

THE INNOVATION PROCESS OF START-UP FIRMS AND
THE MODERATING EFFECTS OF INCUBATORS

ANDREW C. CORBETT
(STUDENT)

Graduate School of Business Administration
University of Colorado at Boulder
Department of Management
Campus Box 419
Boulder, CO 80309-0419
Tel: (303) 492-1175
Fax: (303) 417-9617
e-mail: andrew.c.corbett@colorado.edu

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Andrew C. Corbett, University of Colorado at Boulder

ABSTRACT

By examining entrepreneur's biases and heuristics and the effects of incubators, this paper proposes that there are significant temporal differences in the innovation process of start-up firms. Additionally, this paper theorizes that incubators can have a moderating and positive effect on the innovation process of small technology firms. The paper concludes by developing a research program that is designed to empirically test the propositions that are put forth. The study is designed to make a contribution both to scholars studying entrepreneurship; and practitioners making public policy decisions regarding new venture development and its supporting infrastructure.

Key words: innovation, process, incubators, high technology

INTRODUCTION

Innovation as a topic of scholarly inquiry has been studied and researched from many different perspectives. Researchers have studied the links between innovation and learning (Brown & Duguid 1991, Cohen & Levinthal 1990, Roberts 1988, Van de Ven & Polley 1992) and how firms design and manage for innovation (Galbraith 1982, Van de Ven 1986). There has been a great deal of work that examines the innovation activities in large established firms (Brock & MacMillan 1993, Burgelman 1983, Day 1994, Dougherty 1992, Dougherty & Cohen 1995, Zahra & Covin 1995). Similarly, many researchers have studied innovation in small firms (Audretsch & Acs 1991, Lee, 1995, Acs & Gifford 1996). Scholars have also investigated innovation from a product perspective (Cooper & Kleinschmidt 1986, Cooper & Kleinschmidt 1987, Dougherty & Cohen 1998, Henderson & Clark 1990) and from a process perspective (Burgelman 1983, Cooper 1983, Pettigrew 1992).

Like most fields of study, innovation research has evolved over time. Van de Ven and Rogers (1988) illustrate this evolution while calling for a focus on the investigation of innovation process research. While noting changes in innovation research over the past five decades, they argue that much innovation research has been flawed. Van de Ven and Rogers state that researchers need to move away from survey research toward more longitudinal case studies in order to truly understand innovation in organizations:

“But the too-direct transfer of models and methods from research on individual innovativeness to organizational innovativeness had several intellectual shortcomings. For example, how adequately do the data provided by the head of an organization represent the actual innovation behavior of the relevant members of the organization? Further, and worse, the studies of organizational innovativeness could not effectively investigate how organizational structure affected innovation. Structural variables were not very adequately measured, nor could they be accurately operationalized.” (1988: 636)

Heeding his own call, Van de Ven et al (1999) use data gathered from multiple longitudinal case studies to map the innovation process as a three-period, twelve stage process from gestation to implementation (or termination). The authors note that while these components will appear in all innovations, “key process elements are expected to be more pronounced for innovations of greater novelty, size, and temporal duration” (1999:25). Integral to the process they uncovered was the fact that the “innovation journey” is characterized by a nonlinear dynamic system that consists of a cycle of divergent and convergent behaviors that the authors suggest best explains the development of cultures that allow for innovation (see Figure 1).

In this study Van de Ven and his colleagues conducted longitudinal field studies of fourteen innovations in their natural settings as they evolved over time from concept to implementation (the Minnesota Innovation Research Project [MIRP]). This massive and impressive effort gives innovation researchers new insights and also reveals new questions that need to be addressed. The MIRP study had an eclectic mix of firms, industries, and innovations, but had only one start-up firm. The present study will attempt to build upon this by proposing a study to investigate whether the innovation process may be different for start-up firms (as opposed to established firms) and to investigate the moderating effects of incubators.

This study will investigate a set of firms that have the aid of an incubator and a set of firms that do not. Results of this study will be examined against Van de Ven et al’s findings to see whether there are differences in the innovation process between established organizations, start-up firms, and start-up firms working in an incubator.

As noted above, the management literature is replete with studies showing the differences between large and small firms. This research allows entrepreneurs to better understand their unique organizational environments and allows them to gain insights into ways in which they can better compete. By distinguishing any potential differences in the innovation processes of start-ups versus large organizations, this study can add to this base and make a substantial contribution to the study on entrepreneurship. A similar investigation of the effects of incubators can contribute to public policy.

ORGANIZATIONAL DIFFERENCES BETWEEN LARGE AND SMALL FIRMS

Much research has been conducted examining the differences between large and small firms and this work can be used to establish a foundation for investigating differences in the innovation processes of established firms and start-up firms. The differences in firm strategy and performance between start-ups (typically small) and established firms has been well documented in the literature (Henderson, 1999). One measure of these firms' performance is in relation to their age and size. Researchers have examined the concepts of the liability of newness (Stinchcombe 1965; Hannan & Freeman 1984), the liability of smallness (Hannan & Freeman 1984), and the liability of obsolescence (Baum, 1989). By examining these particular "liabilities," we can begin to build a theoretical base for investigating distinctions in the innovation processes of start-up firms.

Liability of newness suggests that expectations of success favor established firms and that the deck may already be stacked against new entrants (Stinchcombe 1965). Stinchcombe states that

because of this newness, young firms have a higher likelihood of failure. Baum (1996) further explains this position: “Underlying this argument is the assumption that young organizations are more vulnerable because they have to learn new roles as social actors and create organizational roles and routines at a time when organizational resources are stretched to the limit. New organizations are also assumed to lack bases of influence and endorsement, stable relationships with important external constituents, and legitimacy.” (1996:79).

Hannan and Freeman (1984) suggest that this liability of newness negatively affects start-ups because of their lack of reliability and accountability. They state that newer firms may lack a record of accomplishment and, therefore, may not be able to demonstrate these characteristics as well as their older, larger, established competitors. Newness, therefore, could manifest itself to affect the innovation process of a firm by dramatically influencing the convergent-divergent cycle within the process (Van de Ven, et al 1999). See Figure 1 for an expanded understanding of the convergence-divergence model.

Closely related to the concept of “newness” is the liability of smallness. Here, again, large firms seem to be in a better position because many stakeholders assume prior success is an indicator of future success. Hannan and Freeman again use the reliability argument and state that large firms gain an advantage because it is assumed they are less vulnerable to failure. Aldrich and Auster (1986) state that small firms do not perform as well as large firms and have higher failure rates due to problems of raising capital, recruiting and training workers, higher interest rate payments, and higher administrative costs. Again, Baum (1996) states that size gives larger firms an advantage of assumed future dependability. Similar to the concerns brought on by newness,

smallness could also bring about distinctions in the innovation processes of start-up firms. The problems of raising capital, recruiting workers, and higher costs will undoubtedly affect the structure of the small start-up firm – and thus, the structure may affect innovation (Van de Ven & Rogers 1988).

A corollary to these views, and one that suggests small and young firm success, is the liability of obsolescence. The liability of obsolescence suggests that established firms' failure rates increase with age as they become inertial and their original fit with the environment erodes (Baum 1989). Again, we see a difference in the structure of the established firm and the start-up firm. Baum (1996) expounded on this fit with the environment: "Inertial tendencies make it difficult, if not impossible, for individuals to keep their organization aligned with environmental demands. Environmental change also creates opportunities for new organizations to enter and undermines the competitive positions of established organizations. Ironically, attempts to realign the organization with its environment may carry additional hazards that result from constraints on the ability of individuals to conceive and implement changes successfully and the potential for major change attempts to lower organizational performance reliability and disrupt key external relationships." (1996:83)

Relating this concern of fit to innovation, Dougherty states in her article "Organizing for Innovation" that established organizations have problems in effectively innovating. "They have difficulty shifting to new technologies (Tushman and Anderson 1986); moving away from familiar customers (Christensen and Bower 1993); changing their strategic paradigm (Johnson 1988); breaking out of prevailing patterns of decision-making (Starbuck and Miliken 1988);

adjusting their product architecture (Henderson and Clark 1990); using marketing tools appropriately (Mahajan and Wind 1992); and learning from experience (Van de Ven and Polley 1992).”

From the all of the above information, we can see the advantages that small and large firms might expect to gain by virtue of their relative size and age. Based on this research and Van de Ven and Roger’s 1988 critique, we can surmise that the different structures of established and start-up firms may have different impacts on their processes of innovation. Further explanation of the differences is provided by Ross and Unwalla (1986) in list of characteristics (Table 1) that differentiate small firms from larger ones.

Insert Table 1 about here.

Ross and Unwalla emphasize the fact that established firms differentiate themselves from start-ups by tending towards bureaucracy. “Most large and medium-sized businesses tend to take on the characteristics of a bureaucracy, including a hierarchy of authority, a system of rules and standards, and a spirit of formalistic impersonality.” (1986: 45-46)

Illuminating this difference between start-ups and large established firms, research also suggests that as firms grow their structure becomes more complex and the organizations become more bureaucratic. Williamson (1971) suggests that organizations may become complex and bureaucratic in response to coordination and control problems associated with the growth and

product diversity of large firms. Grinyer and Yasai-Ardekani (1980) stated that the greater the complexity of organizations, the more bureaucratic they will become. Grinyer and Yasai-Ardekani (1981) also found that bureaucracy increases to meet the needs of a company as it grows and diversifies.

Weber's seminal piece (1946) that outlined the characteristics of the classic bureaucracy states that an organization was run best when it was based on strict rules and regulations and a strong (one way) relationship between supervisors and subordinates. While many have shown the restrictive affects of bureaucracy on creativity and innovation (Kamenka 1989, Whorten and Worthly 1981, Foster-Fishman and Keys, 1995), others have suggested that innovation can thrive in bureaucracies (Toren 1977, Blau 1956). What all of this research suggests is that as firms grow their structure changes. This paper proposes that this difference in structure will also show differences in the innovation process between start-ups and established firms.

SIZE, SPEED AND DECISION-MAKING

Why is this delineation of size and structure important? Primarily because firm size (entrepreneurial and small versus inertial and large) has been seen to affect the speed of decision-making (Busenitz & Barney 1997). Additionally, Eisenhardt (1989) has shown that in fast-paced industries (the dominant form today with the rate of change around us) the faster you make decisions, the better you perform.

Haley and Stumpf (1989) state that biases and heuristics may be an integral part of the variation in strategic decision-making. Busenitz and Barney furthered this work by investigating decision-

making in large and small firms. Specifically, they investigated the differences in the use of biases and heuristics between entrepreneurs and managers in large organizations. By examining overconfidence (overestimating the probability of being right) and representativeness (the tendency to over generalize from a few characteristics or observations) Busenitz and Barney found that “entrepreneurs do behave differently than do managers in large organizations and that these differences are substantial (1997:10).”

In part, Busenitz and Barney surmised that the success of the entrepreneur is due to timing and the ability to make quicker decisions than managers in large organizations. “With entrepreneurs in particular, the window of opportunity would often be gone by the time all the necessary information became available for more rational decision-making. Additionally, successfully starting a new business usually involves overcoming multiple hurdles. Using biases and heuristics as simplifying mechanisms for dealing with these multiple problems may be crucial. (1997:10).”

The relative speed of entrepreneurs’ decision-making compared to managers in established firms does make a performance difference. Eisenhardt (1989) considered the implications of different variables on the speed of strategic decisions. Her work suggests fast decision-makers use more, not less, information than do slow decision-makers and that the use of real-time information will increase the speed of the decision making. Eisenhardt also states that the greater the number of alternatives considered simultaneously, the greater the speed of the decision process. The greater the integration among decision makers, the greater the speed of the decision process. In essence, Eisenhardt found that the greater the speed of the strategic decision-making process, the

greater the performance in high velocity environments. This appears to be very important in an economy where things change quickly and opportunities are fleeting. What I propose in this paper is that this faster decision-making affects the innovation process as well.

The Innovation Process

Van de Ven et al (1999) state that there are six key elements that are part of the concept of innovation – ideas, people, transactions, context, outcomes, and process. These researchers found that innovation could be seen as a model continuous convergence and divergence behaviors that are enable and constrained by other internal and external factors. Specifically, Van de Ven and his colleagues defined innovation as “new *ideas* that are developed and implemented to achieve desired *outcomes* by *people* who engage in *transactions* (relationships) with others in changing institutional and organizational *contexts*.” (1999:6-7)

These researchers also found that the innovation process is comprised of three specific periods (initiation, development, and implementation/termination) which encompassed a total of twelve different process patterns. These periods and processes are detailed below.

Initiation Period

1. Gestation of the idea
2. “Shocks” that trigger the innovation
3. Developing and submitting plans to gain resources and exposure

Development Period

4. Proliferation of the initial idea into many different ideas and activities
5. Setbacks and mistakes
6. Shifting innovation performance criteria
7. Fluid participation of innovation personnel
8. Top management involvement and roles
9. Relationships frequently altered
10. Industry team playing

Implementation/Termination

11. Innovation adoption by linking the “new” with the “old”
12. Termination when implemented or when resources run out

(adapted from Van de Ven, et al, *The Innovation Journey*, 1999)

The longitudinal case studies done by Van de Ven and his team of thirty researchers provides us with a far better understanding of the innovation process than any previous survey-based research. We intend to further this work by expanding their general innovation theories to detail the distinctive characteristics of the innovation process of start-ups and the effects of incubation. By researching and accounting for the differences in organizational structure and by exploring the entrepreneurs’ use of heuristics, we hope to uncover variations in start-up firms from the Van de Ven et al’s general model. Additionally, we expect to find further variations in new ventures that develop with the assistance of an incubator.

Van de Ven et al’s work suggests that the innovation process in large and small firms in the same. In the book, *The Innovation Journey*, the authors state that the gestation time for innovation in large and small firms in the same and that it is often lasts three or more years. Work by Knight (1989) confounds this by suggesting that there are differences in research & development and innovation in small and large firms. However, Knight’s methods included survey questionnaires, phone interviews, and personal interviews, and thus, may not give us much insight into the true innovation process (again, see Van de Ven and Roger’s critique of innovation research, 1988).

We intend to clarify and fill this gap in the literature by designing and executing a longitudinal case study that will examine the innovation process of high-tech start-up firms. Based on the literature review presented earlier, we will meticulously detail differences in the start-up structure (as opposed to large established firms), the use of biases and heuristics by the entrepreneurs, and the decision-making speed of the firm. Initially, we propose that there will be a temporal difference in the innovation processes of established and start-up firms. Specifically, the entrepreneur's use of the heuristics – overconfidence and over-representation – suggests a shorter gestation period for start-up firms. We then propose a moderating effect for incubating firms.

P1a The innovation gestation stage will be shorter for start-up entrepreneurs than for innovations being developed in established firms due to the use of biases and heuristics by entrepreneurs.

P1b The innovation gestation stage will for start-ups working in an incubator will be shorter than established firms, but longer than new firms not working in an incubator.

In addition, since entrepreneurs are overly confident in their own abilities, we propose that innovations initiated by start-up firms are more likely to develop from external organizational shocks. Entrepreneurs are less likely to change their own minds or have them changed by an internal occurrence.

P 2a Innovations initiated by start-up firms will be triggered by a greater number of external shocks than internal shocks. *[overconfidence in own abilities will lead to less internal shocks – impetus for change will come from external events]*

P 2b Innovations initiated by start-up firms working in incubators will be triggered by a greater number of external shocks than established firms, but they will have more internal shocks than start-ups not working in incubators.

Similarly, we propose that the development period will also be affected by the biases and heuristics of entrepreneurs and by the larger social and industry networks of established firms. Overconfidence and over-representation will be greater in start-up firms, leading to less deviation. Also, assuming that a greater number of people are involved in the innovation process in an established firm, more ideas will proliferate in these larger organizations.

P3a The initial innovative idea will proliferate into more numerous ideas and activities in the established firm as opposed to the start-up firm.

[overconfidence and over-representation is greater in start-up firms leading to less deviation; greater number of people involved in established firm leads to more ideas]

P3b An incubator will moderate the above effect so that start-up firms working in an incubator will proliferate more numerous ideas than start-ups not working in an incubator, but they will proliferate still less ideas than established firms.

Again, related to the size of the established firm and its assumed greater social and industry network, the development period will be longer in established firms.

P4a The innovation development period in established firms will be longer than in start-ups. *[overconfidence and over-representation is greater in start-up firms which will shorten the development time; also, the greater number of people involved in established firm leads to more options to consider and a longer development period.]*

P4b An incubator will moderate the innovation development period so that it is shorter than established firms, but longer than start-ups not working in an incubator.

Mistakes and setbacks may be mitigated by the established firm's experience, routines, knowledge and industry connections.

P5a Innovations being developed by established firms will encounter fewer setbacks and mistakes than innovations from start-up entrepreneurs due to greater knowledge and greater use of the industry infrastructure.

P5b Innovations from start-up firms working in an incubator will also encounter fewer setbacks and mistakes than innovations from start-up entrepreneurs, but these incubating firms will have more than established firms.

THE STUDY

Testing these propositions will require an in-depth field study of entrepreneurs in their most nascent stages. The research design for this study will do just that as well as compare and contrast to the findings to previous studies in large firms.

Van de Ven and a group of thirty researchers tracked the development of fourteen innovations in their natural settings. The field work alone went on for ten years – starting in 1983 and ending in 1993, when the last of the innovation projects ended (it was terminated). This team of investigators used interviews, surveys, site observations, and archival records to record the process of innovations in the various organizations. Although we can not replicate this design in its full scale and scope, we intend to use the same rigorous methods and techniques. Moreover, since we will be examining only the gestation and development periods, a shorter scope may be appropriate.

My research partner and I will conduct longitudinal studies with six start-up firms. The field setting for this study will include four technology firms located in an entrepreneurial high technology region in the United States. Additionally we will examine three technology

companies housed within a 501(c)(6) not-for-profit incubator. This incubator is a public-private business development organization that specializing in technology growth opportunities in the areas of information, process, energy/materials, healthcare, and telecommunications. All six firms will be telecommunications firms. The organization houses dozens of independent business start-ups and provides them with office space, managerial advice, and other services.

Replicating the work of Van de Ven's team, interviews with prospective entrepreneurs will be conducted in order to find four start-up firms that will allow the researcher full access to their firm. Over the span of twelve months the researchers will observe and interview key personnel on weekly basis. The researchers will have access to archival records and will conduct surveys as necessary. All case notes and interviews from observations will be recorded into a data file within 24 hours after their occurrence. All events will be coded in the following scheme – ideas, outcomes, people, transactions, and context – in order to allow for easier comparison to Van de Ven's data on established firms.

This study will contribute to the entrepreneurship literature by further defining the innovation process and by providing a finer roadmap for future entrepreneurs. Additionally its findings should provide public policy makers with greater information on the efficacy of incubators.

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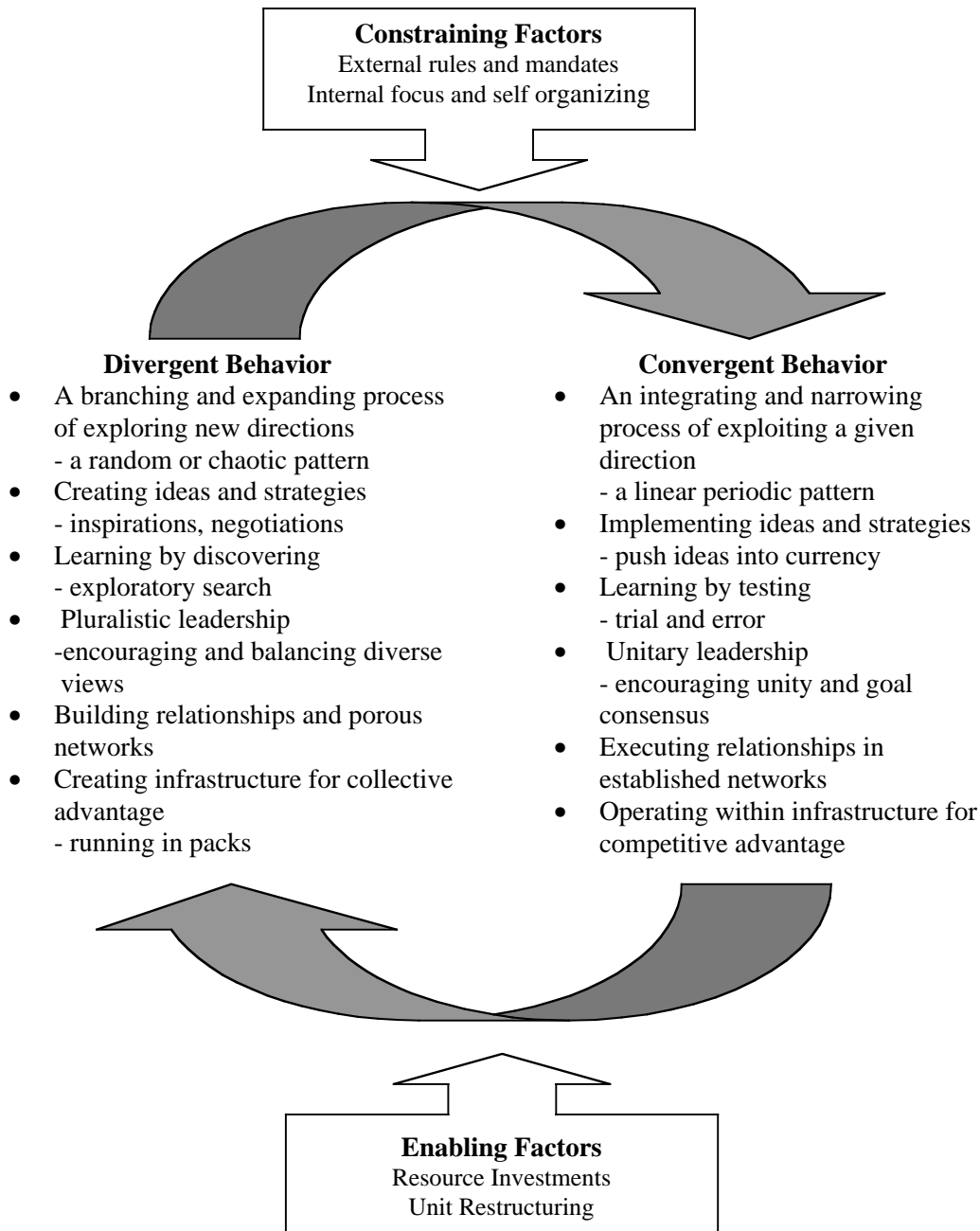
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Table 1
Characteristics of Small and Large Organizations

<u>Entrepreneurial Organizations</u>	<u>Bureaucratic Organizations</u>
Takes risks.	Avoids risks.
Stays innovative.	Does routine work.
Focuses on results.	Focuses on activities.
Focuses on teamwork.	Focuses on structure.
Does technical work.	Does administrative work
Stays flexible.	Has tight controls.
Sees the organizations as a system	Practices parochialism and “nichemanship.”
Sees change as good.	Prefers the status quo.
Tolerates and learns from mistakes	Avoids and punishes mistakes.
Believes that managers are motivated by creating something out of nothing.	Believes that managers are motivated by upward movement in an established structure.

Adapted from Ross & Unwalla, *Who is an Intrapreneur?*, Personnel 1986.

Figure 1
Divergent – Convergent Behavior Model



Van de Ven’s cycling of the innovation journey

Adapted from Van de Ven, et al, *The Innovation Journey*, 1999.