analyzed each firm. We examined all press releases and articles within the 2 month period before and after the entry and exit of each firm in the sample as well as SEC filings and annual reports and coded reasons identified for entry and exit looking for common patterns. Finally, for a subset of firms for which we had intrafirm information, we explored the rationale of individual managers or groups within the firm.

3. The Mini Shakeout Phenomenon

Prior work has paid little attention to exit during the emerging stage of the industry and has failed to address the potential for mass exodus during this stage. However, there are reasons to expect that the emerging stage of the industry may not be characterized as

smooth sailing, since it is fraught with technological and demand uncertainty. On the technology side, firms have to spend effort understanding the fundamentals of the technology and experiment with a variety of designs, resulting in unpredictable growth along a performance trajectory. Uncertainty regarding alternative drivers of technological change or paths of improvement may result in unmet expectations even after significant investment of effort and resources. On the demand side, undeveloped customer preferences, lack of complementary assets, and lack of necessary infrastructure may create uncertainty regarding the potential market size and the speed at which the innovation is adopted by consumers. Firm level studies in the context of first mover advantage, for instance, discuss the demand and technology uncertainty faced by pioneering firms (Lieberman and Montgomery,1998), resulting in higher likelihood of failure (Golder and Tellis, 1993). The classic work by Utterback and Abernathy (1975) and Anderson and Tushman (1990) also discusses firm experimentation with alternative designs during the emergence stage. Thus, there is reason to believe firms that enter with the "wrong design," or find their experimentation efforts unsatisfactory and/or expectations unmet may choose to exit the industry.

Empirically, there have been relatively few studies that provide systematic documentation of the degree to which significant exodus may occur in emerging industries. This partly stems from the difficulty in obtaining accurate historical data on multiple industries. Another reason may be that the emergence stage has not been the primary focus of most evolutionary studies, since research in this vein has largely investigated differences in the time trend across all stages of the life cycle and firm performance. Further, as noted above, several of these studies grouped the emergence and growth stages together.

In this section, we focus our attention on firm exit during the emergence stage, and document evidence for what we term the "mini shakeout" phenomenon, i.e., a significant decline in the number of firms operating in the industry and over successive periods. We

also investigate when this is more likely to occur, i.e. what industries may be more likely to experience a mini shakeout.

3.1 How Pervasive is the Mini Shakeout in Emerging Industries?

Consider the four industries depicted in Figure 2. In each panel, we focus on the emergence stage of the industry. The number of competing firms and total industry sales are plotted over time. Particularly noteworthy in all four industries is a period of consistent decline in the number of firms, which occurs before the take-off in sales. Thus, these graphs show that several firms chose to exit the industry in a relatively short period of time. Are these industries exceptions to the rule, or is the observed phenomenon more pervasive than one would believe? We turn to Table 1 to address this question.

Table 1 provides descriptive statistics regarding the year of commercial introduction, the firm and sales take-off years, the number of entries, and the number of exits for each industry in our sample. We follow the methodology described in Agarwal and Bayus (2002) to determine the year of take-off in sales and number of firms for each industry in our sample. (A more detailed description is included in the Appendix.) Regardless of when an innovation was first introduced, there is significant variation in length of the emergence stage (the time to sales take-off) across industries. Additionally, there is wide variation in the number of firms that enter during the emergence stage. While the average number of entrants across industries is 31, some industries have only a few entrants, while others experience significant entry.

We define an industry to have experienced a mini shakeout if, in the period between commercial introduction and time of sales take-off, it experiences either (a) at least a 20% reduction in the number of firms over at least a two consecutive year period, or (b) a more than 50% reduction in one year. Based on this definition, 46% of the industries in our sample experience a mini shakeout during the emergence stage. On an average, the duration of the mini shakeout lasts 2.5 years, and results in a 40% decline in the number of firms in

the industry. Further, five of eleven industries experience more than a 50% decline in the number of firms during the mini-shakeout period. Importantly, these high percentages are not a function of low denominator values; all industries that experience a mini shakeout have double digit entrants prior to the emergence stage.

Exit, however, is not confined to the mini shakeout period; we observe it throughout the emergence stage. Table 1 documents the rate of churn for each industry, defined as the ratio of cumulative number of exits to the cumulative number of entrants during the emergence stage. Interestingly, industries such as compact disc players that exhibit zero rates of churn are an exception rather than a rule. On an average, 38% of the firms that enter prior to sales take-off also exit prior to sales take-off, with the rates of churn being higher than 50% for nine of the 24 industries. Thus, the relatively smooth increase in the number of firms depicted in earlier studies masks significant turnover in the firms that operate in a new industry.

It is also worthwhile to compare the statistics reported above on the mini shakeout to the findings on the shakeout experienced in an industry *after* its legitimacy has been established and it has entered the growth period. Gort and Klepper (1982) report that 80% of the industries in their sample experienced a major shakeout. While the percent of industries experiencing a mini shakeout in our sample is much lower, the decline in the number of firms in each period are roughly comparable. In particular, the average decline in the number of firms during the major shakeout is 40%, and the range across industries varies from a low of 19% to a high of 77%. Based on Table 1, the average decline in firms during the mini shakeout is also 40%, and the range across industries varies from a low of 20% to a high of 70%. Thus, the magnitude of the exodus in the emergence stage, for the industries that do experience a mini shakeout, is close to what is observed when the industry enters a consolidation stage.

3.2 Which Industries are Likely to Experience a Mini Shakeout?

In the preceding section, our focus was on documenting the mini shakeout phenomenon. Our findings indicate that 46% of the industries in our sample experience a mini shakeout, and even in industries that don't, there is significant turnover in firms. In this section, we examine whether there are systematic explanations for variation across industries in the degree of churn and the likelihood of experiencing a mini shakeout.

Prior studies have highlighted industry characteristics such as year of commercialization, type of product innovation, and the number of new entrants as causes for variation in the observed patterns of industry evolution (Agarwal and Bayus, 2002). We use standard probit analysis to model the probability of a mini-shakeout and ordinary least squares to model the rate of churn experienced during the emergence stage. For brevity, we do not discuss these statistical procedures here.

Key Variables

The dependent variable in our probit analysis for the probability of an industry experiencing a mini-shakeout takes the value of 1 if there was a mini shakeout, and 0 otherwise. The dependent variable in the regression model for churn is the ratio of the number of exits to the number of firms that entered in the emergence stage. The values for both these variables for each industry in our sample are reported in Table 1.

Independent variables

Number of entrants prior to sales take-off. Cumulative number of firms that have entered the industry prior to the sales take-off year.

Year of commercialization. The first year in which a product is shipped in the commercial market.

Consumer good. Takes the value of 1 if the industry involves a good for final consumption rather than an intermediate product.

Time to sales take-off. The difference between the sales take-off year and the year of commercial introduction.

The descriptive statistics and correlation matrix for the variables included in our analyses are reported in Table 2.

Estimation Results

The estimation results from our analyses are reported in Table 3. While the cumulative number of firms entering during the emergence stage has no significant effect on the probability of mini shakeout, it does significantly increase the rate of churn in the industry. Year of commercial introduction has no significant effect on either dependent variable. Consumer goods tend to have a lower probability of experiencing a mini shakeout, though it has no effect on the rate of churn.

Of most interest, the longer the time to sales take-off, the more likely is the occurrence of a mini shakeout, and the greater is the degree of churn[1]. The marginal effects computed at mean levels indicate that a one year increase in the time to sales take-off increases the probability of a mini shakeout by 9%.

The above aggregate level analysis highlights two issues. First, exit is far more prevalent in the emergence stage of a new industry than one might have believed based on prior industry evolution studies. Importantly, many industries experience a significant exodus of firms in a contracted period of time—what we call a mini shakeout. While irregularities in annual rates of entry and exit have been acknowledged (e.g., Klepper and Graddy, 1990), these have been attributed to random circumstances. Thus, this specific phenomenon has not been previously acknowledged in the literature. Second, the likelihood of a mini shakeout is higher in industries that develop slowly, i.e., industries that take a long time before sales take off.

[1] In robustness checks, we find that exogenous shocks such as World War 2 and the Great Depression have no significant effect on either the probability of a mini shakeout or the rate of churn.

4. Inside the Mini Shakeout

We now move to a different level of analysis to better understand the potential underlying causes of the mini shakeout. What factors distinguish firms that exit before or during the mini shakeout from those that stay the course? Based on an inductive analysis of two emerging industries, digital imaging and handheld computing, we propose a conceptual model to explain firm exit (see Figure 3). Our insights into exit come from careful consideration of industry, firm and intra-firm factors.

4.1 Industry Background

Before discussing our conceptual model, we briefly describe the two industries used for our inductive analysis.

Digital Imaging

As reported in Table 1, the first digital camera was available on the market in 1984. The camera, introduced by Eikonix—a firm that sold prepress systems to the graphic arts industry—was expensive at about $20,000, and needed a dedicated mini-computer that cost $30,000 to store and process images. The graphic arts industry had already begun to digitally scan analog images for publishing, and Eikonix perceived an opportunity for direct digital capture. The market for the camera, however, was slow to develop. Kodak acquired Eikonix in 1985, but exited the digital camera market in 1989. "The market just wasn't there for cameras," commented management at the time (*MacWeek*, 1989). Kodak and other photography firms, however, continued to invest in digital imaging technology in preparation for when the industry did develop. Kodak invested approximately $5 billion over 10 years throughout the 1980's and, along with Fuji, re-entered the market in 1991. Other photography firms followed their lead, and by 1995, twelve more photography firms had entered the digital imaging industry. Entrants from other industries such as computers and consumer electronics waited until 1997 when a large wave of 23 firms entered. The expectation at that time indicated that the market (sales) was on the verge of taking off. An article in one of the industry's trade journals noted, "Most market watchers believe 1997 will

be the year that makes scanners and digital cameras as ubiquitous as color printers have become" (Aranoff, 1997). Despite this optimism however, sales did not accelerate until 2001. By this time, however, 55% of the entrants had given up and exited the industry.

Handheld Computing

The handheld computing industry experienced a similar phenomenon. Typical of really new innovations, the handheld computing devices commercialized in 1978 had to considerably improve before widespread market acceptance was to occur almost twenty years later (Bayus, etal., 1997; Koblentz, 2005). Firms in three different industries (consumer electronics, personal computers, telecommunications) considered this opportunity to be the next big thing (Allen, 2005). This "could be the hottest new product, or product category, since the PC arrived on the scene in the late 1970's," said Andrew Seybold, newsletter editor of *Seybold's Outlook on Professional Computing* (Lewis, 1992). Excitement about the potential of this new industry attracted twenty entrants between 1991-1994, including established companies like HP, Apple, Tandy, Sony, AT&T, Bell South, Motorola as well as startups like Momenta (Bayus, et al., 1997; Stieglitz, 2002). However, despite all this attention, most potential buyers ignored the initial product offerings. Sales followed a hockey-stick pattern: initial sales were relatively low for several years before the takeoff finally occurred in 1998. But this delay had its impact; almost 40% of the early entrants abandoned the industry before substantial sales were achieved.

4.2 A Conceptual Framework for Abandoning Innovation in Emerging Industries

Using these two industries, we now propose a conceptual framework for a firm's exit decision (see Figure 3). We posit that exit before and during the mini shakeout is fundamentally different from the major shakeout. As characterized in the extant literature, when the major shakeout occurs, the market has already developed, with industry sales having taken off and stabilized. The drivers of exit in this situation have been primarily attributed to increased competition. Larger firms that reap the benefits of economies of

scale (Klepper, 1996) or organizational forms that have better fit (Hannan and Freeman, 1989) survive.

In contrast, firms exiting during the mini shakeout do so even before the market fully develops. Why would a firm enter an emerging industry and then abandon it before the market materializes? While some firms (e.g., startups) run out of resources and are forced to exit, for many firms abandoning the emerging industry is an explicit choice. Our primary interest is to better understand what distinguishes firms that remain in a new industry and wait for the market to develop from those that choose to exit before the industry takes off.

In analyzing exit before and during the mini shakeout, we identify two primary, but related, factors that drive the exit decision. The first concerns *unmet expectations*, i.e., the disparity between a firm's expectations about the industry's development and the industry's actual development. The second concerns the *strategic importance of the emerging industry to the firm*. We discuss each of these in turn.

Unmet Expectations

Firms enter an emerging industry with an expectation that there is an opportunity to be exploited. This belief is predicated on a number of assumptions about the expected evolution of the industry – assumptions about how quickly the market will grow, how technologies will perform, what customers will value, how competitors will respond, etc. Firms develop these assumptions under conditions of high uncertainty, and we therefore expect to find a substantial amount of variance in the ex-ante beliefs of firms. This variance is important in explaining a firm's decision to abandon an emerging industry. Unmet expectations are an important consideration in deciding whether to exit, e.g., a firm that justified its entry into a new industry based on aggressive forecasts will have a greater motivation to abandon the industry when it actually develops more slowly.

Our detailed analyses of the digital imaging and handheld computing industries indicate that unmet expectations originate at the industry, intra-firm, and inter-firm levels. Firms that enter an emerging industry from an existing industry are influenced by the norms

and beliefs of their prior affiliation (Porac, 1997). In digital imaging, entrants from four diverse industries (photography, graphic arts, consumer electronics, and computers) formed varying expectations about the industry. Firms from each of these prior industries looked to different sources for information and projections. For example, the Photo Marketing Association (PMA) was one of the key sources of information for firms in analog photography. In October, 1996 the PMA issued a conservative forecast of 1.2 million digital camera units to be sold in 1999 and 1.8 million in 2000. In stark contrast was the forecast by International Data Corporation (IDC), a research firm that covered a broad range of computing and communications industries. Their forecast in August 1997 was that the industry would reach sales of 4 million units by 1999 and 10 million units by 2000. These widely divergent forecasts should have influenced the formation of very different expectations for firms from photography as opposed to computing regarding the development of the digital camera market. Indeed, an internal planning document of one computing firm in 1998 showed an estimated market size of 22 million digital cameras by 2000, based on the assumption that 20% of PC owners would also own a digital camera. Thus, prior industry affiliation can certainly affect expectations about market size and growth in an emerging industry.

Further, even after accounting for industry level differences, firms can have divergent expectations about demand in the emerging industry since idiosyncratic firm history influences these expectations. For example, Sony, a firm with a track record of "creating" new markets, believed that it could influence and accelerate the development of digital imaging. This resulted in their having more optimistic expectations than other consumer electronics manufacturers.

A second firm level factor that influences expectations is the selection of the target market within the emerging industry. For example, consider the early entrants in the handheld computing industry (Bayus, et al., 1997; Gomes-Casseres and Leonard-Barton, 1997; McGahan, et al., 1997). Expected market potential varied by whether initial customers

were located in horizontal (consumer) or vertical (business) markets. The market size for individual use of personal electronic devices was the largest (e.g., in 1993 there were about 16 million US cellular phone subscribers, 19 million pager users, and 17 million computers in homes)); followed by mobile business professionals, (e.g., in 1993 there were about 6 million business people who are early adopters of technology); with customized business applications representing a very small segment (e.g., , only a few thousand sales professionals, delivery drivers, physicians). Thus, firm expectations about potential sales were clearly dependent on the targeted market.

According to David Hennell, Amstrad's director of international marketing in 1994, Amstrad was looking for a "mass market avalanche" to create "almost impulse purchases" (quoted in Gomes-Casseres and Leonard-Barton 1997). From their advertising campaign, AT&T targeted at a broad class of users who might be engaged in "calling up an article on a national politician's speech, watching video highlights of a football match, scribbling a note and faxing it to your office, calling up your bank account, TV schedules and a hundred other services" (Highfield 1993). Similarly, Tandy targeted their *Zoomer* device to the consumer market (Jerney 1995). On the other hand, firms like HP, Casio, and Sharp aimed their products at more conservative but familiar markets, i.e., consumers of calculators and electronic organizers. For example, HP's "The Road Warrior's Weapon of Choice" advertising campaign for their *100LX* device in 1993 was directed at salespeople who spent much of their time on the road.

Given the relatively slow market acceptance of handheld computing devices, the firms targeting broader markets were very disappointed with their product sales. In one year of business, AT&T sold 10,000 *EO* devices; less than 10 percent of what it expected (Keller, 1994). Amstrad and Tandy were also disappointed with early sales levels, e.g., Tandy lowered the price of the *Zoomer* by $200 in an attempt to stimulate sales (Gomes-Casseres and Leonard-Barton, 1997). All of these firms exited the market in short order. At the same time however, firms with more conservative target markets and thus lower expectations

stayed in the emerging handheld industry. For example, although HP sold less than 100,000 handheld units in its first year, it considered this level of market acceptance to be "better than expected" (Buckley, 1991).

Variation in expectations about market development also originates inside a firm, with conflicting perspectives potentially coming from development groups, management, and the corporate board within a single firm. For example, consider the eventual fate of AT&T's *EO* handheld computing device. AT&T corporate had very different expectations than EO management and EO engineers. Although EO's CEO, Bob Evans, admitted that the original market forecasts in his company were "not credible," AT&T still believed that there was a market for a handheld computing device with communications capability (Gomes-Casseres and Leonard-Barton, 1997). EO managers expected to iterate through a few product versions before they could "get it right," and therefore initially targeted a broad customer base and undertook a "market morphing" experimentation strategy (Gomes-Casseres and Leonard-Barton, 1997). As noted by CEO Bob Evans, "If you hit it right and succeed with the first product, it's wonderful, but you need the customer experience" (quoted in Gomes-Casseres and Leonard-Barton, 1997).

Based on early market feedback to the *EO,* management decided that it should be targeting the upper 20 percent of cellular phone users. This customer group required a different combination of product functionality, so engineers were already working on the next generation product before *EO* was even introduced. In fact, a fully functioning prototype had been completed by the spring of 1994 and was scheduled for launch in December 1994. Yet, by August 1994, AT&T decided to exit this industry only a year after it had entered. EO managers felt they had "learned what the customer really wanted" just as the company was exiting the market (quoted in Gomes-Casseres and Leonard-Barton, 1997).

While all this product development was happening at EO, AT&T corporate was pursuing additional partners and investors to share the financial burden of developing this new market---efforts that were eventually unsuccessful (Rohrbough, 1994). In this case, the

lack of additional investors proved to be the lynchpin that led to the board's vote to abandon this industry. Carl Ledbetter, former president of AT&T Consumer Products and EO board member, issued the following statement (Edge Publications 1994): "We are disappointed that EO must close. But, given the slow development of the personal communicator market generally, and the low acceptance of EO's products, AT&T believed it would not be prudent for AT&T to invest more in EO without additional financing from other investors. EO's Board of Directors voted to close EO after several months of efforts to find other external funding bore no fruit."

Strategic Importance of the Emerging Industry

The other major factor that explains whether a firm remains committed to a new industry as opposed to exiting is the strategic importance of the emerging industry to the firm. Is the emerging industry core to the firm's future strategy and identity, or peripheral? A firm may be more willing to overlook disparities between expected and actual performance if an industry is believed to be central to the firm's future. And likewise, a firm will be less willing to commit to a peripheral industry. For example, Christensen and Bower (1996) show that firms in the disk drive industry were less willing to sustain investments in emerging market segments that were viewed as small and peripheral relative to the firm's existing customer base. Similarly, we find that different levels of emerging industry strategic importance helps explain firm exit. As indicated in Figure 3, we view the strategic importance of the emerging industry to be a moderating factor of the relationship between unmet expectations and a firm's exit decision.

In digital cameras, 64% of firms from the computer industry that entered before the mini shakeout had exited by 2001. For firms that made computer peripherals, digital cameras were yet one more device to connect to a PC. A typical example is Best Data, a small vendor of computer peripherals, modems and graphics cards that entered the market in 1996 and then quickly exited in 1997 when sales failed to materialize. Intel also entered the market in 1997 in the hope of influencing industry standards with a PC peripheral

camera, but subsequently exited the industry. Forrester, a market research firm aptly captured the situation with the heading "Digital imaging is the 'flavor of the month' for the PC industry" in a report from 1997 (*The Forrester Report* 1997).

In contrast, for analog camera makers, digital cameras were a direct substitute; without a presence in the emerging market, these firms faced declining sales. Only 40% of firms that made analog cameras exited, and many of these were small firms or primarily OEMs such as Chinon that were acquired. As one industry participant noted, "one can say it [digital photography] is a matter of life and death for some companies, notably Kodak and Fuji" (Australian Stock Exchange Company Announcements 2000). Imaging was also a key part of these firms' identity, which made exit difficult. Fuji's slogan for many years had been "Information and Imaging" making an existence without imaging hard to picture.

Firms introducing handheld computing devices also had different perceptions of the strategic importance of the new industry. AST, for instance, abandoned this industry quickly since it was not a comfortable fit with the company's line of laptop computers (Gardner, 1995). Similarly, companies like IBM and Compaq delayed product introductions due to lackluster industry sales, instead focusing on selling their other computer products. As stated by Bill Lempesis, president of Lempesis Research, "By not being on the market today are you missing anything? The answer is no. They are not flying off the shelves. People are reassessing, reevaluating" (*The Financial Post*, 1994).

On the other hand, Sony had a different perspective of the opportunity related to this industry. According to Brian Sroub, then vice president of sales and marketing for Magic Link (a Sony partner in the handheld computing industry), "By the end of the century, as the infrastructure matures and standards are developed, there is going to be a huge revenue opportunity for people who are capable of sending messaging and entertainment through the service…We have lots of cards to play where hardware is in overall support of our software. This is an old strategy for Sony, where we get in on the hardware and then get increasingly involved on the software side." Sensing an early opportunity, Sony marketed

their *Magic Cap* device between 1994 and 1996. At the time, Tim Bajarin, then president of Creative Strategies, commented (Bennahum, 1995): "The Magic Link in this first iteration will not succeed in the consumer marketplace. I have to say that I don't think Sony is expecting it to do wonderful things in the consumer market. I think they've planned this quite well because their expectations are modest. They're learning what needs to be done for the second and third generation." Thus, given the strategic importance of this industry to Sony, they did not abandon this industry. Instead, Sony re-entered again in 2000 with a device that used the Palm operating system (the same operating system used in the hugely successful Palm *Pilot*) and currently offer a variety of handheld computing devices.

4.3 Applying Our Conceptual Framework

To better understand the interactions among the elements of our conceptual framework in Figure 3, we compare and contrast the experience of Apple Computer in the digital imaging and handheld computing industries. Since Apple has been the subject of several case studies (e.g., Yoffie and Wang, 2002), we do not present an extensive historical background here. Suffice it to say that John Sculley was brought in to raise Apple's financial results by building on their core capabilities in graphics and design by focusing on desktop publishing as well as the education market.

To implement this strategy, Apple carefully studied the emerging digital imaging and handheld computing industries. Apple created the Newton research group to develop the next generation of more personal and intimate computing devices. A product concept involving pen-based input (intelligent ink, handwriting recognition) and communication functions was approved in early 1990. Since MacIntosh computers were widely used in graphic arts and desktop publishing applications, Apple's digital camera was part of a broader effort to extend its influence in the imaging category. The camera was developed within the Imaging Products division, a group that announced a personal Laserwriter printer as well as Photoflash photo editing software, before it entered the digital camera arena. In that context, the digital camera was one small piece of an effort that itself was relatively new.

Although many different electronic organizers were introduced during the 1980's (e.g., Koblentz, 2005), significant attention about the potential opportunity for a new industry did not occur until Sculley raised expectations in 1992. During the January 1992 Winter Consumer Electronics Show, Sculley coined the term "personal digital assistant" to describe Apple's next great consumer product that would essentially be a personal communicator and information manager (Bayus, etal., 1997; McGahn, etal., 1997). Later that year in his address during the MacWorld Conference, Sculley peaked industry expectations that the convergence of several digital technologies would result in a new $3.5 trillion industry. Interestingly, Apple made no significant comments on the digital imaging industry.

Given the magnitude of Sculley's vision, many firms believed that the personal digital assistant concept was the "next big thing" (e.g., Allen, 2005). As a result, several significant players rushed to develop key strategic alliances in order to deliver the required technology, product, and infrastructure (e.g., Gomes-Casseres and Leonard-Barton, 1997; McGahn, etal., 1997; van Wegberg, 1998; Gomes-Casseres, 1999; Minshall, 1999; Stieglitz, 2002). The prospect of setting technological standards for this emerging industry was at the forefront of many firms' decisions to bring their products to market as quickly as possible, even at the expense of introducing products that were not quite ready (Gomes-Casseres and Leonard-Barton, 1997). Apple shipped their *Newton MessagePad* in August 1993.

Whereas the Apple Newton received broad press coverage long before its initial announcement, Apple's first digital camera was discussed publicly at a US MacWorld convention only one month before its formal announcement at MacWorld Tokyo in February 1994. In addition, the camera was not considered important enough to mention in the annual report. Wall Street analysts at the time all commented on the announcement of the Apple Newton, but none mentioned the digital camera when it was initially announced. The one analyst that did mention the digital camera – in January 1995 – devoted two

paragraphs to the Newton and in a section on Printers/Peripherals wrote, "Apple also sells a digital camera for use in graphics work on a PC" (Smith Barney 1995).

Our discussion to this point suggests that the Newton product was strategically important to Apple. According to Janet Cole, an analyst with Dataquest, "I don't believe they are betting the farm on Newton…but if they want to expand and grow, this is important" (Enders, 1993). Moreover, Apple's plan was to make key parts of the Newton platform into an industry standard from which it could earn royalties. Unlike all the other competitors, Apple signed on six licensees and four distribution partners in vertical and foreign markets (McGahn, etal., 1997). Despite earning a low margin on the hardware, Apple expected to make a healthy return on royalties from software as well as other licenses and accessories. At the same time, Apple's low key actions with respect to the digital imaging industry strongly suggest that it was relatively unimportant from a strategic perspective.

Over the course of its participation in the digital imaging industry, Apple shipped only three digital cameras: the Quicktake 100 in 1994, the Quicktake 150 in 1995 and the Quicktake 200 in 1997 before exiting the market in 1998. Although each of these cameras was designed by Apple, they all were heavily based on technology Kodak used in its own digital cameras, including Kodak CCD sensors for image capture. Apple's initial goals for the product were modest. The product line manager for the QuickTake 100 noted in 1994, "It won't be a mainstream computer product, save for computer enthusiasts and early adopters. It will be aimed at the business community initially…what we're finding is that mass merchants want something below $500" (Ryan, 1994). These modest goals appear to have been met initially; for example, Apple noted in a June 1996 press release that it was the world market leader in unit digital camera sales (Pihichyn, 1996).

In contrast, Apple clearly had high early expectations for the Newton handheld device. In Sculley's mind, "we believe that Newton will be seen as the defining technology of the digital age" (Enders, 1993). Not surprisingly, Apple envisioned a mass market. As

stated by Ken Wirt, then director of marketing for Newton: "We think this is a market that is at least as big as the personal computer market. There are an estimated 100 million installed PCs in the world today" (Enders, 1993). With respect to the digital imaging industry, Apple's expectations were much more conservative.

Apple's high expectations for the handheld computing industry went unfulfilled. While they sold 50,000 *Newtons* in the first month, sales levels plummeted in the ensuing months so that cumulative sales of the *Newton* one year after introduction were only 90,000 units: well short of even conservative expectations of 150,000 units (Bayus, etal. 1997). Microsoft Chairman Bill Gates is quoted as saying that the Newton may have "set the category back a couple of years" (Hill and Carlton, 1994).

Given its strategic importance however, Apple did not abandon the emerging handheld computing industry between 1993-1998. Instead, Apple lowered its expectations by shifting to vertical market applications (e.g., Bennahum, 1995). As observed by Joseph Graziano, then Apple's CFO and acting GM of the Personal Interactive Electronics Division: "We always knew that there'd be business users for the Newton. But our marketing message and approach at launch were wrong" (Hall and Swartz, 1994). To exploit these markets, Apple worked closely with specialized value added resellers that could develop customized hardware and software, as well as with software developers (by 1995, 300 out of Newton's 380 applications were for vertical markets; Bennahum, 1995). In addition, Apple developed and introduced several new devices including the *MessagePad 110*, *MessagePad 120*, *MessagePad 130*, *MessagePad 2000*, *MessagePad 2001* and the *eMate 300* (targeted at education markets). It was reported that by September 1995 Apple had invested about $300 million in the Newton so far (Bayus, etal., 1997).

Although there are several theories as to why Apple killed the Newton (e.g., MacNeill 1998), the one that has the most empirical support involves a change in the strategic importance of this industry to Apple. During the 1998 timeframe, Apple was struggling financially and probably at it lowest point (Yoffie and Wang, 2002). Apple didn't

have the financial resources to stray too far from its core business which at the time centered on the Mac OS operating system (MacNeill, 1998). The company needed to cut costs in order to become profitable again, and the Newton effort had been a financial drain.

By 1998, the competitive environment in these two industries had shifted. For example, there were 52 new entrants in the digital imaging industry between 1995 and 1997; in the handheld computing industry, Microsoft had entered with its Windows CE software and had begun to establish relationships with significant hardware firms like Compaq, IBM, and Dell (e.g., see HPD Factor, 2005 for a history of Windows CE). Due to increased competition and low strategic importance, Apple exited the digital imaging industry in 1998. Since the strategic importance of the handheld industry for Apple had also diminished, Apple decided to exit this industry in the same year.

This example demonstrates that Apple's decision to exit the emerging digital imaging and handheld computing industries was a function of unmet expectations as well as the perceived strategic importance of the new industries to the company. As the strategic importance of the handheld computing industry to Apple diminished, Apple's exit decision became easier. Together, this decision history is consistent with the idea that strategic importance of the emerging industry moderates the relationship between unmet expectations and a firm's exit decision.

Moreover, this example highlights that an understanding of Apple's exit decisions requires consideration of industry, intra-firm, and inter-firm level factors. For the digital imaging industry, Apple set their relatively low expectations based on the more conservative industry forecasts. For the handheld computing industry however, Apple championed the concept of a personal digital assistant and thus was the one who created huge industry expectations. Our discussion of these two emerging industries also shows that there was a wide variation in expectations across the entrants. Apple clearly entered the digital imaging industry with different expectations than Kodak and Fuji, and had very different expectations of the handheld computing industry than firms coming from consumer

electronics (HP, Casio and Sharp) or telecommunications (AT&T, Motorola, Bell South). Within a firm, consideration of the differing opinions of the CEO, management, and product developers is also important to completely understand Apple's decision to abandon the handheld industry. For Apple, the perspectives of these various stakeholders were important in shaping the firm's beliefs of the new industry's strategic importance.

5. Discussion and Conclusions

In this paper, we challenge the widely accepted model of industry evolution in which the emergence of new industry is characterized by a smooth progression of three stages: (1) high levels of entry with an increasing overall number of firms, (2) a shakeout in which the total number of firms decreases significantly, and finally (3) stability, when the market matures with little change in the total number of firms. While this model holds for many new industries, we provide evidence that in a large proportion of industries there is an additional stage of disillusionment, where many firms abandon their innovative efforts in a new industry before it has completely developed. We term this additional stage a "mini shakeout." In a sample of 24 new product industries, we find that 46 percent experienced a mini shakeout. Perhaps not surprisingly, we find that mini shakeouts are much more likely to occur in an industry when sales take a long time to materialize. On average, the time from initial commercialization of a product to sales takeoff is 21 years for industries that experience a mini shakeout vs. only 8.5 years for industries that do not. A simple probit model of whether an industry experiences a mini shakeout also supports this result. Certain firms simply get tired of waiting and choose to exit the industry.

Using inductive case studies of handheld computers and digital cameras, we then develop a conceptual model to distinguish those firms that exit from those that remain committed. The drivers of the exit in the major shakeout of traditional models are primarily related to firm performance. For instance, poorly managed, less innovative or smaller firms that do not have a competitive cost position exit. The tacit assumption is that the winners

survive and the losers exit. In the mini shakeout, however, the industry has yet to develop and there are no obvious winners or losers. Instead, we argue that factors explaining exit may relate to patience and management of expectations. In particular, we find two factors that differentiate firms that chose to exit from those that didn't: (1) Expectations about the industry's development, including how quickly the market would grow and what segments would develop first, and (2) The level of strategic importance the industry held for the firm. Both of these factors varied significantly for firms that entered the two industries we examined. The variation in expectations originated from multiple levels, including prior industry affiliation, idiosyncratic firm history, and intra-firm dynamics.

In our conceptual model, we propose that once actual market data start to be available, the variation in expectations leads some firms to have clearly unmet expectations while others do not. For those firms that are disappointed in their performance, whether they abandon the industry or not hinges on the strategic importance of the industry to the firm. For instance, even though photography firms had unmet expectations in digital cameras, most were unwilling to exit a market that they considered critical to their future.

Conceptualizing exit as a choice variable is a unique contribution of this paper. While the factors driving entry into an industry have been studied extensively (e.g., Gort and Klepper, 1982; Mitchell, 1991), much less attention has been placed on decisions to exit that are not based simply on competitive necessity. The burgeoning literature on real options has started to address the strategic importance of the choice to exit (McGrath, 1997; Adner and Levinthal, 2004); but this work does not examine how those choices happen within a firm. It simply proposes that those choices are important and can create value. Similarly, limited research in entrepreneurship has examined why start-ups with similar levels of performance have a differential propensity to exit and found that non-monetary factors affect firm profit thresholds (Gimeno, Folta et.al. 1987; Scott-Morton and Podolny, 2002) , but this work does not examine the exit decisions of established firms.

While we contribute to understanding the drivers of exit choices early in an industry's emergence, we believe that much work remains. Testing our conceptual model with a larger sample of firms and industries would be a first step. In addition, in would be interesting to examine the role of feedback effects that unmet expectations and firm exit have on the evolution of the industry; it may be that industries that have a virtuous cycle between exceeding expectations and firm entry decisions develop faster than industries that experience a vicious cycle between unmet expectations and firm exit decisions. While our study documents the inverse relationship between time to sales take-off and firm decisions to continue their innovative activity, the nature of the causality may be questioned. This highlights the need for future research that systematically surveys firms at the time that the expectations are being formed, and gathers evidence from industry analysts, forecasts etc. on multiple emerging industries, to investigate the variation in the time to sales-takeoff experienced by the industry.

Additional research is also needed in understanding proactive exit. While recent research has begun to draw attention to inter-temporal economies of scope and firm decisions to re-deploy resources by exiting some industries while entering others (Helfat and Eisenhardt, 2004), linkages between diversification patterns over the firm life cycle and life-cycles of the industries that they choose to enter into and exit from will help further the literature on both firm and industry evolution. We hope that our study calls attention to the need to examine deviations in the stylized trends observed in the industry evolution literature, and concomitantly for a focus on exit decisions, in addition to entry, as firms invest in strategic renewal activities.

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APPENDIX

To consistently identify the take-off time for firms and sales, we used the approach employed by Gort and Klepper (1982) and Agarwal and Gort (1996). To determine the take-off year for each product, we first partitioned the appropriate series into three categories—the first and third category contained the years where the net entry rate(for firm take-off) or the percentage change in sales(for sales take-off) clearly reflected the pre- and post-take-off periods, respectively. The series of the T consecutive "in-between" years of the second category were then labeled $x_1, x_2,\ldots,x_T$. The problem was then to choose an optimal dividing year j such that observations $x_1, x_2,\ldots,x_j$ were classified in the pre-take-off period, and $x_{j+1}, x_{j+2},\ldots,x_T$ were classified in the post-take-off period. This was accomplished using a three-step procedure:

1. For each j = 1, 2, …, T, we computed

$$d_1(j) = \frac{1}{j}\sum_{i=1}^{j} x_i$$
$$d_2(j) = \frac{1}{T-j}\sum_{i=j+1}^{T} x_i \qquad (1)$$

2. The choice of the dividing year was limited to those values of j for which

$$\left|d_1(j) - \mu_1\right| \le \left|(\mu_1 - \mu_2)/2\right|$$
$$\left|d_2(j) - \mu_2\right| \le \left|(\mu_1 - \mu_2)/2\right| \qquad (2)$$

   where μ_1 and μ_2 represented the mean rate of net entry or percentage change in sales in categories 1 and 2. If there were no values of j satisfying (2), then all observations were classified in the pre-take-off period; if $\left|d_1(T) - \mu_1\right| < \left|d_1(T) - \mu_2\right|$ then it was in the post-take-off period.
3. If there are multiple values of j satisfying (2), then we selected the value of j from this set that maximized $\left|d_1(j) - d_2(j)\right|$.

Step 2 required that the mean of the observations classified in each of the two periods be closer to the sample mean of the observations initially classified in that period than in the alternative. Step 3 ensured that, among the classifications that would satisfy (2), the classification chosen maximized the difference between the means of the points classified in the two alternative periods.

Table 1: Rate of Churn and Presence of "Mini Shakeout" across Industries

Product	Year of Product Introduction	Firm Take-Off Year	Sales Take-Off Year	Time to Sales Take off	# of Entrants prior to sales takeoff	# of Exits prior to sales takeoff	Rate of Churn† Prior to sales takeoff	Mini Shakeout	Reduction in firms during mini-shakeout	Duration of mini-shakeout
Antibiotics	1948	1950	1956	8	16	2	0.13	0	--	--
Ball-Point Pen	1948	1957	1958	10	17	11	0.65	0	--	--
Cathode Ray Tube	1935	1943	1949	14	18	7	0.39	0	--	--
Clothes Dryer	1935	1946	1950	15	11	4	0.36	1	0.20	1941-1943
Clothes Washer	1921	1923	1933	12	63	34	0.54	1	0.60	1922
Compact Disc Player	1983	1984	1985	2	4	0	0.00	0	--	--
Digital Cameras	1984	1995	2001	17	96	62	0.65	1	0.50	1998-2001
Dishwasher	1915	1951	1955	40	10	5	0.50	1	0.70	1935-1937
Electric Blanket	1915	1923	1952	37	27	17	0.63	1	0.25	1933-1935
Electric Razor	1937	1938	1943	6	35	20	0.57	1	0.42	1941-1944
Freon Compressor	1935	1938	1964	29	32	14	0.44	1	0.50	1913
Garbage Disposer	1949	1953	1955	6	11	2	0.18	0	--	--
Heat Pump	1954	1960	1976	22	36	18	0.50	0	--	--
Home Freezer	1946	1947	1950	4	42	10	0.24	0	--	--
Home Microwave Oven	1970	1974	1976	6	12	1	0.08	0	--	--
Home VCR	1974	1975	1980	6	7	3	0.43	0	--	--
Magnetic Recording Tape	1952	1953	1968	16	53	18	0.34	0	--	--
Microcomputer	1974	1977	1982	8	104	19	0.18	0	--	--
Outboard Engine	1913	1916	1936	23	44	32	0.73	1	0.25	1920-1923
Handheld Computers	1978	1997	1998	20	28	11	0.39	1	0.20	1995-1996
Phonograph Record	1897	1917	1919	22	17	5	0.29	1	0.50	1914
Piezoelectric Crystals	1941	1944	1973	32	58	33	0.57	1	0.25	1948-1951
Styrene	1938	1943	1946	8	6	1	0.17	0	--	--
Turbojet Engine	1948	1949	1951	3	6	1	0.17	0	--	--
Mean				**15.25**	**31.38**	**13.75**	**0.38**	**0.46**	**0.40**	
Standard Deviation				**20.21**	**10.88**	**27.26**	**0.20**	**0.51**	**0.18**	

† (# of Exits/# of Entrants)

Table 2: Descriptive Statistics and Correlation Matrix

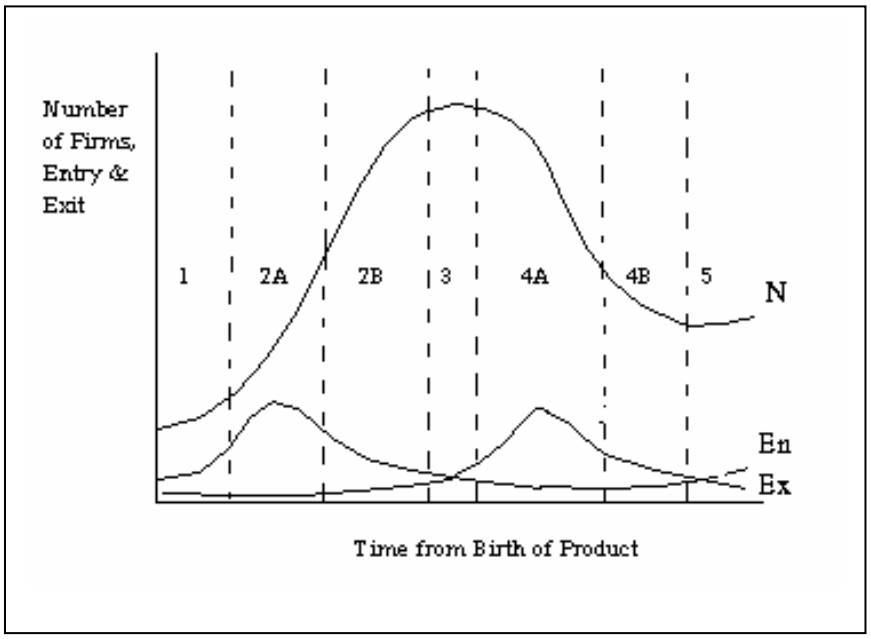
	Variable	Mean	Std. Dev	1	2	3	4	5	6
1	Mini-shakeout	0.46	0.51	1					
2	Churn	0.38	0.20	0.63	1				
3	Entrants prior to sales take-off	31.38	27.26	0.24	0.36	1			
4	Year of Commercialization	1945.42	23.46	-0.47	-0.34	0.20	1		
5	Consumer Good	0.33	0.48	-0.12	0.06	0.01	-0.18	1	
6	Time to Sales Take-off	15.25	20.21	0.59	0.59	0.11	-0.60	0.23	1

Table 3: Probability of Mini-Shakeout and Rate of Churn in Industries (standard errors in parentheses)

Variable	Probability of Mini-shakeout	Rate of Churn
Intercept	11.85 (37.23)	1.66 (3.82)
Number of Entrants Prior to Sales Take-off	0.01 (0.01)	0.002* (0.001)
Year of Commercialization	-0.01 (0.02)	-0.001 (0.002)
Consumer Good	-3.81* (2.11)	-0.04 (0.08)
Time to Sales take-off	0.27** (0.21)	0.01** (0.004)
Number of Observations	24	24
Model Chi-squared/ F-statistic	18.13 **	3.48**
Adjusted R-squared	--	0.32

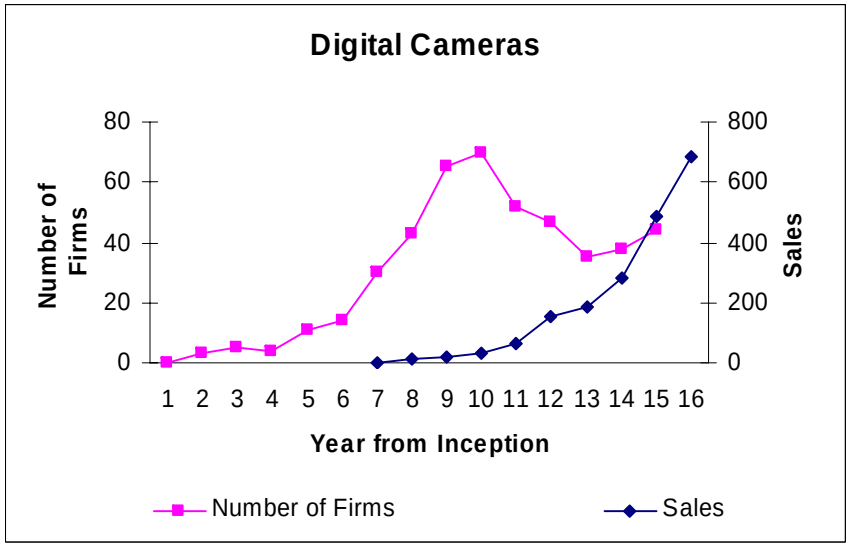
** Significant at the 5 % level; * Significant at the 10 % level

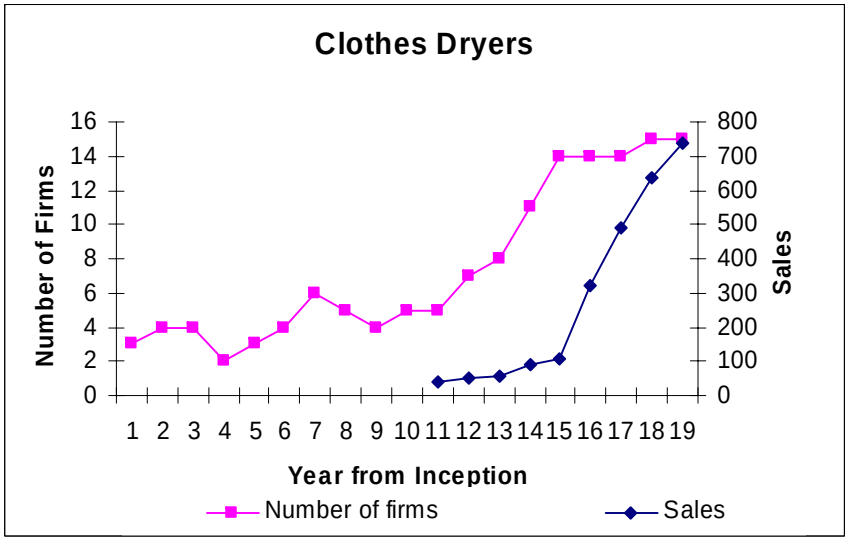
Figure 1: Diffusion of Product Innovations over Time

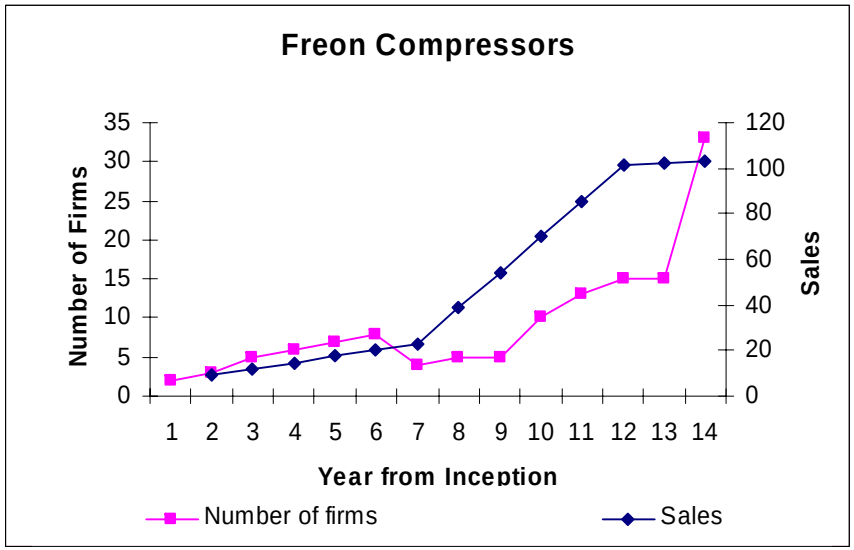


Reproduced from Agarwal and Gort (1996)

Figure 2: The "Mini Shakeout" Phenomenon







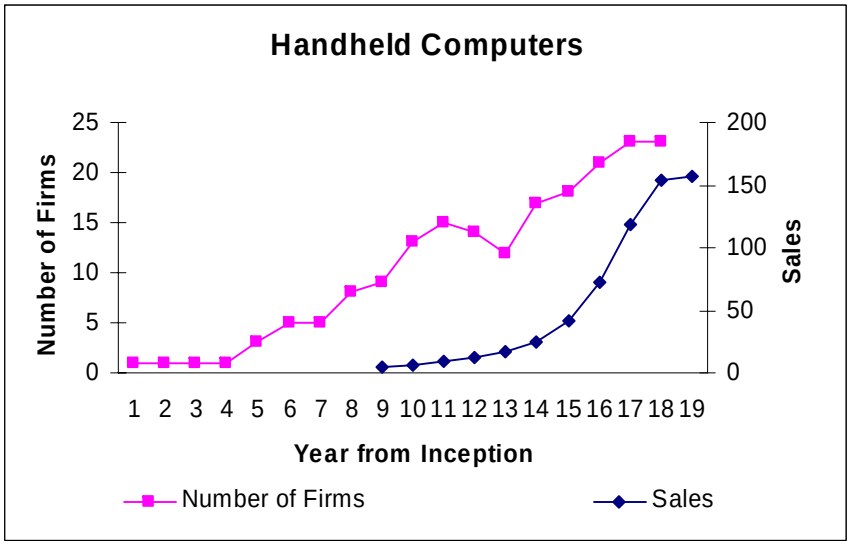


Figure 3
A Conceptual Model of Exit during the Emergence Stage of Industry Evolution