

# **Learning While Innovating: The Abandonment of Corporate Venture Capital Programs**

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## **ABSTRACT**

This paper investigates the abandonment of an administrative innovation- corporate venture capital (CVC) programs - by information technology (IT) corporations. CVC programs are modeled upon the venture capital (VC) practices of finding, funding, and guiding entrepreneurial startups. We draw upon prior research on organizational learning and innovation diffusion to empirically examine the role of innovation related experience and of inter-organizational contagion on organization's decision to abandonment an innovation. We find that direct experience with the CVC programs decreases the likelihood of its abandonment by a focal organization. We also find that abandonments by industry peers are contagious and bias firms towards abandonment. More importantly, we evaluate the relative influence of experience vs. contagion and find that organizations' with greater experience and a richer understanding of the CVC program are less susceptible to contagion influences.

## INTRODUCTION

Many organizational innovations become widely popular only to decline or even disappear. For example, Quality Circles diffused from Japanese firms to American firms and by 1983 nearly 43% of manufacturing firms in the US had adopted Quality circles. However by 1988, 80% of these programs had been abandoned (Castorina and Wood, 1985). Abrahamson and Fairchild (1999) note a similar pattern of popularity and decline for organizational innovations such as TQM, re-engineering, quality of work life programs and M-form structures. While extant research provides contagion as the main explanation for the adoption and diffusion of innovations, we know much less about what causes organizations to abandon innovations they once adopted (Greve, 1995; Strang and Macy, 2001).

Organizational scholars have long argued that the innovation literature suffers from a proinnovation bias (Abrahamson, 1991; Rogers, 1995). Proinnovation bias is the implicit assumption in the diffusion research that innovations are universally beneficial, that innovations are neither rejected nor reinvented, and that innovations should be adopted by all the organizations. This has led to an emphasis on explanations for the rate of innovation diffusion, and a de-emphasis on explanations for the likelihood of innovation abandonment (Abrahamson, 1991; Rogers, 1995). Furthermore, models of innovation diffusion, with its focus on the boom phase of diffusion, are well equipped to explain adoption of innovations, but are poorly equipped to account for almost anything else and may require substantive modification to account for the subsequent abandonment of innovations (Rogers, 1995; Strang and Macy, 2001). Understanding innovation abandonment can help provide insights into cycles of adoption and abandonment, into the temporal instability of organizational innovation, and why and how reasonable innovations are discarded or discredited. It is also important because in reality only a small minority of innovations actually become institutionalized while most end up looking more like fads or fashions (Zucker, 1988; Strang and Macy, 2001).

Why are organizational innovations abandoned? Few studies have tried to address this question. According to one view, innovation abandonment is as a function of innovation related experience of an organization. Unlike in the adoption process, where organizations have no direct experience with the

innovation and therefore seek external cues to guide their decision, in the post adoption phase, organizations are more likely to base their decision on their own experience with the innovation and are less likely to be swayed by the external influences (Burns and Wholey, 1993; Knoke, 1982). An alternative view posits innovation abandonment as a social learning process where organizations' evaluation of an innovation is influenced by the observation that others are abandoning it. This suggests that the innovation is evaluated less positively the more other organizations abandon it, leading to contagion of innovation abandonment (Greve, 1995). While these alternative accounts provide important insights into the innovation abandonment process, it raises two important questions. First, if abandonment of innovations is mainly a consequence of contagion influences then does it cause organizations to abandon innovations that they find useful and appropriate? Second, are all organizations' equally susceptible to these contagion influences? Or is there heterogeneity in organizations' susceptibility to contagion influences?

In this paper we empirically investigate the abandonment of an administrative innovation - corporate venture capital (CVC) programs - by information technology (IT) firms from 1992-2003. These programs are modeled upon the practices of private venture capital (VC) firms. The time period of our study coincides with the explosive popularity and subsequent decline of CVC programs. We bring in insights from research on organizational learning and innovation diffusion to explain the heterogeneity in organizations' ability to retain or abandon an innovation.

We hope to make three contributions with this research. First, we empirically investigate the determinants of the abandonment of an administrative innovation - an important but relatively under studied issue in the innovation literature. To the best of our knowledge, Burns and Wholey (1993) is the only study that examines the abandonment of an administrative innovation (matrix management programs). Two other studies examine abandonment; however, Greve (1995) analyzes strategy abandonment while Rao, Greve and Davis (2001) examine the decision of security analysts to abandon coverage of NASDAQ firms. Understanding the abandonment of innovations by organizations can also yield theoretical insights into the underlying dynamics of management fads and fashions and speak to the

broader issues of deinstitutionalization. Second, we try to reconcile two alternative explanations offered by the literature for understanding the abandonment of new innovations. Innovation diffusion literature emphasizes that organizations act based on the inferences that they draw from the behavior of others. However, organizations also make inferences from their own experience with the innovation. We believe that both these processes factor into the abandonment decision of organizations. Third, we highlight the conditions under which firms are more or less susceptible to the contagion influences in the context of innovation abandonment. We argue that the innovation related experience – acquisition of the skills, values, procedures, behaviors, and know-how necessary to utilize the innovation – makes organizations relatively immune to the contagion influences of prior abandoners. Thus organization-level heterogeneity with the innovation related experience manifests itself as heterogeneity in organizations' susceptibility to contagion influences.

Our paper is organized as follows. We begin by describing our research setting, the innovation we study, and the abandonment of that innovation by information technology firms. We then draw upon prior research on organizational learning and innovation diffusion to develop our hypotheses. Next, we describe our measures and analytical methods, and go on to report findings. The paper's final section discusses the implications of our results.

## **RESEARCH SETTING**

We study the abandonment of corporate venture capital (CVC) programs. CVC programs are modeled upon the practice of private venture capitalist (VC) firms. The venture capital model is an organizational form that has become increasingly popular as a vehicle for finding, financing, and guiding the development of entrepreneurial startups (Kenny and Florida, 2000). Over the last three decades, annual venture capital investments have swelled from less than \$1 billion to over \$103 billion, far outstripping growth in any other investment class (Gompers and Lerner, 1999). In the decade of 1990s, private venture capital firms, primarily located in Silicon Valley, California, (see Figure 1 for a geographic breakdown of VC investments) began outperforming public technology firms in identifying

promising business opportunities, accelerating the progress of new ventures through their early development, and helping these ventures achieve liquidity (Gompers and Lerner, 1999). Incumbent corporations, alarmed at the erosion of their markets by new VC-backed entrants, concluded that the VC model might be a powerful tool for harnessing technological change. Subsequently, to complement, or even to substitute for in-house R&D units, corporations began setting up their own CVC programs to make external equity investments in startups. The corporate share of overall venture capital investing rose rapidly from 2 percent in 1994 to 15 percent in 2000 and nearly \$16 billion was invested by over 300 corporations (Venture Economics, 2001). Then, economic recession and a collapse of equity and IPO markets in 2000 ended the boom in the venture capital industry. During the first quarter of 2001, corporate venture investing fell 81 percent and many corporations shut down or idled their CVC programs (Venture Economics, 2003).

CVC programs are structured and managed differently than traditional in-house corporate R&D or business development functions and they typically report into the firm's top executive team at the senior vice president level, usually through the corporate strategy or business development function. Corporate venture capital investments are typically riskier and less subject to rigid management of internal costs than conventional in-house R&D (Hamel, 1999). Ideally, these units are designed to facilitate a coordinated and proactive approach to new business development by focusing on external sources of new technologies. Corporations establish CVC programs for a variety of strategic and financial reasons. While some corporations are undoubtedly enticed by the financial returns of venturing, most adopters report that their foremost objectives are strategic ones – gaining exposure to new and disruptive technologies, access to new markets and business models, and identification of prospective acquisition targets. Firms can easily assess the financial return on their investment in start-ups (through taking the entrepreneurial venture public) by looking to IPO markets. However, strategic returns from CVC programs are not so easily assessed – they are long term, potentially risky, and not easily quantifiable.

Corporations, however, find it difficult to replicate VC practices and outcomes – many of these practices are encoded in tacit knowledge, and some clash with corporate systems and cultures (Gaba and

Meyer, 2005). The novel practices that make up the VC business model fall into two categories: pre-investment activities and post-investment activities (Sorenson and Stuart, 2001). VCs build social capital in the form of networks of contacts that are the source of their “deal flow”. A large VC firm screens over 1,000 investment proposals per year, and typically invests in between one and two percent of them. The selection of high-caliber opportunities occurs through a process termed “due diligence” in which VCs scrutinize a target’s business plan, technology, intellectual property, management team, and business alliances. After investing their financial capital in a startup, experienced VCs shift to advising, monitoring, and building the company. They supply contacts to law firms, headhunters, real estate brokers, and prospective customers. VCs take seats on startups’ boards, providing infusions of financial advice and management expertise as needed. Prominent VC firms tap their stocks of reputational and social capital, lending their prestige and connections to startups in forging new alliances and attracting new resources. Finally, returns are realized through either the acquisition of the VC-backed startup by an established corporate buyer, or through the issuance of shares in an initial public stock offering (IPO). The IPO is the preferred outcome for all participants – it generally results in the highest valuation of the company, provides liquidity to the investors, and preserves the young company’s independence (Gompers and Lerner, 1999). The repertoire of skills possessed by the VCs that are required in the selection, advisement and IPO phases are not easily available to or accessible by all corporations. In addition, R&D personnel often resist CVC programs as they prefer funding be allocated to internal R&D programs (Gompers and Lerner, 1999).

We define abandonment of CVC programs as cessation of all the new investment related activity in entrepreneurial startups. It is generally accompanied by the dissolution of a distinct structural entity that was initially created for the very purpose of the investing in external entrepreneurial startups.

## **THEORY AND HYPOTHESES**

Much of the innovation research focuses on the initial adoption of the new practices with the assumption that organizations learn about the innovation prior to its adoption, and subsequently, become

more effective at implementing the innovation as they move up the learning curve. However, the assimilation of innovation related knowledge rarely happens in one shot – there remain gaps in the innovation related knowledge which requires a continual process of reassessment of the innovation. Moreover, the inherent uncertainty in the innovation process precludes exhaustive knowledge of the precise characteristics and consequences of an innovation even when it has been adopted and the organization has garnered some experience with it. Consequently, the process of acquiring and processing information does not come to a standstill once an innovation has been adopted but continues in the post-adoption phase as well (Nelson and Winter, 1982). Furthermore, it seems reasonable to expect that the information that organizations need to evaluate the innovation resides not just within the organizational boundaries but also in its external environment. As such, organizations are likely to examine the behavior of their peers in terms of their decisions to retain or abandon the innovation. Innovation abandonment can thus be viewed as one particular culmination of this learning process where the weight of the information acquired, processed and interpreted tips to a point where the firm initiates abandonment (Granovetter, 1978).

In this section, we draw upon research on organizational learning and innovation diffusion to propose that innovation abandonment decision is a function of both organizations' experience with the innovation and organizations' social comparison with its reference group (which leads to contagion). We develop hypotheses about the direct effects of innovation related experience and inter-organizational contagion. We also argue that experience and contagion substitute for one another and organizations that develop a deep understanding about the innovation and experience positive outcomes are less susceptible to contagion influences.

### **Innovation Related Experience**

According to the behavioral theory of firm, experience is one of the fundamental mechanisms facilitating organizational learning (Huber, 1991; Cyert and March, 1992). Organizations can gather experience with an innovation and learn about its objectives, practices and outcomes in multiple ways.

We define innovation related experience very broadly: it includes experience acquired through geographic proximity to the source of innovation, the depth of learning and experience prior to adoption, and the results experienced from implementing the innovation.

The ability to implement and retain an innovation is not only a function of access to knowledge about the innovation, but also depends on the firm's capability to utilize, modify and build on such knowledge (Cyert and March, 1992). Rarely, if ever, are novel innovations universally applicable across time, circumstances, and organizational contexts. Knowledge about an innovation entails acquisition of a causal model that links the novel practices to valued outcomes for the organization. It also entails a profound understanding of the specific practices required to implement the innovation – the skills, values, procedures, behaviors, and know-how necessary to adopt and exploit the target innovation. However, acquisition of innovation related knowledge rarely occurs without difficulty. Gaps in information acquired and errors in interpretation imply that recipients must actively seek to build on their existing base of knowledge and experience by experimenting with its application to new problem domains and environmental contexts (Sorenson, Rivkin, and Fleming, 2004). Any attempt to apply an innovation in a new setting will require the adopter to fill in these information gaps and correct the errors in interpretation. Organizations that are directly exposed to the innovation and the skills required to actuate the innovation are better placed to adapt these elements to their organizational context.

Lave and Wenger (1991) argue that learners are not simply passive recipients of “objective” knowledge; rather they learn to function in the context of a community. They acquire that particular community's viewpoint, familiarize themselves with its culture and language, its interpretive conventions and acquire the ability to behave as community members. Learning in this view is a social construction process (Brown and Duguid, 1991) and what is learned is profoundly linked to the context in which it is learned. Organizations that are detached or distant from the innovation seldom learn its intricacies. Without a clear understanding of these intricacies and the role they play, the innovation itself cannot be well understood, enhanced or adapted successfully. Therefore, the extent to which organizations are able to acquire knowledge about an innovation, and build an accurate assessment of its long-term benefits

depends not just on their direct exposure to the original source of innovation but also on participation in the community.

In the context of our study, the source of innovation does not reside exclusively within firms but in a distinct set of organizations – the private VC firms. Consequently, the degree to which firms learn about the VC practices is a function of the extent of their exposure to and participation in the larger VC community – a community that includes VCs, entrepreneurs, lawyers, headhunters and consultants. This in turn, is linked to organization’s position in geographic space. Organizations in closer physical proximity to the VC community have superior and ongoing access to the VC template. First, individuals in these organizations are likely to have greater chance encounters with VCs that lead to lasting ties. Because geography strongly influences daily activities, being co-located increases the probability that a firm’s employees will meet and form a relationship with a member of the VC community (Sorenson and Audia, 2000). As local bonds form, this facilitates the transfer of knowledge, especially of tacit knowledge which is difficult to transfer except through face-to-face interaction. Second, the local nature of labor markets and employee turnover implies a greater likelihood that individuals with a deeper understanding of VC practices enter into an employment relationship with corporations located close to the VC community – these include employees of VC firms, lawyers, and entrepreneurs. Significant fluidity exists in the VC community as personnel move between high-tech companies and venture capital (Bahrami and Evans, 2000). These individuals may be instrumental not just in supporting CVC programs, but also in effectively implementing them by acting out the role of venture capitalists (Florida and Kenney, 1998). Finally, the VC community has its own culture and language. For instance, in the VC community there is no stigma attached to failure and learning by failing is part of the cultural mindset of this community (Bahrami and Evans, 2000). Similarly, the VC community has its own language, examples of which include “seed capital,” “multiple,” “harvest,” “angels.” Corporations physically close to the community are more cognizant of its culture of risk taking, so that even if the CVC program does not yield instantaneous results, corporations who are co-located with the VCs may not abandon their

programs. Moreover, familiarity with the language facilitates communication of complex concepts that are peculiar to the VC model.

To sum up, geographic proximity to the VC community provides organizations with more opportunities to acquire tacit knowledge of the VC model, form critical networks, acquire skilled personnel and be more comfortable with the inherently uncertain nature of venture capital investing. Organizations that are co-located with the VC community possess broader experience with the VC model itself and are just better placed to replicate VC practices within their organizational context. Therefore,

*Hypothesis 1: Firms located geographically proximate to the VC community are less likely to abandon their CVC programs.*

One of the consistent themes in the innovation diffusion literature is the distinction between early and late adopters. Rogers (1995) utilizes the S-shaped curve of cumulative adopters to distinguish between five categories of adopters – ranging from “innovators” to “laggards” – derived from their time of adoption of the innovation. He further argues that early adopters have greater knowledge of innovations, search for information more actively, and have greater exposure to inter-organizational channels of communications that help decision makers learn about the innovation. As such they have a deeper understanding of the innovation. Early adopters also have more opportunities to familiarize themselves with the innovation; this increases their productivity and effectiveness in implementation. In contrast, late adopters lack such deep knowledge about the innovation and tend to adopt for faddish or symbolic reasons (Tolbert and Zucker, 1983). Late adopters who inhabit the peripheral strata of social networks face prohibitively high search costs and economize on these by relying on the cognitive heuristic of “do-as-others-do” (Abrahamson and Rosenkopf, 1997; Rogers, 1995). Moreover, unlike early adopters, late adopters are less likely to customize the innovation to suit their organization’s unique needs and capabilities (Westphal, Gulati and Shortell, 1997). However, reliance on cognitive heuristics and placing trust in the collective judgment of others can lead to errors and post-decision regret (Rao et al., 2001). The lack of customization of the innovation also implies errors in implementation, failure to

realize returns in line with initial expectations, and a consequent amplification of post-decision regret. All this implies that late adopters are at greater risk of abandoning the innovation.

In the context of CVC programs, early adopters have a richer understanding of the VC model, are better placed to adapt the programs to their distinctive capabilities and resources. They also have more opportunities to form critical networks, and experiment with and tailor the CVC program to their organizational context (Sorenson and Audia, 2000). In contrast, late adopters have few ties to the VC community, adopt the programs mainly in response to contagion influences, and possess little knowledge of the challenges inherent in implementing the VC model, (Gaba and Meyer, 2005). Accordingly, we hypothesize

*Hypothesis 2: Late adopters of CVC programs are more likely to abandon their CVC programs.*

Organizations routinely adjust their behavior based on their performance. Research on performance feedback models emphasize that organizations make adjustments based on the outcomes of prior actions (Greve, 2003). New innovations seldom realize their full productive potential at the time of adoption and organizations seek to learn from the coincidence of innovative strategies and the outcomes experienced (Strang and Macy, 2001). Therefore, one of the most persuasive forms of evaluating new innovations is by assessing how well they are meeting their goals for adopting the innovation in the first place (Burns and Wholey, 1993; Rao et al, 2001). Specifically, strong performance decreases the intensity of search and experimentation for alternates, and motivates adopters to exploit and retain the current innovation that has proven successful (Greve, 2003). Weak performance, on the other hand, stimulates search for an alternative and motivates organizations to abandon the current innovation. A number of studies have shown that positive outcome is associated with organizational persistence, while poor outcome is related to changes in the course of action (Audia, Locke and Smith, 2000; Greve, 1998b.)

For organizations, one of the main strategic goals for adopting CVC program is to identify and acquire new technologies that complement or build on their existing set of competencies. Through minority equity investments in entrepreneurial start ups, at a fraction of the risk and cost of an acquisition,

organizations have the option to ally themselves with entrepreneurial startups developing proprietary technology or penetrating new markets. Organizations that acquire start ups in which they invested in through their CVC programs, are likely to view CVC programs as successful and an effective means for externalizing R&D. Therefore they are more likely to retain these programs. Furthermore, the decision to retain or abandon CVC programs cannot be viewed in isolation from its main alternative – internal R&D. While CVC programs and internal R&D functions are often viewed as complementary activities by organizations, they compete for corporate resources, time, and attention from the organization. R&D personnel resist CVC programs as they prefer funding be allocated to internal R&D programs (Gompers and Lerner, 1999). Internal R&D program directors often develop what has become known as a "not invented here" syndrome. Consequently, any alternative programs that the organizations adopt for complementing the internal R&D efforts are met with resistance. Boundary disputes and the difficulty of getting co-operation from the internal R&D divisions can further destabilize the CVC group. This may be especially true for firms with a long and successful tradition of tapping innovative ideas and products through internal R&D. Such organizations may find it politically and culturally difficult to retain these programs. Therefore,

*Hypothesis 3a: Firms that experience positive results with the CVC program are less likely to abandon it.*

*Hypothesis 3b: Firms who experience success with internal R&D are more likely to abandon CVC programs.*

### **Inter-Organizational Contagion**

Inter-organizational contagion is frequently used as an explanation for the adoption and spread of organizational innovations (Rogers, 1995). Contagion occurs especially when an innovation is poorly understood and when its goals are ambiguous (Dutton and Freedman, 1985; Greve, 1995). It is especially prevalent in situations characterized by a high degree of uncertainty and ambiguity. Under these conditions, not only are decision-makers unable to assess all the connections between actions and outcomes, they may not even be cognizant of the full range of potential actions and outcomes

(Abrahamson and Rosenkopf, 1997). In such a scenario, organizational decision makers are influenced by and tend to mimic the observed actions of their peers. This process of contagion may be viewed as a form of social learning where uncertainty and ambiguity compels organizations to use social comparison to evaluate the innovation.

Even though organizations learn from their direct experience with the innovation in the post-adoption phase, they may not be able to fully resolve the uncertainty and ambiguity surrounding the innovation. Consequently, we expect that social learning will continue even after the innovation has been adopted. Organizations will examine the actions of other organizations in an attempt to supplement their personal experience with the current innovation (Greve, 1998a.) An organization's evaluation of an innovation may be influenced by the observation that other organizations are abandoning it since this signals that others have formed a negative opinion about the innovation (Greve, 1995). Subsequently, the focal organization also makes an abandonment decision. However, researchers have argued that not all organizations are equally contagious and that the actions of some organizations may be weighted more strongly than others. Research shows that organizations tend to pay more attention to organizations who are perceived as similar, of high-status, and more salient (See Greve, 2005 for a comprehensive review). We argue that similar patterns will hold in the case of abandonment.

Judgments of relevance affect the extent to which a focal organization will draw inferences from the decisions of other organizations (Greve, 2005). For a previous abandonment to influence a potential abandoner, the previous abandoner and its context must be viewed as similar to the potential abandoner, so that the information is seen as diagnostic of the value of abandoning the practice for the potential abandoner (Kiesler and Sproull, 1982; Strang and Meyer, 1993). In the diffusion of innovation literature, the potential adopter's social similarity to previous adopters (their homophily) is seen as an important driver of contagion (Rogers, 1995). For instance, Davis and Greve (1997) find that adoption of poison pills by organizations in the same industry sector was especially contagious. By extension, an important driver of contagion of abandonment decisions should be the similarity of the industry context of the two

organizations so that prior abandonment by peers in the same industry is likely to trigger abandonment by the focal organization.

Organizations model themselves after those prominent firms who are accorded special status as opinion leaders and who have special influence because others want to be affiliated with their status (Rogers, 1995). Prominent organizations are also regarded as worthy of imitation because of the legitimacy gains accruing from imitating them (DiMaggio and Powell, 1983; Burns and Wholey, 1993).). Others have demonstrated a survival advantage for organizations who follow a simple strategy of “imitate prominent organizations” (Mezias and Lant, 1994). In fact, several studies have shown that that the adoption decisions of prominent firms are especially contagious – in the context of matrix management (Burns and Wholey, 1993); entry decisions by thrifts (Haveman, 1993); and the choice of investment bankers as advisors for acquisitions (Haunschild and Miner, 1997). Similarly, we expect that abandonments by prominent organizations will spur abandonment by the focal organization.

Because the information gathering and processing abilities of firms are limited, we would expect that not all organizations are observed with equal ease. While news of abandonments can spread widely through media such as trade publications, newspaper articles, and consultants, so even abandonments far away are potentially influential, personal observation and communication are stronger mediators of information over small distances due to the higher density of contacts and information spillovers (Greve, 2005). Organizational decision-makers tend to be more aware of the strategies of nearby competitors. Stronger contagion over smaller geographical distances has been noticed for a variety of innovations such as municipal reform, matrix management golden parachutes, unionization (Knoke, 1982; Burns and Wholey, 1993; Hedstrom, 1994; Davis and Greve, 1997). Therefore, prior abandoners who are co-located with the focal organization are a richer source of information spillovers and this makes their abandonment decisions more influential for the focal organization.

To summarize, abandonment decisions of similar, prominent and proximate peers are likely to be contagious, and compel a focal organization to abandonment the CVC program. Therefore,

*Hypothesis 4a: Prior abandonments by firms in the same industry will increase the likelihood of CVC program abandonment by a focal firm.*

*Hypothesis 4b: Prior abandonments by prominent firms increase the likelihood of CVC program abandonment by a focal firm.*

*Hypothesis 4c: Prior abandonments by geographically proximate firms increase the likelihood of CVC program abandonment by a focal firm.*

### **Relative Influence of Innovation Related Experience and Contagion Influences**

So far, we have argued that the abandonment decision is contingent upon not only organizations' direct experience with the innovation but also on the contagion influences emanating from the actions of others in its social reference group. Next, we argue that not all organizations are equally susceptible to the contagion influences – organizations who experience positive results with the innovation and who have a deeper understanding of the innovation will be relatively immune to the contagion influences.

Organizations have access to multiple sources of information when it comes to assessing an innovation – these include own experience (Argote, Beckman, and Epple, 1990), looking to the actions of others in their social reference groups (Abrahamson and Rosenkopf, 1997), vivid accounts in the media about successful innovations (Strang and Macy, 2001) and consultants touting the miraculous outcomes of new managerial innovations (Abrahamson and Fairchild, 1999). With very few exceptions (e.g., Haunschild and Beckman, 1998), existing research does not examine the interaction of these multiple information sources. In the presence of multiple sources of information, the question naturally arises whether certain types of firms find particular types of information more persuasive and pay close attention to them or are all firms equally susceptible to all information? In the context of our study, how is fine-grained information acquired through own experience combined with coarse-grained information implicit in the actions of others?

In Bayesian models, as new information arrives, decision makers periodically revise their subjective assessment of an innovation's returns, with the size of each revision determined by the quality of each incoming piece of information (Banerjee, 1992; Bikhchandani, Hirshleifer, and Welch, 1998, Rao et al., 2001). According to this logic, innovation-related information from all sources would be

assimilated into a prospective abandoner's subjective assessment about the viability of the innovation. This in turn implies that these information sources complement each other and organizations pay equal attention to all sources of information. However, Bayesian models make heroic assumptions about the rationality and information processing abilities of decision makers, who are assumed to behave as if endowed with unlimited knowledge, time, and information-processing power. Although this idealized view of decision-making serves as a useful benchmark, decision makers seldom conform to it (Camerer, 1995). A more realistic depiction of decision-making would take into account organizational actors' limited cognitive capabilities in processing information and the costs of information gathering and processing (March and Simon, 1958). As Simon (1947) argues, individuals and organizations are better understood as "boundedly rational agents who experience limits in formulating and solving complex problems and in processing (receiving, storing, retrieving, transmitting) information." Limitations on cognition suggest that potential abandoners will attend to some information sources while ignoring or discounting others. Second, the search costs involved in assessing an innovation varies across organizations. This leads to a trade-off between the reliability of information and cost of acquiring this information. Organizations for whom search costs are high may economize on these costs by paying more attention to information that is easy to obtain but whose reliability may be questionable (Cyert and March, 1992). Others for whom acquisition of fine-grained reliable information is less costly are likely to pay less attention to noisy, less reliable sources of information. Third, organizations that have experienced positive results with the innovation are likely to pay more attention to their own experience and discount the actions of others. All these suggest that forms of information received from disparate sources are likely to serve as substitutes rather than as complements.

One way to examine the effects of alternate sources of information is to determine which firms have greater access to fine-grained information about the innovation (Haunschild and Beckman, 1998). Furthermore, unlike in the case of innovation adoption where organizations face considerable uncertainty in terms of the connection between the action and outcome of the innovation, for innovation abandonment decisions organizations are usually able to draw on their direct experience with the innovation. However,

experience with innovation varies across organizations. Consequently, in the post-adoption phase, organizations that have a deeper understanding of the innovation, who are better positioned to acquire fine-grained information and tacit knowledge of the innovation, and who have experienced positive results with the innovation, are better able to resolve the innovation related uncertainty. These firms are likely to pay more attention to these factors and discount the abandonment decisions of their peers. Organizations lacking these informational advantages face considerable greater uncertainty in their assessment of the innovation and are unable to assess connections between actions and outcomes with confidence (Lieberman and Asaba, 2002). They are more likely to use social comparison is used as a basis for making decisions (Greve, 1995; DiMaggio and Powell, 1983; Abrahamson and Rosenkopf, 1997) and will be more susceptible to contagion influences. In the context of our study, we expect that organizations who are geographically proximate to the VC community, who are early adopters of the CVC program, and who experience efficacious outcome with the CVC program are less susceptible to the contagious influences. Therefore, we hypothesize:

*Hypothesis 5a: Firms that are geographically proximate to the VC community are less susceptible to contagion influences.*

*Hypothesis 5b: Late adopters of CVC programs are more susceptible to contagion influences.*

*Hypothesis 5c: Firms that experience positive results with the CVC programs are less susceptible to contagion influences.*

## **METHOD**

### **Sample and Data**

To test our hypotheses, we gathered longitudinal data for a sample of U.S. firms in the information technology (IT) sector. Our first task was to construct a set of adopters of CVC programs who are at risk of abandoning these programs. We focused on IT firms drawn from the Forbes 500 list for the years 1997-2003. Following an approach taken by the National Science Foundation (NSF, 2000), we defined the IT sector to include firms in these five industry subsectors: (1) Office, Computing and Accounting Equipment, (2) Communications Equipment, (3) Electronic Components, (4) Communication

Services, (5) Computing and Data Processing Services. The Forbes 500 list is an annual compilation that ranks U.S. firms by sales, profits, assets, and market value. 264 IT firms ranked among the top 500 on one or more of these criteria made the first cut. Next, we used the Corporate Venturing Yearbook and Directory (2000, 2001, 2002) which reports the year in which firms adopted CVC programs. 94 firms were classified as adopters of CVC programs - this information was also confirmed and verified using the VentureXpert database<sup>1</sup>. These firms form our risk set; however, the time of entry into the risk set is conditional on the year of adoption of CVC programs so we have an unbalanced panel of observations. Our data covers the time period 1992-2003 with the earliest entrant into the risk set, adopting a CVC program in 1992.

### **Model Estimation**

We use a discrete-time event history methodology to model the abandonment of CVC programs (Allison, 1982, 1995). Our dependent variable  $P_i(t)$  is the conditional probability that firm  $i$  abandons the CVC program at time  $t$ , given that it is at risk of abandoning.  $P_i(t)$  is related to the covariates by the following equation:

$$P_i(t) = \Phi[\alpha + \beta_1 x_{i1}(t) + \dots + \beta_k x_{ik}(t)]$$

where  $\Phi$  is the cumulative density function and  $x_i$ 's are covariates which may be time-invariant (e.g., geographic distance). A discrete event history methodology is appropriate when information on the exact timing of an event is not available, i.e., when we have interval censoring (Allison, 1982). In our case, exact abandonment dates are not known since we have annual data – all we know is whether an abandonment has occurred within a yearly interval. A second advantage of this method is that firms that enter the risk set late, or are lost due to mergers or bankruptcies, or do not abandon, contribute to the regression model exactly what is known about them. Thus, right censoring is moot. Finally, time-varying explanatory variables are easily included because each time-period a firm is at risk is treated as a separate

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<sup>1</sup> Note that subsequently 3 firms drop out due to missing COMPUSTAT data.

observation. Left censoring (Tuma and Hannan, 1979) is not an issue since none of the 94 firms in our sample were in the risk set of abandoning a CVC program prior to 1992. We assume that the cumulative density function for the error term  $\Phi (\cdot)$  is normally distributed, so we use a probit model to estimate the probability of an abandonment event in a given year, in a pooled sample consisting of each organization observed during each of the twelve years (1992-2003).

## **Measures**

### ***Dependent Variable***

To operationalize the abandonment of CVC programs, we relied primarily upon the VentureXpert database that provides information on CVC investments. In open-ended interviews with corporate venture capitalists, informants told us that when corporations cease direct investments in technology startups for at least two calendar years, they almost always abandon their CVC program. Following their recommendation, we treated any firm that had not made any investments for at least two years as having abandoned the CVC program. The first year in this interval was coded as the year of abandonment<sup>2</sup>. Since this is an indirect and perhaps noisy way of assigning abandonment decisions, we sought to confirm our coding through Lexis-Nexis searches of business press articles and venture capital newsletters, from websites of IT firms, and through direct contact with Business Development executives. Furthermore, we stratified firms into dual categories of ‘abandoners’ and ‘retainers’ on the basis of the Venture Xpert database, and drew a stratified random sample from each category. For every firm in this stratified random sample, we made strenuous efforts to confirm the abandonment of CVC program by getting in touch with the Business Development executives. In all cases, our original coding of the abandonment decision based on the two year interval tallied with the information that we received directly from these firms.

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<sup>2</sup> Even though our analysis stops in the year 2003 we analyzed the investment decisions of firms in the risk set in the year 2004 and 2005 in order to code their abandonment decision. The two-year window for the abandonment decision constraints us to stop the analysis in 2003.

## ***Independent Variables***

### *Innovation Related Experience Variables*

Geographic Distance. Silicon Valley houses the world's dominant cluster of private venture capital firms. As figure 1 shows in 2000, approximately 40 percent of all U.S. venture capital originated in Silicon Valley . Information technology corporations headquartered closer to Silicon Valley enjoyed earlier and deeper exposure to the VC model, acquiring tacit knowledge from trusted acquaintances and through direct observation of the process of venture capital investing. Therefore, we measured geographic distance as miles from corporate headquarters to Silicon Valley . The zip code for corporate headquarters was obtained from the Forbes lists. We classified the following counties as comprising Silicon Valley: Alameda, Contra Costa, Marin, San Francisco, San Mateo, and Santa Clara. Distance was calculated as the number of miles from headquarters to the most proximate of these 6 counties. We used a spherical geometry formula to calculate distance between zipcodes (Sorenson and Stuart, 2001).

$$\text{Distance (miles)} = 3963.0 * \arccos(\sin(\text{zip1.lat}) * \sin(\text{zip2.lat}) + \cos(\text{zip1.lat}) * \cos(\text{zip2.lat}) * \cos(\text{zip2.lon} - \text{zip1.lon}))$$

where  $\text{zip}_i.\text{lat}$  is latitude of zip  $i=1, 2$  and  $\text{zip}_i.\text{lon}$  is longitude of zip  $i=1, 2$

To check for robustness of our results, we added two dummy variables, one for Massachusetts and one for New York (the other two prominent VC clusters); however, none of these dummies are significant and we omit them to save on degrees of freedom.

Year of Adoption. Instead of using an arbitrary time period to classify firms into early vs. late adopters we use the year of adoption as an independent variable. This is simply the year that the firm adopted the CVC programs. We relied primarily upon the Corporate Venturing Yearbook and Directory (2000, 2001, 2002) which reports the year in which firms adopted CVC programs. The variable ranges from 1992 to 2001. We also operationalized 'late adopters' as a categorical variable that takes the value one if the year of adoption was after 1998. The results remain unchanged.

Outcome of CVC programs. While VCs realize returns on their investments by taking their portfolio companies public, corporations arguably, are less concerned with such direct financial returns.

Instead, corporations are more concerned with strategic returns. Through these programs firms can screen private entrepreneurial ventures at the forefront of emerging technologies that can significantly impact the competitive dynamics of their industries. If the entrepreneurial startup turns out to be strategically relevant for the IT firm they are likely to acquire it to reap the benefits of the research and development performed by the startup. The acquisition of private entrepreneurial companies is therefore one of the visible indicators of the health of CVC programs (Gompers and Lerner, 1999). We use the cumulated number of CVC backed acquisitions by each firm as a measure of the efficacious results experienced by the adopters of CVC programs. It is true that firms realize a variety of intangible benefits from CVC programs such as a window to new technologies, environmental scanning, etc., that this measure may fail to capture. However, these benefits are hard to quantify so finding a comprehensive measure for all the benefits accruing from CVC programs is virtually impossible. We collected these data from two sources. First, we used the Securities Data Corporation's (SDC) Mergers and Acquisitions database to obtain a list of all private acquisitions by all the CVC adopters in our sample for each of the years from 1992-2002. We then matched the acquisitions by each adopter with the VentureXpert database to include only those acquisition targets that the CVC adopters had invested in during the time period of the study. Finally, we cumulated such acquisitions since the year of adoption obtain a measure of results experienced by the adopters of CVC programs.

Outcome of Internal R&D. Firms that excel at internal R&D are likely to abandon or discount alternative programs for accessing new technologies (Pisano, 1990). We measure firms' internal R&D outcome by cumulating the number of patents awarded to them, since adoption of the CVC program. These data were obtained from a database compiled by Hall, Jaffe, and Trajtenberg (2001) containing information on all utility patents granted between January 1, 1963 and December 30, 1999. However, these data end at 1999, while our study covers the time period 1992-2001. Accordingly, we augmented the Hall et al. dataset by collecting primary data on patents granted in the years 2000-2003 directly from the USPTO website (<http://www.uspto.gov>).

### ***Contagion Variables***

Prior abandoners in the same industry. This is measured as the number of prior abandoners in the same 3-digit industry sector lagged one year (Burns & Wholey, 1993). By confining this measure to the same 3-digit SIC code, we recognize that potential abandoners tend to pay greater attention to more comparable organizations (Haveman, 1993).

Prominence of prior abandoners. We used the average number of patents of all prior abandoners in the same industry sector as a measure of prominent prior abandoners. An increase in this measure implies that traditionally innovative organizations are eschewing the CVC route of externalizing innovation.

Proximate prior abandoners. We use this variable to measure the local forces of adoption. We calculated the number of prior abandoners in the same geographic state as the focal organization lagged one year (Burns and Wholey, 1993; Davis and Greve, 1997).

### ***Controls***

Size. Large firms are endowed with greater resources that enable them to adapt to changing market conditions and sustain strategic change (Haveman, 1993). With fewer resource constraints, large firms are likely to continue to explore and experiment with alternative means of R&D such as CVC programs. We measured size as total sales by the firm in the appropriate calendar year, extracted from the Compustat tapes.

Slack. Slack resources can facilitate continuance of CVC programs by easing resource constraints and by allowing continued experimentation with innovative programs (Levinthal and March, 1981). Slack is measured by a firm's current ratio, defined as current assets divided by current liabilities (Bourgeois, 1981). The slack measures are constructed from the Compustat tapes.

Organizational Age. Organizational ecologists argue that older organizations are relatively inert and they are likely to persist with existing routines (Hannan and Freeman, 1989). With age, firms tend to become technically complex which means internally it is harder to garner enough support and build a coalition for change. Therefore we expect older firms as less likely to abandon CVC programs. We

measure age as the number of years since founding. Firms' founding dates were obtained from Standard & Poor's Million Dollar Directory, with missing observations extracted from the FIS online database compiled by Moody's Financial Information Services.

Return on NASDAQ. To control for the boom and busts in public equity markets we controlled for the return on NASDAQ stock markets. We used the value weighted annual return on NASDAQ (including dividends). Since a disproportionate majority of portfolio investments in the decade of the 1990s were in the IT sector and because the firms in our sample are IT firms as well, the choice of NASDAQ is appropriate. If firms are interested in financial returns then a decline in returns on the NASDAQ should increase the likelihood of abandonments. We also experimented with a couple of other variables. First, we used year dummies for the years 1998-2001. The years 1998-2000 were the years of irrational exuberance, of hot IPO markets, and a boom in venture capital activity. In contrast, the latter half of 2000 saw the bursting of the tech bubble – equity markets crashed and a VC activity experienced a profound slump. Second, we used the number of VC backed IPOs to capture the temporal ebbs and flows in VC activity. All our results are robust to these alternate specifications.

Table 1 provides summary statistics and shows correlations between the predictor variables.

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Insert Table 1 here  
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## RESULTS

Table 2 shows the maximum-likelihood estimates of 4 models predicting likelihood of abandonment of a CVC program, using a discrete time event history model.

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Insert Table 2 here  
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Model 1 includes only the control variables – age, slack, size and the return on NASDAQ. In line with earlier research on innovation (Drazin and Schoonhoven, 1996), we find that the firm characteristics, slack and size, influence the abandonment decision, and that the temporal effects are accurately captured

by the return NASDAQ. The significant negative coefficients on slack and size variables indicate that greater access to slack resources and larger firms are less likely to abandon CVC programs.<sup>3</sup> The positive coefficient on age indicates that older firms are more likely to abandon the CVC program; however the coefficient is not statistically significant. With respect to the return on NASDAQ, we find that a crash in the NASDAQ (which occurred in the year 2000) leads to CVC program abandonment. That a slump in public equity markets would lead VCs to pare back their activities is expected; for them taking the startup public is the most desirable outcome. But given that corporations are more likely to abandon CVC programs as returns on stock markets dry up suggests that at least for a subset of firms, the financial return on CVC programs looms large in their decision to persist with these programs.

Model 2 examines the role of innovation related experience in the abandonment of CVC programs. Our results support hypotheses 1- 3b. First, firms that are geographically distant from Silicon Valley, who are at a relative disadvantage in terms of learning and implementing the VC model are more likely to abandon CVC programs. Firms embedded in the primary VC cluster, who have greater access to tacit knowledge, and skilled personnel and who are comfortable with the language, norms, and culture of the VC model are more likely to retain their CVC programs. Second, we find that late adopters of CVC programs are more likely to abandon the CVC programs – we obtain a positive and significant coefficient on the year of adoption. As we argued, early adopters of CVC programs have a deeper understanding of the VC model, and are more likely to customize CVC programs to their organizational contexts. These firms retain CVC programs even in the face of a market downturn. On the other hand, late adopters of CVC programs who are more susceptible to contagion influences and who adopt for faddish or legitimacy reasons, lack a basic understanding of how CVC programs lead to valued outcomes. As public markets collapse and observing their peers abandoning these programs, they follow suit. Third, firms who were successful in their CVC programs, in terms of acquiring startup companies in which they had invested in through their CVC program, are less likely to abandon these programs. These firms realize strategic

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<sup>3</sup> We used assets as a measure of size as well. However, with a correlation between sales and assets of 0.95 it makes very little difference which measure of size we use.

returns from their CVC programs and are more likely to view these programs as a useful way to access externally developed technologies and products. In contrast, firms with internal R&D programs that have been successful in terms of generating patents are more likely to abandon CVC programs. Our results suggest that favorable results from an innovation enhances the likelihood of continuance while favorable results from its close alternates increases the likelihood of discontinuance. A Wald statistic ( $=21.53$ ) comparing Models 1 and 2 indicates a significant improvement in model fit.

Model 3 examines the role of the contagion variables – the variables measuring prior abandonments in the same industry, prominence of prior abandoners, and prior abandonments in the same state are added to the controls. We find that the prior abandonment decisions of firms in the same 3 digit SIC code strongly accelerate the abandonment decisions of the focal organization. The coefficient is positive and strongly significant. Similarly, prominent prior abandoners who are known to be innovative, exercise a strong contagion influence on a focal organization. The coefficient on prior abandonment in the same geographic area has the right coefficient but fails to be significant. However, it is significant in the subsequent models. Thus, we have support for hypothesis 4a and 4b – firms are influenced by the abandonment decisions of their peers, especially those that are prominent and those that are most relevant. To evaluate the relative influence of three contagion variables, we calculate the magnitude of their influences in model 3. The marginal effects are evaluated at the means of the independent variables. We find that the both the prior abandonments in the same industry and prominence of prior abandoners are equally influential – a 1% increase in the former raises the probability of abandonment by 0.27% while a 1% increase in the latter raises the probability of abandonment by 0.2%. In contrast, the influence of abandonments in the same geographic area variables is of a considerably smaller magnitude – a 1% increase raises the probability of abandonment by only 0.05%. A Wald statistic ( $= 51.18$ ) comparing Models 1 and 3 indicates a significant improvement in model fit.

Finally, model 4 considers the simultaneous influence of all the variables. As in models 2 and 3, we find that variables measuring innovation-related experience, and contagion influences are significant predictors of the likelihood of innovation abandonment. Note that now prior abandonments in the same

state is strongly significant as well. Our results suggest that prior abandonments are contagious with more and more firms jumping onto the abandonment bandwagon. However, firms who have developed a deep understanding of the venture capital model and who have experienced positive outcomes in its implementation are less likely to abandon these programs. Wald tests show that Model 4 is a significant improvement on models 1-3. In terms of magnitude of effects, distance from Silicon Valley exercises the biggest influence. The median firm not located in the counties comprising Silicon Valley is about 2000 miles away from this primary VC cluster. The estimated coefficients suggest that this firm is thrice as likely to abandon the CVC program. Second, the timing of adoption plays a big role as well. A one year delay in the adoption of CVC programs raises the probability of abandonment by about 10.8%.

Next, we examine whether there is heterogeneity amongst firms in terms of their susceptibility to these contagion influences. Accordingly, models 5-13 in tables 3 and 4 examine evidence for hypotheses 5a-5c.

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Insert Tables 3 and 4 here  
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To test hypothesis 5a, we interact distance from the VC cluster with each of the three contagion variables. We expect that firms that are distant from the primary VC cluster are especially susceptible to contagion influences. Models 5-7 support this contention and we find that the interaction term in each model is positive and significant. Alternatively, firms that are proximate to the VC cluster are relatively immune to and discount these contagion influences. Next, Models 8-10 show support for hypothesis 5b – the coefficients on the interaction of year of adoption and contagion are positive and significant so that late adopters are more susceptible to the actions of their peers. Late adopters who have had less experience with the CVC programs react more strongly to contagion influences that originate from the actions of their peers within their industry, prominent prior abandoners, and prior abandoners in the same state. Finally, models 11-13 in table 4 show that firms that experience beneficial results from the CVC programs discount the contagion influences so that the coefficient on each of the interaction terms is negative. So we find support for hypothesis 5c as well. Wald tests show that models 5-13 are a significant

improvement on model 4 (without the interaction terms). Cumulatively, our results suggest that not only does innovation related experience makes firms less likely to abandon CVC programs but also makes them more immune to the contagion influences. While contagion does play an important role in the abandonment decision, the relative strength of its effect varies with firms' direct experience with the innovation itself. Firms who are closer to the source of the innovation, who were early adopters of the innovation, and who have experienced beneficial results in its implementation weight more their own experience with the innovation and discount the actions of their peers.

## **DISCUSSION AND CONCLUSION**

The innovation diffusion literature has paid less theoretical and empirical attention to understanding the abandonment of innovations. In this paper, we empirically examine the direct and interactive effects of two alternative drivers of innovation abandonment – organizations' own knowledge of and experience with the innovation and contagion influences emanating from the actions of peers. We find that organizations' experience and knowledge of the innovation decreases the likelihood of abandonment. However, contagion influences biases organizations towards abandonment as more and more organizations jump on the abandonment bandwagon. Furthermore, differences in organizations' innovation related experience also leads to heterogeneity in susceptibility to contagion influences. Organizations with greater knowledge and positive experience with the innovation are less susceptible to contagion influences. Specifically, we find that proximity to the VC population confers an informational advantage that manifests itself in two ways: it makes organizations more likely to retain the CVC program and it makes them less susceptible to the contagion influences. Our results also showed that early adopters of the innovation, who are less likely to have adopted the CVC program for purely faddish reasons, are also less likely to abandon it. Even as equity markets collapse and peers abandon, these organizations continue to experiment with the innovation and put less weight on the abandonment decisions of their peers. Next, organizations making large number of acquisitions through their CVC programs are less

likely to abandon these programs. These organizations are relatively successful in realizing strategic benefits of the CVC programs and are less concerned with the abandonment decision of their peers. Finally, we find that organizations that have been historically successful in generating new ideas, products and technologies through their internal R&D, see less value in CVC programs as a source of innovative ideas. They are more likely to abandon the CVC programs. Pisano (1990) reported a similar finding that organizations with in-house R&D experience are less likely to move towards externalizing their innovation functions.

Our results have implications for theories of learning and contagion. First, we find that the process of learning continues even in the post-adoption phase. Firms continue to evaluate an innovation by looking to their own experience, by tapping information flowing through their proximity to the source of the innovation, and by looking at the decisions of their peers. Second, we find that organizations' own experience and contagion influences act as substitutes. Much of the prior literature has found experiential and social learning as key drivers for a variety of organizational decisions. While both may be important, we present a more nuanced perspective by showing that an organization's direct experience with the innovation determines the relative influence of social learning. This interaction between experiential and social learning has seldom been investigated in prior theoretical or empirical work (Lieberman and Asaba, 2002). We show empirically, that not only do firms pay close attention to their own experience with the innovation, but the weight they attach to the abandonment decision of peers is itself a function of this experience. Third, our results also contribute to the emerging theory of organizational attention (Ocasio, 1997). March and Olson (1976) proposed that an important component of organizational learning is a theory of how the attention of organizational decision makers is shaped by the context and how these influences organizational search processes. Our results imply heterogeneity in the attention structure of decision makers, and that an important source of this heterogeneity is the extent to which they have a deep understanding of the innovation itself.

Our results also have implications for the innovation diffusion literature. First, it takes the pro-innovation bias critique seriously by focusing on the abandonment of an innovation. Second, both

Bayesian and neoinstitutional accounts of innovation diffusion implicitly imply that innovations diffuse to the fullest extent (Abrahamson and Rosenkopf, 1997). All potential adopters eventually adopt as they get pulled in by the contagion influences. However, this prediction does not square with observed cyclical patterns of adoption and abandonment (Strang and Macy, 2001). In our study, abandonment decisions by poorly informed organizations, implies that full diffusion even if it does take place, is likely to be reversed. Even as the contagion pressures for abandoning an innovation build up, we are unlikely to see the innovation completely disappear since a subset of organizations will resist these contagion influences. So we are unlikely to observe either a complete institutionalization or a complete deinstitutionalization of an innovation (Oliver, 1992). Furthermore, if a certain set of organizations retain the innovation and experience stellar performance, then a potentially new cycle of adoption (re-adoption to be more accurate) may start. Future research should examine the re-diffusion of an innovation. It is plausible that organizations abandoning the innovation may experience post-decision regret and may want to re-adopt the innovation. If so, then do these organizations learn from their prior experience or do they suffer from a memory loss after having abandoned the innovation.

The limitations of our study point to the need for future research. We examine a complex administrative innovation that originates amongst a distinctive set of firms (private venture capital firms) who agglomerate in a well-defined geographic space (Silicon Valley). As such the ambiguity and uncertainty associated with adopting this innovation persists so that organizations continue to draw inferences from the behavior of their peers. Neither Burns and Wholey (1993), nor Rao et. al. (2001) found a big role for contagion influences in their study. Perhaps the role of contagion influences is conditional on the speed with which the ambiguity surrounding the innovation can be resolved in the post adoption phase. This merits further investigation. Furthermore, our results show that experiential and social learning substitute for one another. It would be interesting to examine if our findings can be extended in the context of innovations that are administratively or technically less complex.

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**Table 1: Descriptive Statistics and Correlations**

<b>Variable</b>	<b>Mean</b>	<b>S.D.</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>
1. Distance	1119.67	1076.22	1										
2. Year of adoption	1997.03	2.73	0.24	1									
3. CVC outcome	0.56	2.15	0.12	0.2	1								
4. Internal R&D outcome	346.51	962.15	0	0.05	0.51	1							
5. Prior abandonments by industry	2.43	4.23	0.09	0.21	0.31	0.26	1						
6. Mean patents of prior abandoners	14.06	29.98	-0.01	-0.02	-0.48	-0.16	-0.1	1					
7. Prior abandonments by state	2.27	3.66	-0.05	-0.23	0.32	0.26	0.29	-0.26	1				
8. Sales	9.99	15.16	0.25	0.41	-0.17	-0.19	-0.01	0.25	-0.16	1			
9. Slack	0.94	0.61	0.13	-0.04	0.19	0.09	0.06	-0.27	0.23	-0.42	1		
10. Age	27.34	26.82	0.02	0.33	-0.17	-0.15	0	0.29	-0.17	0.46	-0.31	1	
11. Return on NASDAQ	1119.67	1076.22	-0.03	-0.08	-0.34	-0.34	0.4	0.06	-0.22	0.03	-0.02	0.03	1

**Table 2: Discrete Time Event History Analysis of Innovation Abandonment**

	(1)	(2)	(3)	(4)
<i>Distance</i>		0.023*** (0.005)		0.038*** (0.008)
<i>Year of adoption</i>		0.139*** (0.023)		0.053* (0.033)
<i>CVC outcome</i>		-0.089** (0.052)		-0.064* (0.044)
<i>Internal R&amp;D outcome</i>		0.055*** (0.007)		0.014* (0.008)
<i>Prior abandonments by industry</i>			0.056*** (0.016)	0.056*** (0.018)
<i>Mean patents of prior abandoners</i>			0.095*** (0.020)	0.082*** (0.024)
<i>Prior abandonments by state</i>			0.010 (0.015)	0.037*** (0.014)
<i>Sales</i>	-0.179*** (0.041)	-0.238*** (0.053)	-0.178*** (0.041)	-0.182*** (0.057)
<i>Slack</i>	-0.138** (0.059)	-0.265*** (0.067)	-0.150*** (0.054)	-0.175** (0.078)
<i>Age</i>	0.003 (0.004)	0.001 (0.004)	0.006 (0.004)	0.005 (0.004)
<i>Return on NASDAQ</i>	-0.709*** (0.211)	-0.493*** (0.215)	-0.941** (0.370)	-0.747* (0.407)
<i>Constant</i>	0.216 (0.274)	-276.84*** (46.479)	-0.012 (0.372)	-105.578 (66.964)
<i>No of observations</i>	410	410	410	410
<i>No of firms</i>	91	91	91	91
<i>No of abandonments</i>	48	48	48	48
<i>Overall Model test</i>	24.43***	42.27***	63.12***	68.63***

Standard errors in parentheses adjusted for clustering on 3 digit SIC codes; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1% (one-tailed for hypothesized variables, 2 tailed for controls)

**Table 3: Discrete Time Event History Analysis of Innovation Abandonment**

	(5)	(6)	(7)	(8)	(9)	(10)
<i>Distance</i>	0.045*** (0.006)	0.059*** (0.008)	0.063*** (0.012)	0.058*** (0.010)	0.039*** (0.009)	0.043*** (0.014)
<i>Year of adoption</i>	0.067*** (0.018)	0.056*** (0.020)	0.040* (0.027)	0.059*** (0.018)	0.041* (0.028)	0.039* (0.028)
<i>CVC outcome</i>	-0.059* (0.039)	-0.065* (0.043)	-0.056* (0.042)	-0.066* (0.043)	-0.069* (0.045)	-0.065* (0.042)
<i>Internal R&amp;D outcome</i>	0.029*** (0.011)	0.028*** (0.006)	0.019** (0.008)	0.034*** (0.006)	0.009* (0.007)	0.006 (0.010)
<i>Prior Abandoners in Industry</i>	0.003 (0.005)	0.072*** (0.015)	0.084*** (0.017)	0.029*** (0.010)	0.059*** (0.019)	0.066*** (0.024)
<i>Mean patents of prior abandoners</i>	0.006* (0.004)	0.007** (0.004)	0.009** (0.004)	0.004* (0.003)	0.005 (0.004)	0.074*** (0.026)
<i>Prior Abandoners in State</i>	0.111*** (0.018)	0.069*** (0.012)	0.036** (0.017)	0.072*** (0.015)	0.039*** (0.014)	0.029* (0.024)
<i>Distance*Prior Abandoners in Industry</i>	0.004** (0.002)					
<i>Distance* Mean patents of prior abandoners</i>		0.004*** (0.001)				
<i>Distance*Prior Abandoners in State</i>			0.019*** (0.003)			
<i>Year of adoption* Prior Abandoners in Industry</i>				0.00003*** (0.00001)		
<i>Year of adoption* Mean patents of prior abandoners</i>					0.0003*** (0.00001)	
<i>Year of adoption* Prior Abandoners in State</i>						0.00001* (0.00001)
<i>Sales</i>	-0.159** (0.069)	-0.160*** (0.056)	-0.206*** (0.060)	-0.166*** (0.058)	-0.174*** (0.058)	-0.164** (0.066)
<i>Slack</i>	-0.295*** (0.085)	-0.268*** (0.080)	-0.396*** (0.110)	-0.258*** (0.078)	-0.166** (0.082)	-0.170** (0.083)
<i>Age</i>	-0.106 (0.131)	-0.063 (0.133)	0.004 (0.004)	-0.068 (0.125)	0.004 (0.004)	0.005 (0.004)
<i>Return on NASDAQ</i>	-0.544* (0.324)	-0.561* (0.325)	-0.651* (0.334)	-0.190 (0.308)	-0.962** (0.427)	-0.793** (0.377)
<i>Constant</i>	-133.428*** (36.379)	-112.746*** (39.379)	-79.190 (54.665)	-118.738*** (35.275)	-81.436 (55.817)	-78.433 (56.448)
<i>No of observations</i>	410	410	410	410	410	410
<i>No of firms</i>	91	91	91	91	91	91
<i>No of abandonments</i>	48	48	48	48	48	48
<i>Overall model test</i>	78.0***	81.08***	86.15***	71.13***	70.48***	72.06***

Standard errors in parentheses adjusted for clustering on 3 digit SIC codes; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1% (one-tailed for hypothesized variables, 2 tailed for controls)

**Table 4: Discrete Time Event History Analysis of Innovation Abandonment**

	(11)	(12)	(13)
<i>Distance</i>	0.051*** (0.016)	0.030*** (0.010)	0.038*** (0.009)
<i>Year of adoption</i>	0.020 (0.026)	0.054* (0.028)	0.051* (0.036)
<i>CVC outcome</i>	-0.092** (0.051)	-0.078* (0.058)	-0.042 (0.074)
<i>Internal R&amp;D outcome</i>	0.015** (0.009)	0.024*** (0.009)	0.022*** (0.009)
<i>Prior Abandoners in Industry</i>	0.208*** (0.030)	0.057*** (0.016)	0.052*** (0.018)
<i>Mean patents of prior abandoners</i>	0.067** (0.029)	0.092*** (0.028)	0.078*** (0.027)
<i>Prior Abandoners in state</i>	0.052** (0.024)	0.003 (0.021)	0.034*** (0.014)
<i>CVC outcome*Prior Abandoners in Industry</i>	-0.030*** (0.007)		
<i>CVC outcome * Mean patents of prior abandoners</i>		-0.028* (0.022)	
<i>CVC outcome *Prior Abandoners in state</i>			-0.119* (0.080)
<i>Sales</i>	-0.142** (0.062)	-0.163*** (0.063)	-0.159*** (0.061)
<i>Slack</i>	-0.211* (0.108)	-0.200** (0.081)	-0.209** (0.085)
<i>Age</i>	-0.009 (0.170)	-0.049 (0.156)	-0.035 (0.154)
<i>Return on NASDAQ</i>	-0.464 (0.386)	-0.856** (0.430)	-0.747* (0.415)
<i>Constant</i>	-39.908 (51.728)	-107.566* (56.485)	-101.111 (71.559)
<i>No of Observations</i>	410	410	410
<i>No of firms</i>	91	91	91
<i>No of abandonments</i>	48	48	48
<i>Overall model test</i>	79.91***	72.89***	80.03***

Standard errors in parentheses adjusted for clustering on 3 digit SIC codes; \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1% (one-tailed for hypothesized variables, two-tailed for controls)

Figure 1

