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OPPORTUNISTIC ADAPTATION AND NEW VENTURE GROWTH: EXPLORING
THE LINK BETWEEN COGNITION, ACTION AND GROWTH

BY

ANDREEA NOEMI KISS

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree

of

Doctor of Philosophy

in the Robinson College of Business

of

Georgia State University

GEORGIA STATE UNIVERSITY

ROBINSON COLLEGE OF BUSINESS

2010

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ACCEPTANCE

This dissertation was prepared under the direction of the candidate's Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor in Philosophy in Business Administration in the Robinson College of Business of Georgia State University.

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Finally, I would like to dedicate this dissertation to my son, Victor, and in memory of a dear friend lost forever, Adela.

ABSTRACT

OPPORTUNISTIC ADAPTATION AND NEW VENTURE GROWTH: EXPLORING THE LINK BETWEEN COGNITION, ACTION AND GROWTH

By

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30 JUNE, 2010

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This dissertation introduces the model of opportunistic adaptation to explain new venture growth. In established firms processes of change and adaptation usually imply a transition from one steady-state strategy to another and a problem oriented perspective as firms change in response to potential threats to their current positions. However, in the context of new ventures, adaptation is less about moving from one existent strategy to another and more about the entrepreneur's effort to reach a steady state for the first time by continuously experimenting and combining resources in creative and innovative ways. The model of opportunistic adaptation rests on three key assumptions: 1.) new venture growth results from actions grounded in an opportunistic (proactive) logic; 2.) entrepreneurial cognition is viewed as an antecedent to all organizational actions leading to growth; 3.) the relationship between entrepreneurial cognition and action is influenced by industry and firm level attributes. The model is tested using quantitative and

qualitative data on new ventures founded between 1996 and 2006 in technology intensive industries. The results provide partial support for the notion of opportunistic adaptation as a process in which entrepreneurial cognition, firm and industry related factors are closely intertwined. The results of the dissertation suggest that some aspects of entrepreneurial cognition, such as entrepreneurial schema focus have a more direct effect on actions related to new venture growth than others whose effect is strongly moderated by contextual influences such as industry growth and social network heterogeneity. This dissertation also finds that not all types of organizational actions associated with an opportunity logic lead to new venture growth. Of the three action types included in the model (fast, diverse and frequent) only action diversity was found to have a positive impact on new venture growth. Theoretical implications of the study results for both the literature on new venture growth and the literature on organizational adaptation, as well as practical implications are discussed.

TABLE OF CONTENTS

CHAPTER I: INTRODUCTION.....	1
CHAPTER II: LITERATURE REVIEW	10
2.1 NEW VENTURE GROWTH.....	10
2.1.1 Scholarly Perspectives on New Venture Growth.....	11
2.1.2 The Ecological Perspective.....	12
2.1.3 The Environmental Perspective	17
2.1.4 The Strategic Content Perspective	20
2.1.5 The Entrepreneur Characteristics Approach.....	22
2.1.6 Forms of New Venture Growth	25
2.2 CONCLUSIONS AND RESEARCH QUESTIONS.....	28
2.2.1 Contributions of Existing Research	28
2.2.2 Unresolved Research Issues.....	29
CHAPTER III: THEORY DEVELOPMENT. MODEL AND HYPOTHESES	33
3.1 ORGANIZATIONAL ADAPTATION	33
3.1.1 Models of Adaptation	34
3.1.2 The Cognitive View of Organizational Adaptation.....	37
3.2 THE MODEL OF OPPORTUNISTIC ADAPTATION	43
3.3 HYPOTHESES.....	45
3.3.1 The Impact of Schema Complexity on Speed, Frequency and Diversity of Organizational Actions	45
3.3.2 The Impact of Schema Focus on Speed, Frequency and Diversity of Organizational Actions	47
3.3.3 The impact of Proactive Causal Logic on Speed, Frequency and Diversity of Organizational Actions	50
3.3.4 The Moderating Effect of Resource Availability on the Influence of Schema Attributes on Organizational Actions	53
3.3.5 The Moderating Effect of Industry Context on the Influence of Schema Attributes on Organizational Actions	56

3.3.6 The Moderating effect of Social Networks on the Influence of Schema Attributes on Organizational Actions	59
3.3.7 The Impact of Speed, Frequency and Diversity of Organizational Actions on New Venture Growth.....	63
3.4 SUMMARY	67
CHAPTER IV: RESEARCH METHOD	68
4.1 POPULATION AND SAMPLE.....	68
4.2 DATA COLLECTION METHODS	72
4.2.1 Data Collection: Entrepreneurial Cognition	75
4.2.3 Data Collection: Organizational Actions	81
4.3 MEASUREMENT	82
4.3.1 Dependent Variables	82
4.3.2 Independent Variable	85
4.3.3 Moderators	87
4.3.4 Control Variables	90
4.4 SUMMARY	92
CHAPTER V: RESULTS.....	93
5.1 DATA SCREENING AND DESCRIPTIVE STATISTICS	93
5.2 TESTS OF HYPOTHESES - INFLUENCE OF ENTREPRENEURIAL COGNITION ON DIVERSITY, FREQUENCY AND SPEED OF ORGANIZATIONAL ACTIONS	97
5.3. TESTS OF HYPOTHESES - NEW VENTURE GROWTH	105
CHAPTER VI: DISCUSSION	108
6.1 DISCUSSION OF THE RESULTS AND THEIR SPECIFIC IMPLICATIONS	108
6.1.1 How do new ventures grow? The model of opportunistic adaptation	108
6.1.2 The relationship between entrepreneurial cognition and new organizational actions	113
6.1.3 The effect of resource slack, industry growth and social network heterogeneity on the relationship between cognitive characteristics and new venture action.....	118
6.2 GENERAL CONTRIBUTIONS.....	126
6.2.1 Contributions to the New Venture Growth Literature	126

6.2.2 Contributions to the Organizational Adaptation Literature	130
6.2.3 Practical Implications.....	132
6.3 LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH.....	133
REFERENCES	137
APPENDIX.....	162

LIST OF TABLES

Table 1: Example of causal mapping coding sheet.....	164
Table 2: Categorization scheme.....	165
Table 3: Example of organizational action coding sheet	166
Table 4: Environment, Actions, Performance – Definition of terms	168
Table 5: Organizational Actions - Descriptives.....	171
Table 6: Summary of hypotheses.....	172
Table 7: Descriptive statistics and correlations	174
Table 8: Direct and moderated effects of schema attributes on organizational actions..	175
Table 9: Direct effects of organizational actions on sales and employment growth	176
Table 10: Alternative models: The effect of deterministic causal logic on organizational actions diversity	177

LIST OF FIGURES

Figure 1: A model of opportunistic adaptation and new venture growth	162
Figure 2: An illustration of the causal mapping procedure (adapted from Nadkarni and Narayanan, 2007)	163
Figure 3: Causal map example.....	167
Figure 4: The effect of industry growth on the relationship between entrepreneurial schema complexity and diversity of organizational actions	178
Figure 5: The effect of industry growth on the relationship between entrepreneurial schema complexity and frequency of organizational actions	178
Figure 6: The effect of industry growth on the relationship between entrepreneurial schema focus and frequency of organizational actions.....	179
Figure 7: The effect of industry growth on the relationship between proactive causal logic and frequency of organizational actions	179
Figure 8: The effect of social network heterogeneity on the relationship between complexity of entrepreneurial schema and diversity of organizational actions.....	180
Figure 9: The effect of social network heterogeneity on the relationship between complexity of entrepreneurial schema and speed of organizational actions.....	180
Figure 10: The effect of social network heterogeneity on the relationship between entrepreneurial schema focus and diversity of organizational actions	181
Figure 11: The effect of social network heterogeneity on the relationship between entrepreneurial schema focus on speed of organizational actions	181
Figure 12: The effect of social network heterogeneity on the relationship between proactive causal logic and diversity of organizational actions	182
Figure 13: The effect of social network heterogeneity on the relationship between proactive causal logic and frequency of organizational actions	182

CHAPTER I: INTRODUCTION

The topic of new venture growth has emerged as an important area of inquiry in the last two decades. Achieving growth has different implications for new ventures than it has for established firms (Gilbert, McDougall and Audretsch, 2006). While established firms have already achieved a certain level of viability and survival, new ventures face various types of liabilities stemming from their size, age, and lack of functional and facilitating mechanisms such as resources which can significantly reduce their chances for survival and growth (Cooper, Gimeno and Woo, 1991; Gimeno et al, 1997). At the same time new and small firms face lower likelihoods of survival if growth is not present (Freeman, Carroll and Hannan, 1983). This often translates into a higher variance of growth rates at the new venture level as opposed to variance in established firms' growth where growth is often independent of size and age (Gilbert et al. 2006; Sutton, 1997). This makes the topic of new venture growth particularly interesting to study.

Prior studies have linked new venture growth to factors such as entrepreneur's characteristics, resources, strategy, industry and organizational structure and systems. Educational background (Sapienza and Grimm, 1997), industry experience (Eisenhardt and Schoonhoven, 1990; Cooper, Gimeno-Gascon and Woo, 1994) and prior start-up experiences (Baum et al., 2001) are examples of entrepreneur characteristics that have been analyzed in the context of new venture growth. Resources such as human and financial capital (Birley, 1987; Cooper et al., 1994) are considered necessary for entrepreneurs to execute their growth plans while their personal networks are essential in

establishing a certain level of legitimacy for the new venture (Ostgaard and Birley, 1996). In addition to individual and firm level factors, the stage of the industry, emerging or growing markets and industry velocity, have been found to have strong implications for new venture growth as well (Covin, Slevin and Covin, 1990; Eisenhardt and Schoonhoven, 1990). Furthermore there is increasing evidence that suggests that strategic factors (market related, competitive related and managerial) impact the survival and growth chances of new ventures (Bruderl, Preisendarfer and Ziegler 1992; Lieberman and Montgomery, 1988). However, studies directly linking strategy types to new venture growth have mostly produced equivocal results: this prompted scholars to argue for a contingency or “fit” perspective which takes into account resources and industry contexts, and which better reflects the relationship between strategy and new venture growth (Chandler and Hanks, 1994; Eisenhardt and Schoonhoven, 1990)

Despite these advances, a major weakness of prior studies on new venture growth is a lack of attention to the process leading to it. For example, though decisions made by entrepreneurs are thought to be important, most empirical studies link entrepreneurial characteristics or resources directly to growth outcomes. These studies have produced equivocal results (Gilbert et al, 2006) suggesting that perhaps neither resources nor strategies affect growth directly (Edelman, Brush and Manolova, 2005) and that other factors might intervene in the process of new venture growth. In short, the manner through which elements such as entrepreneurial characteristics, firm resources and industry characteristic influence the process of new venture growth is poorly understood.

Though process-oriented research has been limited, some recent research has emphasized the importance of adaptation for new ventures to achieve high performance

and growth (Bhide, 2000; Cooper, Gimeno and Woo, 1991; Nicholls-Nixon, Cooper and Woo, 2000; Slevin and Covin, 1997). This research argues for a departure from ecological approaches and from the planning school rooted in I/O economics in favor of a focus on internal processes. Adaptation through continuous adjustment of organizational systems and products has been advanced as a key component of the process of new venture survival and growth (Covin and Slevin, 1998; Miller, Lant, Milliken and Korn, 1996; Nicholls-Nixon et al. 2000). New ventures face high levels of uncertainty and ambiguity in their environments, and they have to choose from a continuously changing (fleeting) set of opportunities. Adaptation at the new venture level can thus be seen as a process of continuous change (Brown and Eisenhardt, 1997) in which fast and diverse actions related to a variety of internal and external dimensions could contribute to new venture growth.

Despite these important conceptual links between adaptation and growth, the literature on new venture adaptation is still in its infancy; adaptation or flexibility is often seen as a quality of the entrepreneur (Boccardelli and Magnusson, 2006; Pitt, 2000) or as an approach through which changes are made to the initial business ideas (Andries and Debackere, 2006). Aldrich and Martinez (2001: 25) call the lack of understanding of how young organizations adapt during the process of identifying strategic opportunities “the weakest point in the field of entrepreneurship”.

Adaptation processes have received a lot of attention in the strategic management literature where the focus has been on established firms and on explaining why managers initiate strategic change (Miller and Friesen, 1980; 1982), how the process progresses (Brown and Eisenhardt, 1997; Gersick, 1994; Tushman and Romanelli, 1985; Van de

Ven and Poole, 1995) and the organizational and environmental factors that influence it (Dutton and Dukerich, 1991; Greve, 1998; Kraatz and Zajac, 2001; Lant and Milliken, 1992). The emphasis on large established firms reveals processes of change and adaptation that usually imply the transition from one “steady-state strategy to another” (Nicholls-Nixon et al., 2000 p: 495). These works also imply a problem oriented perspective: firms change in response to potential threats to their current positions. In the context of new ventures, adaptation is less about moving from one existent strategy to another and more about the entrepreneur’s effort to reach a steady state for the first time by continuously experimenting and combining resources in creative and innovative ways (Stevenson, Roberts and Grousbeck, 1985; Woo et al, 1994). Adaptation processes at the new venture level can thus be seen as grounded in opportunity logic (Bingham and Eisenhardt, 2008) where growth may result by capturing opportunities faster, sooner and more effectively than competitors (Eisenhardt and Martin, 2000; West and Meyer, 1997).

In this dissertation I build on the view of adaptation as an *opportunistic* process (Bhide, 2000; Bingham and Eisenhardt, 2008; Miller et al., 1996; West and Meyer, 1997) and investigate its links to new venture growth. Opportunistic adaptation is a concept that is particularly appropriate for new ventures that are usually surrounded by high levels of uncertainty and ambiguity (Bhide, 2000). Opportunistic adaptation is driven not by crises in a firm’s environment but by the constant search for opportunities and by the day to day choices entrepreneurs make (Bingham and Eisenhardt, 2008; Brown and Eisenhardt, 1997 Miller et al, 1996). It is a process intrinsic to the entrepreneur (internally motivated) rather than driven by perceived threats and failures in the external environment. Opportunistic adaptation at the new venture level is different from natural selection

processes because it implies conscious entrepreneurial choices, imaginative variations and radical choices (Bhide, 2000).

Although previous entrepreneurship research analyzing new venture strategic behavior has developed *firm-level* constructs such as entrepreneurial orientation or entrepreneurial strategic-posture (Covin and Slevin, 1991; Lumpkin and Dess, 1996) in an attempt to capture a venture's propensity to act on market opportunities, these concepts do not fully capture the extent to which the process of opportunistic adaptation is dependent on the entrepreneur and his or her interpretation and information processing capabilities (Cooper et al., 1991; West and Meyer, 1997). The ability to recognize opportunity and to aggressively pursue it is most often ascribed to *individual* entrepreneurs. As such, this ability is fundamentally shaped by entrepreneurs and their perceptions (Klepper, 2002). Thus, entrepreneurial cognition in general, and more specifically the entrepreneurs' schemas, become particularly important as these are the direct result of how entrepreneurs experience and interact with the environment. Furthermore, entrepreneur's mental models can be directly linked to entrepreneurial behavior or action and are an important component in the process of opportunistic adaptation. Building on previous literature on managerial cognition and adaptation (Calori et al., 1994; Eden et al., 1992) this dissertation identifies cognitive complexity, proactive causal logic and focus as three dimensions of entrepreneurial cognition that are important for opportunistic adaptation.

Building on the above ideas the aim of this dissertation is to develop and test a process model of new venture growth by explaining the link between entrepreneurial cognition, entrepreneurial action and new venture growth given certain contingencies:

resources, social networks and the environmental context. More specifically, this dissertation hypothesizes that in the context of new firms, growth can be achieved through opportunistic adaptation. Opportunistic adaptation is seen as a process in which cognitive attributes such as complexity, focus of entrepreneurial schemas, and proactive causal logic are linked to specific organizational actions characterized by diversity, frequency and speed. I hypothesize that this relationship is strongly influenced by factors such as availability of resources, heterogeneity of social networks and the industry context.

Expected contributions of the thesis:

1. This study addresses current weaknesses in the new venture growth literature (Gilbert et al. 2006) related to a lack of focus on the *processes leading to growth*. To address this gap, I use opportunistic adaptation as a guiding mechanism to explain new venture growth. In the opportunistic model of adaptation, entrepreneurial cognition is seen as an antecedent of organizational actions, regardless of their characteristics and orientation. By focusing on a variety of entrepreneurial actions, this study attempts to move away from an exclusive focus on internally oriented actions or on organic growth (Delmar, Davidsson and Gartner, 2003) and by examining speed, frequency and diversity of organizational actions it provides new insights into how new ventures grow over time.
2. This dissertation's modeling of the new venture growth process as a function of the entrepreneur, resources and environmental constraints answers the call of recent new venture growth literature that argues for the *joint* consideration of entrepreneurial, market and resource related factors (cf. Covin and Slevin, 1998).

By considering the joint contribution of several distinct growth related factors and by linking them to entrepreneurial cognition and action this study advances an integrative model of the new venture growth process that can more fully explain new venture growth.

3. This dissertation contributes to the organizational adaptation literature by exploring the mechanisms on which opportunistic adaptation is based. By investigating how cognition facilitates fast, diverse and experimental actions and by analyzing several distinct contingencies of this relationship this dissertation contributes to the emerging stream of the organizational adaptation literature arguing for *opportunistic and experimental* adaptation processes as a departure from traditional reactive models (Bhide, 2000; Brown and Eisenhardt, 1997 Miller et al, 1996; Nicholls-Nixon et al., 2000).

This dissertation is organized as follows. Chapter II provides a review of the existing theoretical perspectives that have been applied to new venture growth research. Particular emphasis is devoted to clarifying the need for an integrative model that incorporates individual, organizational and environmental factors to explain new venture growth. Chapter II concludes with a summary of existing new venture growth research and includes a discussion of the research questions addressed by this dissertation.

Chapter III addresses each of the outstanding research questions listed in Chapter II. In section 3.1 I discuss existing research on organizational adaptation and growth by highlighting the fact that most of the existing research focuses on reactive models of organizational adaptation, driven by threats in an organization's environment, with a limited emphasis on proactive models of adaptation grounded in opportunity logic.

Section 3.1.1 discusses the cognitive view of organizational adaptation and emphasizes the need to adopt a cognitive perspective if we are to understand differences in the types of organizational actions that entrepreneurs are likely to initiate and their subsequent impact on new venture growth.

Section 3.2 introduces the main components of the model of opportunistic adaptation. Figure 1 presents a graphical depiction of how various attributes of entrepreneurial schemas shape the organizational actions entrepreneurs are likely to initiate and considers the joint influence of factors such as resource availability, industry context and heterogeneity of social networks. Sections 3.2.1, 3.2.2 and 3.2.3 introduce this dissertation's first set of hypotheses linking structural attributes of entrepreneurial schemas such as complexity, focus and proactive logic to speed, diversity and frequency of organizational actions. The subsequent sections (3.2.4, 3.2.5 and 3.2.6) recognize the importance of moderating factors such as resource availability, industry context and heterogeneity of social networks on the relationships between structural attributes of entrepreneurial schemas and organizational actions. Section 3.3 summarizes the hypothesized relationships between the main components of the model of opportunistic adaptation.

Chapter IV introduces the research sample, data collection methods, measurement, and analysis used to test the hypotheses introduced in Chapter III. Section 4.1 identifies the population of interest and highlights factors influencing sample selection. The next section (4.2) describes the data collection methods used as well as the procedures undertaken to insure the rigor and integrity of the data collection processes. Section 4.3 discusses the measurement of constructs.

Chapter V presents the data analysis process and the results of the statistical tests performed. The chapter is organized into three main sections. The first section (5.1) presents the data screening steps, the second section (5.2) presents the results for the first set of dependent variables (i.e. diversity, frequency and speed of organizational actions) and the third section (5.3) presents the results for the second set of dependent variables (i.e new venture growth).

The last chapter (Chapter VI) provides an overview of the findings presented in Chapter V and discusses their implications for theory, practice and future research. The chapter is organized into three parts. In section 6.1, I discuss the results of the study and their specific implications for management theory. In section 6.2, I discuss the general implications of the study for theory and practice. Section 6.3 presents limitations of the study and directions for future research.

CHAPTER II: LITERATURE REVIEW

In this chapter I review the various theoretical perspectives associated with new venture growth. The chapter comprises of two major sections. The first section provides an overview of the new venture growth literature. The main purpose of this section is to provide a clear conceptualization of the notion of growth and the factors associated with it and to summarize the key insights provided by various perspectives on growth. The second section focuses on unresolved issues in the literature. As such, this last section introduces the main research questions of the dissertation.

2.1 NEW VENTURE GROWTH

Approximately 600, 000 new ventures are formed in the United States each year. Most of them are out of business within five years, and only about 3% achieve high growth (Eckhardt and Shane, 2010). The question of why some new firms grow and most do not is thus a central question in the field of entrepreneurship (Bhide, 200; Delmar et al. 2003).

Growth is considered the main indicator of venture success (Baum, Locke and Smith, 2001; Slevin and Covin, 1997; Low and MacMillan, 1988) and has attracted considerable attention from scholars in entrepreneurship and strategic management (Delmar et al., 2003; Mata, 1994; Ostgaard and Birley, 1995; Siegel et al., 1993). Of the issues that are often debated in the literature on new venture growth, two have strong theoretical and empirical implications for this dissertation. First, is the issue of factors that enable or hinder new venture growth, and second, the issue of new venture growth

forms and measures associated with it. Each of these issues is discussed in greater detail in the sections that follow.

2.1.1 Scholarly Perspectives on New Venture Growth

Since the original theory of the growth of the firm (Penrose, 1959) scholars have suggested that factors both external to the organizations, such as the environment (Aldrich, 1990) and internal to the organization, such as resources and strategy (Wernerfelt, 1984; Zahra et al., 2000) explain the reasons for why some firms grow while others do not.

Growth is particularly important in new ventures. In the absence of growth, new firms are confronted with a lower likelihood of survival (Freeman, Carroll and Hannan 1983). Despite the importance of growth, new ventures are much less likely than established firms to achieve it. The higher rates of failure have been linked to a number of issues that are particular to new ventures. These issues are discussed below as they appear in each of the major perspectives associated with new venture growth. New venture growth related perspectives are presented in chronological order but can also be viewed as introducing different levels of analysis starting with a broad, population level of analysis and ending with the individual level of analysis. Table A summarizes the main contributions and limitations of each of the perspectives and the following sections discuss each perspective in greater detail.

Table A: Different perspectives on new venture growth

Perspective	Main contributions	Limitations
<i>Ecological</i>	Focus on the liabilities of newness and smallness that hinder new venture growth	A bias towards a deterministic view of all processes leading to growth, i.e. limited to no firm adaptation; Limited focus on actions and decisions related to growth
<i>Environmental (industry)</i>	Focus on various attributes of the environment(industry) such as munificence, dynamism, growth stage which impact new venture growth	Limited focus on growth related actions and decisions
<i>Strategic content</i>	Focus on the role of firm resources, firm strategy and their interaction and influence on new venture growth	Limited focus on growth related actions and decisions; Inconsistent empirical findings
<i>Entrepreneur characteristics</i>	Focus on the role of individual characteristics such as educational background, experience, age in new venture growth	The use of gross proxies to capture cognition; Linking individual characteristics to outcomes directly with no focus on actions Inconsistent empirical findings

2.1.2 The Ecological Perspective

Population ecology models (Carroll, 1983; Freeman and Hannan, 1983; Hannan and Freeman, 1977; 1984) provide potentially powerful explanations for organizational birth, evolution and mortality. These models are based on the Darwinian model of evolution which focuses on variation, selection, and retention. Central issues in this perspective are the role of structural inertia in constraining adaptation, the classification of organizational species and the important role of the environment in determining organizational survival and growth. According to population ecology models, selection of

new or changed organizational forms occurs as a result of environmental constraints and inertia stemming from a firm's sunk costs, communication structures, internal politics and the dominance of institutional norms (Hannan and Freeman, 1977). In the context of mature, established firms, internal inertial mechanisms are what lead to firms being selected out. In the context of new ventures, which lack these mechanisms, new venture age (newness) and size (smallness) become powerful selection mechanisms.

Liability of newness is one of the first concepts associated with both venture growth and survival, and venture failure (Stinchcombe, 1965). According to Stinchcombe, liability of newness suggests that new firms fail to grow because of the lack of resources and capacities that more established organizations have accrued. Limited resources make new ventures vulnerable to even slight inefficiencies and delays limiting their ability to shift to more favorable circumstances (Eisenhardt and Schoonhoven, 1990; Van de Ven, Hudson and Schroeder, 1984).

Liability of newness, and the disproportionately higher likelihood of failure associated with it (Hannan and Freeman, 1977; 1984) stems from several different areas. First, new ventures lack routines for efficiently obtaining and using resources, which translates into a need to develop new organizational roles and systems. New ventures operate at a disadvantage when compared to existing firms as they must incur costs to develop these routines or obtain their benefits through outsourcing (Nelson and Winter, 1982; Schoonhoven, Eisenhardt and Lyman, 1990).

Second, new ventures lack a "track record" with external suppliers, buyers and customers. This lack of history with key constituencies translates into an absence of trust and legitimacy that makes new ventures more vulnerable to opportunism and forces them

to often rely on relations with partners that they have limited knowledge on (Goldberg, Cohen and Fiegenbaum., 2003; Stinchcombe, 1965).

Third, the relative scarcity of social capital (Davidsson and Honig, 2003) and the inability of entrepreneurs to effectively leverage it, because they do not always understand means-end relationships in their markets, (Van de Ven et al, 1989) also negatively affect new venture survival chances. Often, social capital is the main link to those resources necessary for growth and survival () and new ventures operate at a disadvantage if they engage in entrepreneurial activities without the support that social linkages provide (Morse, Fowler and Lawrence, 2007). Social networks are the antecedent to future business networks which are crucial for firm survival and growth (Dubini and Aldrich, 1991; Johannisson, 1998; Lechner and Dowling, 2003; Raz and Gloor, 2007). Both strong ties and weak ties are important at first, but in time, weak ties become more important because they offer new growth options in both domestic and international markets and they do not carry the same constraints and expectations on entrepreneurs' choices as strong ties do (Kiss and Danis, 2008).

Finally, new ventures are also confronted with a lack of financial capital that makes them more vulnerable to financial stress derived from harsh price competitions or economic downturns (Oviatt and McDougall, 1994; Vesper, 1990). The norm for new ventures is thus resource dependency rather than resource sufficiency (Steensma et al., 2000).

Despite these difficulties, some new ventures do gain access to important resources that can lead to growth. The two resources examined most often and found to be strongly related to new venture growth are financial capital and human capital.

Financial capital influences sales and employment growth in new firms (Cooper et al., 1994; Lee, Lee and Pennings, 2001) and it allows entrepreneurs to successfully execute and change strategies. As Zahra and Bogner (2000) showed, access to financial resources also translates into a greater flexibility to support a variety of strategic options and to secure subsequent funding from a variety of sources, beyond the personal resources of the entrepreneurs. Growth can thus be secured through funds borrowed from governmental institutions (Dahlqvist, Davidsson and Wiklund, 2000), banks or venture capitalists (Lee et al., 2001) and relatives or friends (Berger and Udell, 1998).

Human capital, or the capabilities and skills of firm employees, allow entrepreneurs to realize their growth objectives (Chandler and Hanks, 1994). Studies focusing on the role of human capital in facilitating growth have shown that human resource needs change as the firm progresses from start-up to mature firm or as the strategic direction of the firm changes (Birley, 1987; Thakur, 1999). For example, Cardon (2003) argues that new ventures should rely more on highly skilled workers than mature firms and should staff ahead of time to sustain expansion.

A second selection mechanism discussed in ecological approaches to growth in new ventures is *the liability of smallness* (Carroll, 1983). Ecological studies have demonstrated that the size of an organization influences its chances of survival and growth (Aldrich and Auster, 1986). According to Aldrich and Auster (1986) the liability of smallness emerges from the lack of financial resources and the lack of strong financial support from creditors due to a heightened perception of risk associated with small size (Brush, Greene and Hart, 2001). Smallness has also been associated with more acute managerial weaknesses stemming from a lack of insight into alternative avenues for

growth and limited employee support but also an unwillingness to promote and empower employees due to a limited ability to attract and retain qualified, diverse and competent personnel (Chowdury and Lang, 1996). Smallness is often coupled with newness but not all organizations are born small, and the effects of newness on growth and survival are usually stronger (Aldrich and Auster, 1986); large size does not eliminate liability of newness.

Previous research has argued that the liabilities of newness and/or smallness can be mitigated by implementing appropriate organizational systems. For example, Kazanjian and Drazin (1990) argue that functional specialization is important for growth because it allows individuals to gain expertise in certain areas and gives them the ability to handle various circumstances that arise as the firm grows. Functional specialization has also been associated with higher levels of environmental scanning leading to better opportunity recognition and more innovative product introductions (Box, White and Barr, 1993; Olson and Bokor, 1995). Flexible, decentralized decision-making structures have been associated with higher levels of new venture growth (Kazanjian and Drazin, 1990).

As is evidenced in the discussion above, literature in the ecological perspective has contributed to our understanding of new venture growth by first establishing its importance for firm survival and then in identifying two major liabilities to the process of growth – smallness and newness. It has also played an important role in the body of work that focuses on identifying some of the factors related to growth such as resources, social networks and organizational systems.

In spite of these important contributions, a major weakness in the ecological literature is its lack of attention to the role of organizational actions and decisions related

to growth. Due to a strong emphasis on inertial mechanisms that inhibit organizational adaptation, the ecological literature represents a deterministic approach to adaptation and does not focus on firms that proactively pursue opportunities in their environments. This results in an incomplete picture of the process associated with new venture growth.

2.1.3 The Environmental Perspective

An accepted tenet in organizational research is that the context or the environments to which firms need to adapt are multidimensional and pose varying sources of challenges for organizations (Carter, 1990; Dess and Beard, 1984; Duncan, 1972). These challenges become even more important when added to the liabilities of newness and smallness that new firms face. Variables such as industry stage or growth, environmental hostility or geographic location have been advanced as sources of explanation for variations in new venture growth outcomes. The following sections discuss each of these dimensions in more detail.

a) Industry growth

Growing or emerging markets have been found to have a significant positive effect on new venture growth in both early and recent studies on this topic (Brush and Chaganti, 1998; Covin, Slevin and Covin, 1990; Chandler and Hanks, 1994; Eisenhardt and Schoonhoven, 1990; McDougall et al., 1994; Robinson and McDougall, 2001). Growing markets represent munificent environments that allow new firms to secure much needed resources while also being less taxing on various strategy mistakes new firms are prone to making. However, a growing or emerging industry is usually not enough to promote new venture growth; strategic factors play a significant role as well. For example Sandberg and Hofer (1987) found that early-stage markets and broad strategies are

positively related to sales and employment growth while later-stage markets and focused strategies lead to higher sales growth. New ventures competing in growing environments have greater opportunities to adapt their products and services to niches in the market that might lead to growth in sales (Koberg, Uhlenbruck and Sarason, 1996; Siegel et al., 1993).

b) Environmental hostility

Environmental hostility is another dimension that has been included in studies that focus on new venture growth (Nicholls-Nixon et al., 2000; Zahra and Bogner, 2000). Hostility captures the extent to which the firm is threatened by intense interactions with competitors and volatility in the firm's principal industry (Miller and Friesen, 1983). A hostile environment negatively influences venture employment and market share growth. High levels of competition in the venture's industry (Baum et al., 2001), and its capital requirements (Robinson and McDougall, 2001) are examples of environmental hostility dimensions that have been found to have a significant impact on new venture growth.

c) Environmental dynamism

Environmental dynamism reflects both the rate at which the environment changes and also the extent to which changes are difficult to predict (Dess and Beard, 1984). These changes are related to entry and exit of competitors, changes in customers' needs or technological shifts that create opportunities and threats and prompt entrepreneurs to focus on rapid new product introductions (Porter, 1983). For example, Zahra and Bogner (2000) analyzed the impact of a highly dynamic environment, the software industry, on new venture performance and growth and showed that only those new ventures that

invested in radical new product introductions and upgrades consistently outperformed competitors.

d) *The local environment*

The local environment may also be critical for new venture growth (Romanelli and Schoonhoven, 2001). An increasing number of studies look at clusters and at the geographic region as important factors in the process of growth (Folta, Cooper and Baik, 2006; Lechner and Dowling, 2003; Saxenian, 1990; 1994). For example, Folta et al., (2006) showed that new firms that compete in high-clustering locations are more likely to fail than firms competing in other locations because of the added competition they face in their efforts to procure resources. An inability to procure the resources needed for survival has a strong impact on subsequent growth. Thus, a geographic location that facilitates access to these resources becomes extremely attractive.

Others (e.g. Saxenian (1990; 1994); Larson, 1991), however, have shown that areas like Silicon Valley offer new firms access to financial capital necessary to finance firm growth that is not available in other regions like inner cities (Porter, 1995) or rural areas (Green and McNamara, 1987). Cluster regions have also been found to provide better access to human capital (Hanson, 2000; Porter, 1995 Saxenian, 1994). Highly skilled workers or workers with specific competences may often be found in cluster regions. Start-ups that successfully attract these workers can more readily pursue venture growth objectives (Baum et al., 2001; Chandler and Hanks, 1994; Saxenian, 1990).

All in all the context perspective on new venture growth helps us understand that new firms cannot be analyzed in dissociation from the environments in which they compete. A host of variables ranging from environmental hostility to geographic location

have been identified as significant influencers of growth related outcomes. Even though the important impact of these factors has been established, there are some questions left unanswered as to *why* the context matters. A process approach that takes into account the relationship between firm action, the individuals that run it and the environment in which the firm competes would reveal how contextual variables influence growth related outcomes. However, process approaches in this stream of the literature are scarce and the new venture adaptation-growth relationship is thus only partially complete.

2.1.4 The Strategic Content Perspective

The content perspective of new venture growth encompasses works that focus on the general impact of strategy type (focus, differentiation, low-cost) on new venture growth, studies that focus on the impact of distinct factors such as resources on new venture growth, and studies that take contingency based approaches when explaining new venture growth.

Studies that have considered new venture strategy as a direct factor in the process of new venture growth have yielded mixed results. For example, Baum, Smith and Locke (2001) found that low-cost and focused strategies negatively impacted sales and employment growth in a sample of manufacturing firms, while differentiation strategies led to positive outcomes on venture sales and employment. These results contradict earlier studies (e.g. Siegel, Siegel and MacMillan, 1993) which found that focused strategies yielded the most positive impact on sales growth. These differences in results seem to stem from the fact that authors use different measures of growth (sales versus employment) and take a different temporal perspective: some focus on the short-term

effects of strategies on growth whereas others focus on their long-term effects (Gilbert et al., 2006).

The literature that has considered the impact of slack resources on new venture growth builds on the seminal work of Penrose (1959). This literature is based on the assumption that resources controlled by a firm are rarely fully utilized and that the existent slack creates both incentives and means of expansion. Subsequent empirical work has offered some support for this assertion by exploring the links between resource slack and exploratory type of activities (e.g. (Kraatz and Zajac, 2001; Nohria and Gulatti, 1996). However, recent works focusing exclusively on new ventures or small firms argue that slack has a negative effect on exploration and leads to cautious decision-making, risk aversion and an administrative approach to firm management as opposed to an entrepreneurial approach (cf. Mishina, Pollock and Porac, 2004; Tang and Peng, 2003; Bradley et al., 2010). Still others fail to find any relationships between slack and growth (Voss et al. 2008).

A different stream of studies suggests that the relationship between growth and strategy is contingent on factors such as the availability of resources to execute various strategies (Chandler and Hanks, 1994; Eisenhardt and Schoonhoven, 1990), the stage of the industry development (McDougall et al., 1994) or the order in which ventures enter the market and the breadth of their product line (Sandberg and Hofer, 1987). In their comprehensive study of U.S. semiconductor firms Eisenhardt and Schoonhoven (1990) show that successful new firm adaptation -as reflected in sales growth- is better explained through a combination of strategic choice (top-management effects) and environmental determinism, more so than as market strategy.

The main contribution of the content perspective on our understanding of new venture growth lies in the fact that it draws attention to the need to take an integrative approach when explaining new venture growth by simultaneously considering firm and industry related factors. The content perspective on growth can be viewed as building on and integrating the ecological and contextual perspectives by often incorporating variables such as environmental hostility or firm age and size into models that predict growth. The main weakness of this approach stems from its inconclusive results due to measurement issues and the reduced explanatory power of strategy variables when contextual or ecological derived variables are included in the models. These results leave a host of unanswered questions related to how specific dimensions of the industry and the firm are linked and influence new venture growth related actions and outcomes. Another weakness of the content approach is that it provides limited insight in the process of adaptation that precedes new venture growth by focusing only on a limited range of industry and firm related factors that influence new venture growth.

2.1.5 The Entrepreneur Characteristics Approach

Prior research on the topic of growth has also examined the role played by the entrepreneur. In a fashion similar to the upper echelons perspective in which corporations are regarded as a reflection of their top managers (Hambrick and Mason, 1984), new ventures are often regarded as extensions of the entrepreneurs. The entrepreneur's personality traits, motivations, attitudes and intentions have all been linked to growth. For example, personal predispositions such as need for achievement (McClelland, 1965) or locus of control (Boone, DeBrabander and Van Witteloostujin, 1996; Rotter, 1966) have been found to impact venture success.

Early studies linking entrepreneurial characteristics to growth related outcomes have often produced equivocal or weak results. For example, Johnson's (1990) meta-analysis concluded that need for achievement was one of the most significant trait predictor of new venture performance, however less than 7% of the variance in new venture performance was explained by this factor. Traits such as risk-taking propensity (Brockhaus, 1980) or locus of control (Sexton and Bowman, 1986) had negligible effects on new venture growth: this prompted scholars to declare the study of entrepreneurs' characteristics a dead-end strategy (Gartner, 1989). However, recent studies (e.g. Baum et al., 2001; Baum and Locke, 2004) show that entrepreneur characteristics have an indirect rather than a direct impact on the growth of firms.

Factors such as prior related industry experience (Baum et al. 2001; Box et al., 1993; Cooper, Gimeno-Gascon and Woo, 1994; Eisenhardt and Schoonhoven, 1990; Siegel et al., 1993), prior start-up experience (Baum et al., 2001; Box et al., 1993) and educational background (Sapienza and Grimm, 1997) have been shown to have direct effects on the sales and employment growth of the firm.

Education and background experience are important because they enable entrepreneurs to obtain and use information and knowledge relevant to the new venture (Kirzner, 1983) and they provide competencies that influence the decision-making process (Mullins, 1996; Scherer, Adams and Wiebe, 1989). Prior related experience or start-up experience provides access to tacit knowledge and capabilities which reduce the time needed for the new venture to achieve growth (Cooper et al., 1994). Chrisman, McMullan and Hall (2005) showed, however, that too much knowledge promotes rigidity

and works against the fast adaptation processes that new firms often need to be engaged in and thus negatively impacts new venture growth.

New ventures are often founded and run by teams of entrepreneurs and team related characteristics such as tenure, heterogeneity or size have also been investigated in new venture growth related studies. For example, Eisenhardt and Schoonhoven (1990) showed that background heterogeneity and the number of the individuals involved in the founding process are positively related to sales growth. A large team means that responsibilities are distributed across a greater number of individuals while the cohesiveness that exists between team members makes communication easier (Ensley, Pearson and Amason, 2002). Team diversity as a result of differences in age, education and functional expertise may lead to disagreement regarding goals that need to be pursued or means to achieve them but may also alleviate the phenomenon of groupthink (Lant, Milliken and Batra, 1992) and provide interesting, new opportunities for the firms to pursue (West and Meyer, 1997; Amason et al., 2006; Eisenhardt and Bourgeois, 1988; 1989). Team diversity has also been found to negatively impact decision speed (Miller, Burke and Glick, 1998) and, to the extent that firms compete in high velocity environments, might indirectly impact new firm competitiveness (Forbes, 2005).

Taken as a whole, the entrepreneur characteristics approach has the merit of pointing out several links between individual related variables such as prior experience or educational background and growth related outcomes. However, linking traits or attitudes directly to outcomes has lead to weak or inconclusive results thus leaving unanswered questions regarding the actual influence of individual level variables on new venture growth. By linking individual characteristics directly to outcomes scholars have omitted

the important middle ground made of growth related, organizational actions. As prior research in strategic management has shown (West and Schwenk, 1996), demographic characteristics do not always capture managerial (entrepreneurial) mindsets and alternative approaches that capture mindsets in use are needed. Although entrepreneurial cognition has been linked to new venture initiation processes, a cognitive approach to the process through which new ventures grow is currently missing. By including entrepreneurial cognition in models that use firm and industry level variables to predict new venture growth, we gain a new appreciation of the nature of relationship between individual, firm and industry in predicting new venture growth.

2.1.6 Forms of New Venture Growth

The concept of growth is multidimensional in nature (Delmar et al., 2003) and the heterogeneity of growth outcomes across firms is often attributed in the new venture growth literature to variations in the type of growth strategies that firms pursue.

Internal or organic growth refers to growth resulting from innovative product and marketing-related practices that result in the introduction of new products and/or services (Amason, Shrader and Thompson, 2006; Gilbert et al., 2006). Product innovations refer to both novel and incremental innovation. Novel product introductions are, however, more strongly associated with new venture growth performance than incremental developments (Banbury and Mitchell, 1995; Bruton and Rubanik, 2002). Successful internal growth at the new venture level is supported by investments in strong technological capacities and appropriate product development strategies (Siegel et al., 1993; Stuart, 1999; Zahra and Bogner, 2000).

External growth or growth that occurs through acquisitions, reflects an approach that emphasizes acquisition of competencies and extensions of product and service offerings through the pursuit of firms in related or complementary markets. High or rapid-growth ventures in particular, are likely to pursue growth through acquisitions (Delmar et al., 2003; Hambrick and Crozier, 1985). By acquiring existing firms, new ventures can benefit from the reputation that the target firms have established in the market and they can increase their market share (Banbury and Mitchell, 1995). However, previous research has shown that acquisition activity has a direct impact on growth only when growth is measured through employment and not necessarily through sales (cf. Delmar, 2003).

Growth that results from internal or external mechanisms has different outcomes and, as noted by Penrose (1959), can also impact the speed or regularity with which growth occurs. Internal growth is more consistent but also slower than external growth. Internal growth through new product introductions may be immediately reflected in sales but not necessarily in the firm's market share or employment growth. In contrast, external growth can simultaneously affect growth sales and market share or just employment growth (Gilbert et al., 2006).

A second type of classification that can be made when investigating new venture growth is international versus domestic growth (Gilbert et al., 2006). Comparative studies on this topic are still scarce although there has been an increase in the number of new ventures that pursue internationalization from inception (e.g. McDougall, 1989) in the past decades. International activities are seen as important for new venture survival and growth, allowing firms to pursue opportunities or create entirely new markets for their

products abroad (McDougall, 1989; McDougall, Oviatt and Shrader, 1996; Oviatt and McDougall, 1995). Comparisons of domestic and international new ventures reveal different impacts on growth outcomes. For example McDougall, Oviatt and Shrader (1996) found that international new ventures outperformed domestic new ventures in terms of sales growth but not employment growth. Growth outcomes are also influenced by the type of market expansion strategies used by new ventures or by the mode of entry chosen. Market penetration strategies assume that large volumes of products are sold in the international market by investing in heavy advertising programs and local partners while market development strategies refer to reactive type of responses in approaching international markets (Gilbert et al., 2006). Ventures that internationalize through export and licensing may expect immediate impacts on their sales (Brouthers and Nakos, 2004) while ventures using foreign direct investment or joint ventures may expect changes in their employment growth (Zahra and George, 2002). The distinction between international and domestic expansion is important to fully understand new venture growth.

In summary, understanding the various forms of growth that firms pursue is important when building a model of the various antecedents of new venture growth and linking them to the appropriate growth related outcomes; it allows us to accurately identify organizational actions and the firm and industry related factors that have the potential to impact different areas of the firm as captured through different growth indicators.

2.2 CONCLUSIONS AND RESEARCH QUESTIONS

This chapter outlines and discusses the various perspectives associated with new venture. Although each of these perspectives reveals key insights, they do not identify the process associated with new venture growth. As such, existing perspectives are more valuable for understanding the broad factors that affect growth than for understanding the complex process that leads to new venture growth. In the next section, I provide a summary of the key insights emerging from this body of research, then discuss unresolved research issues and introduce the research questions that direct this dissertation.

2.2.1 Contributions of Existing Research

First, early studies on this topic, have built on population ecology and environmental contingency approaches, to identify a series of limitations, such as liabilities of smallness and newness that new ventures face. These perspectives have established the important role of growth in building viability for these firms. The focus on the issues of liability of newness and smallness is important because it provides a basis from which a range of growth-oriented actions can be assessed and a variety of growth supporting factors can be identified.

Second, prior research has demonstrated that a host of factors, ranging from entrepreneurs' characteristics to industry context and access to resources and social networks, influence new venture growth. This body of research is important not just because it empirically validates several direct links between these factors and new venture growth, but also because it points to the need to approach the topic of new venture growth through contingency approaches. Future research should thus take into

account the interactive, moderating effects that various factors have on new venture growth.

Finally, prior studies on this topic have also identified various forms of growth that new ventures can pursue. Recognizing that different mechanisms are involved in the organic and domestic processes of growth and in external and international process of growth is a step towards clearly separating these mechanisms and linking them to various growth related outcomes. Attempts to explain this impact still yield conflicting results due to inconsistencies in the measurement approach and suggest that future studies should focus on linking growth mechanisms with the appropriate growth related outcomes. More specific research issues that remain to be solved and that can contribute to the future development of the new venture growth literature are identified in the following section.

2.2.2 Unresolved Research Issues

As noted earlier in this chapter, one of the goals of research on new venture growth is to develop models that both describe and predict complex patterns of actions and factors that contribute to new firm growth. A review of this literature suggests that although some progress has been made in this direction there remain several unresolved issues.

First existing research has not succeeded at revealing a *holistic, integrative* model that incorporates individual, organizational and environmental factors as determinants of growth. Although existing research has identified several broad factors that influence new venture growth, these factors have been studied independently. As a result, we have little understanding of how they work together to influence new venture growth. A more

predictive model of new venture growth should consider the interplay of individual, organizational and environmental factors and their relationship to growth related actions.

Second, most research on new venture growth has exhibited a bias toward ecological models that take a deterministic stance on the growth issue with comparatively limited interest towards the adaptation process that precedes growth. Therefore, the literature lacks insight into how individual, organizational and environmental factors interact to influence specific growth related actions. Although ecological models have been useful in identifying important liabilities that might hinder adaptive processes at the new venture level, the context perspective or the entrepreneur characteristics approach has revealed the existence of factors that might encourage adaptation. This has created a disconnect between the various perspectives on growth which can only be solved through an integrative approach.

Finally, prior research has sought to link the effect of the entrepreneur on new venture growth through the use of gross level proxies for cognition. The equivocal results associated with this stream of research suggest that the literature still lacks an appreciation for how cognitive factors shape this process. An explicit focus on various dimensions of entrepreneurial cognition will allow this dissertation research to examine the untested assertion that entrepreneurial cognition is at the heart of various entrepreneurial processes including growth (Mitchell et al., 2004). Research in the strategic management literature has shown that clear links between cognition and action exist (Barr et al., 1992; Walsh, 1995); top-managers' schemas have been found to influence the strategies utilized to navigate various competitive landscapes (Day and Lord, 1992), and to predict the adoption of new organizational forms (Fiol, 1989) or the

introduction of novel technologies (Ginsberg and Venkatraman, 1992). Thus a focus on entrepreneurial cognition, as opposed to characteristics, may explain why certain new ventures pursue organic growth, or more internally related actions, while others pursue growth through acquisitions or externally related actions and still others pursue both; it could also help explain the differences in the speed and frequency with which these actions are pursued and the diversity of actions pursued.

In this dissertation I argue that opportunistic adaptation is the primary process through which new ventures grow. Opportunistic adaptation refers to actions related to various areas of an organization (human resources, marketing, finance etc) and more specifically to the speed, the diversity and frequency of these actions, that entrepreneurs take based on how they interpret information received from the environment. Entrepreneurial cognition is thus viewed as an antecedent to organizational actions leading to growth. Accordingly and to further our understanding of the processes that enable new venture growth I develop a model where various dimensions of entrepreneurial cognition influence the types of growth related actions that entrepreneurs take. I further suggest that this relationship is moderated by a firm-level and industry-level factors. In short, and consistent with the overall goal of growth related research to provide a holistic model of new venture growth, I suggest that a focus on fine-grain aspects of the link between entrepreneurial cognition and growth-related actions is critical for the advancement of the field.

Accordingly this dissertation research is guided by the following fundamental research question: How is growth achieved in new ventures?

The specific research questions are listed below:

1. What is the process associated with new venture growth?
2. What role does entrepreneurial cognition play in the process associated with new venture growth?
3. How are various dimensions of entrepreneurial cognition linked to growth related actions?
4. What role do factors such as resource availability, social networks, and the environmental context play in the process associated with new venture growth.

CHAPTER III: THEORY DEVELOPMENT. MODEL AND HYPOTHESES

In this chapter I build on existing research on organizational adaptation and managerial cognition to introduce the main components of a model of opportunistic adaptation. The chapter is organized into three major sections. The first section emphasizes organizational adaptation processes as they are presented in the strategic management literature and their links to adaptive processes at the new venture level. The second section introduces the model and develops hypotheses linking entrepreneurial cognition to various actions conducive to growth. The third section develops hypotheses linking moderating factors to entrepreneurial cognition and growth related actions to develop an integrative model of the process that leads to new venture growth.

3.1 ORGANIZATIONAL ADAPTATION

Organizational adaptation refers to the process by which managers adjust their organizations to meet various environmental demands. The process typically involves monitoring the external environment, diagnosing issues, allocating resources and adjusting strategies and structures through actions that are aimed at achieving both external and internal fit (Miller et al., 1996; Siggelkow, 2001). Adaptation can thus be regarded as an organization's response to changes in the external environment of the organization (Chakravarthy, 1982; Hrebiniak and Joyce, 1985; Kraatz, 1998; Miller and Friesen, 1980) or to changes in the internal systems of the organization (Marginson, 2002; Rouleau, 2005). Organizations may also simultaneously respond to both external and internal pressures for change (Siggelkow, 2001; Siggelkow and Levinthal, 2005).

3.1.1 Models of Adaptation

Scholars in strategic management have sought to understand how organizations adapt their strategic repertoires in order to compete successfully, achieve performance and/or *grow*. They have suggested models of adaptation that take into account the type of environments in which firms compete (e.g. stable or turbulent) (Brown and Eisenhardt, 1997; Hannan and Freeman, 1984; Miller et al., 1996; Tushman and Romanelli, 1991) the pressures for change that firms are exposed to (e.g. internal or external) (Greenwood and Hinings, 1993; Tan and Tan, 2005) and the timing and magnitude of organizational change (e.g. continuous or punctuated equilibrium) (Brown and Eisenhardt, 1997; Gersick, 1994; Miller et al., 1996; Romanelli and Tushman, 1994; Tushman and Romanelli, 1985). Since this dissertation builds on arguments related to continuous models of adaptation, it is useful to review some of the works that focus on the timing and magnitude of organizational change in general and on continuous change in particular.

The research focusing on the timing and magnitude of change is divided in two distinct streams. The first stream, referred to as punctuated equilibrium, argues that adaptation or change processes occur through periodic, on-time corrections (Gersick, 1994; Romanelli and Tushman, 1994; Tushman and Romanelli, 1985). Organizations evolve through long periods of stability in their basic pattern of activities followed by short bursts of fundamental change often triggered by environmental forces. For example Romanelli and Tushman (1994) showed that organizational change in the microcomputers industry was accomplished through rapid and discontinuous changes over important domains of the organization such as organizational structure, strategy and power distribution, and that small change in strategies and practices did not accumulate to produce fundamental transformations. Instead, major environmental transformations and CEO succession influenced these transformations. This perspective of organizational adaptation is

based on the logic of response; stasis is the assumed norm and adaptation is viewed as occurring relatively infrequently and only in response to a significant disconnect between the firm and its environment.

The second stream is grounded in a more proactive logic and suggests that processes of adaptation/change are continuous and dynamic (Brown and Eisenhardt, 1997; Miller et al., 1996; Winter, 2003). Continuous change requires flexible organizational forms and explicit organizational practices that simultaneously address the past, present and future time horizons: this allows rhythmic adaptations to frequent environmental changes (Brown and Eisenhardt, 1997; Eisenhardt and Brown, 1998). Limited organizational structures and extensive communication encourage learning and creativity in these types of environments and improves top managers' abilities to rapidly spot and respond to opportunities in the environment (Brown and Eisenhardt, 1997). Building on previous work in economics (Jacobson, 1992; Kirzner, 1979; Schumpeter, 1934; 1942), scholars who focus on processes of continuous change view them as being driven by opportunity logic (Bingham and Eisenhardt, 2008; Brown and Eisenhardt, 1997; 1998; Miller et al; 1996).

The logic of opportunity is defined as a strategic approach through which competitive advantage and superior performance are the result of entrepreneurial actions designed to capture attractive, fleeting market opportunities faster, sooner and more effectively than competitors (Bingham and Eisenhardt, 2008; Eisenhardt and Martin, 2000). An assumption of high-velocity environments underlies the opportunity logic and suggests that organizations should maintain simple and flexible organizational systems which allow them to adapt to market conditions faster (Davis, Eisenhardt and Bingham, 2007; Miller et al; 1996). It also suggests that, in environments characterized by abundant flows of unpredictable and ambiguous information, executives need to

rely on heuristics- simple rules- that provide behavioral shortcuts and improve the speed of decision making and action (Eysenck and Keane, 1995; Zimbardo and Gerrig, 1999).

Change as a continuous and proactive process is particularly important in the new venture context because this is a context characterized by high levels of uncertainty and ambiguity requiring a high degree of experimentation, trial-and-error learning and improvisation (Nicholls-Nixon et al., 2000; Miller et al., 1996). Not only do new ventures face ambiguity and uncertainty internally, but due to the absence of buffering mechanisms they also face considerable environmental turbulence and uncertainty (Miller et al., 1996; Miller and Friesen, 1982). In new ventures, adaptation is more critical than at any other stage in the life-cycle as the survival and growth of new firms hinges on their ability to quickly process information from the environment and make rapid adjustments in their activities (Pitt, 2000). Whereas organizations that are at a later stage of the life-cycle might rely on strong social and cultural mechanisms to buffer environmental turbulence, new firms are at a higher risk of failing to adapt due to immature and undeveloped organizational systems and networks.

Similar to research on continuous change in the strategy literature, previous research that examines change processes (Nichols-Nixon et al., 2000; Woo et al, 1994) in the context of new ventures and the impact of these processes on new venture performance has suggested that, for the most part, new ventures use a process of “strategic experimentation” (Nicholls-Nixon et al., 2000 p:496) or “opportunistic adaptation” (Miller et al., 1996 p:865) characterized by a series of trial-and-error changes over relatively short periods of time. Adaptive processes are thus iterative and they involve purposive actions aimed at probing the environment and the organization (Miller et al., 1996; Rajagopalan and Spreitzer, 1997).

Opportunistic adaptation is a departure from reactive strategic change processes engaged in by firms competing in more stable environments or by firms that are at a more advanced stage in the life-cycle, which often involve the realignment of an existing strategy. In contrast, opportunistic adaptation focuses more on creating a coherent competitive approach for the first time through exploration of a wide variety of alternative goals, activities and modes of operation (Miller and Friesen, 1982; Miller et al., 1996). Authors have further suggested that opportunistic adaptation is the result of a process in which “trial-and-error learning activities associated with strategic experimentation are part of a process whereby entrepreneurs build schemas that enable them to make sense of their competitive environments” (Nichols-Nixon et al., 2000 p: 497). However, there have been no further attempts either theoretically or empirically to explore the links between entrepreneur’s mental models and the organizational actions that they take. Substantial progress has been made however in the area of cognition and adaptation in the strategic management literature. The next section reviews arguments related to the cognitive view of organizational adaptation.

3.1.2 The Cognitive View of Organizational Adaptation

Building on the behavioral theory of the firm, the cognitive view of organizational adaptation asserts that managers make strategic decisions based on mental models and heuristics that they use to simplify the complex and unstructured problems they face (Bartunek, 1984; Daft and Weick, 1984; Kiesler and Sproull, 1982). Mental models or schemas are cognitive structures that represent organized knowledge about a given concept and contain both attributes of the concept and the relationships among the attributes (Daft & Weick, 1984; Fiske and Taylor, 1991). Schemas develop over time through experience, vicarious learning and direct communication from others (Fiske and Taylor, 1991). Individuals build their mental models

based on how they interact with the environment and with others. They then use these models to make sense of future interactions.

Schemas invoke memory, provide knowledge, specify relationships and lead to outputs by making predictions and inferences and initiating behavior; they also provide a framework for a person to enact his or her environment (Weick, 1979). Galambos, Abelson and Black (1986) argue that mental models affect each of the components of the sensemaking process. They influence what is being noticed and interpreted and reveal actions that could be taken. At the managerial level, schemas help in problem articulation and information organization thus enabling issue understanding and explanation and outcome prediction (Starbuck and Milliken, 1988). The mental models of strategists are particularly important because they influence decision making and direct organizational actions (Barr et al., 1992; Walsh, 1995).

There are several distinct streams in the literature on cognition and adaptation. The first stream refers to studies that focus on responses to environmental turbulence (Barr et al., 1992; Meyer, 1982; Bartunek, 1984). A second stream is represented by studies that focus on high velocity environments and the decision making processes associated with these (Bogner and Barr, 2000; Bourgeois and Eisenhardt, 1988; Brown and Eisenhardt, 1997; Eisenhardt, 1989). Finally, there are studies that focus on how organizations adapt by changing the interpretations of various stakeholders (Corley and Gioia, 2004; Gioia and Chittipeddi, 1991; Rindova and Kotha, 2001).

Studies in the first two streams are particularly important for the purposes of this research because they establish clear links between managerial cognition and firm action. For example, in his pioneering study on the adaptation of hospitals to an external change, Meyer (1982) was the first to show the primacy of managerial mental models over structural and strategy related

variables in guiding adaptation behaviors. Meyer (1982) was able to show that differences in the adaptation responses to a month-long physicians strike were the result of differences in the “power holders’ beliefs” as reflected in the organization’s ideology.

Meyer’s study generated interest in the role of managerial cognition in organizational adaptation. Subsequent studies on this topic (Bartunek, 1984; Burgelman, 1994; Dutton and Dukerich, 1991) were directed towards developing a better understanding of how interaction among different organizational members and different interpretive frames influenced organizational response to issues over longer periods of time. The focus of these studies has been on linking cognitive frames and interpretations to the timing and/or content of response to significant environmental events. Some of these studies have uncovered the inertial properties of cognitive frames by highlighting the fact that schemas used to interpret various changes and events in the environment are relatively stable in time and sometimes lead to rigidity in adaptive responses. For example, Tripsas and Gavetti (2000) explained Polaroid’s failure to respond to changes in the imaging technology from film based to digital, to the founder’s belief that profitability followed from the sale of disposables rather than digital cameras and he did not exploit the digital technology that Polaroid labs had developed. Thus, adaptation to new market conditions was not successful.

Other works have traced timely adaptation to changes in cognitive frames. For example, Barr, Stimpert and Huff (1992) studied the mental models of the top managers of two US railroad firms amidst a radical industry decline from 1943 to 1973 and showed that changes in organizational action are related to changes in mental models. The study also highlights the fact that successful organizational adaptation is not necessarily the outcome of noticing changes in the environment but of linking these changes to firm strategy in a timely manner. This was

attributed to a process of continuous experimentation and learning in which managers at one of the railroads were engaged.

Another stream of research highlights the link between interpretive output – how events are labeled- and response. This research builds on the seminal work of Dutton and Jackson (1987) which theorizes that differences in the magnitude and shape of managerial responses are related to whether issues are framed as a threat or as an opportunity. The issue categorization literature found that when strategic issues are categorized as threats as opposed to opportunities, the managerial response is quick and of large magnitude (Dutton and Jackson, 1987). However, the interpretation of opportunities is more equivocal and may demand greater cognitive effort (Chattopadhyay et al., 2001; Dutton, 1993; Jackson and Dutton, 1988; Julian and Ofori- Dankwa, 2008). While there is a certain level of agreement in the literature that managers suffer from a threat bias (Dutton, 1993; Jackson and Dutton, 1988), there is less convergence on the diagnosis and implications of opportunities (Julian and Ofori-Dankwa, 2008). Prior work in both entrepreneurship and strategic management has examined the extent to which individual knowledge (Shane, 2000), abilities (DeTienne and Shepherd, 2005; Gaglio and Katz, 2001), reasoning strategies (Gregoire, Barr and Shepherd, 2009), position in a social network (Arenius and De Clercq, 2005) and culture (Barr and Glynn, 2004) facilitates opportunity diagnosis.

More recently, scholars have focused on how threat and opportunity framing can occur simultaneously in order to create an appropriate adaptive response. For example, Gilbert (2006) examines the adaptive responses of a newspaper company to the turbulence caused by digital publishing. When framed as an opportunity, the issue of digital publishing lead to an inadequate organizational response as reflected in a lack of resource mobilization. When framed as a threat at all organizational levels, the issue of digital publishing resulted in higher resource allocation

but reduced experimentation. Finally, an adaptive response was elicited when the main organization created an autonomous digital venture so that its staff engaged in opportunity framing, the main organization managers engaged in threat framing and corporate leaders engaged in both types of framing due to a lack of direct operating responsibilities.

Taken as a whole the cognition studies that focus on organizational responses to environmental events have the merit of bringing forward the interpretive model of cognition and of highlighting the links between cognition and organizational action. However, this stream of research also suffers from limitations stemming from its exclusive focus on unique discontinuities and changes in environments that are otherwise stable and the immediate organizational response to it. The environments to which new ventures need to adapt to are characterized by rapid and continuous changes which require numerous adaptive actions; this type of adaptation and its cognitive underpinnings are not currently reflected in the literature.

The second stream of studies that link cognition to organizational adaptation focuses on high velocity environments where the issue of adaptation becomes particularly salient due to a continuously changing decision-making setting. High velocity environments are defined as “environments shaped by rapid and discontinuous changes in demand, competitors, technology and regulations” which result in “information that is inaccurate, unavailable or obsolete” (Bourgeois and Eisenhardt, 1988; p: 816). In their pioneering set of studies, focusing on microcomputer firms, Eisenhardt and Bourgeois showed that successful firm adaptation in these types of environments depends on *fast and careful* decision making processes, (Eisenhardt and Bourgeois, 1988; Bourgeois and Eisenhardt, 1988).

Previous research focusing on managerial cognition used in high-velocity environments has also revealed that cognitive diversity as an attribute of managerial schemas, *rapid decision-*

making and taking *diverse experimental actions* are essential for successful organizational adaptation (Bogner and Barr, 2000; Eisenhardt, 1989; Lyles and Schwenk, 1992). Bogner and Barr (2000) refer to the process leading to managerial schema formation for successful adaptation in high velocity environments as adaptive sensemaking (Ashby, 1956; Lyles and Schwenk, 1992; Weick, 1979). Adaptive sensemaking starts with cognitive diversity or complexity which allows more stimuli to be noticed and responded to. A second component of this process refers to the heavy use of real-time information to improve interpretation and thus speeds decision making processes. Multiple and diverse experimental actions that target both the external and the internal environments of the firm are needed to complete the adaptive sensemaking process.

One common theme that emerges from the studies summarized here is that *fast, frequent* and *diverse* organizational actions targeted towards both the external and the internal environments of the firm are associated with successful adaptation, particularly in contexts characterized by high levels of uncertainty and unpredictability (Ansoff, 1988; Evans, 1991; Eisenhardt and Martin, 2000; Fombrun and Ginsberg, 1990; Miller et al., 1996; Nicholls-Nixon et al., 2000; Volberda, 1999). Unpredictability and uncertainty are hallmarks of the new venture context and have significant implications for new venture action (Miller et al., 1996; Nicholls-Nixon et al., 2000). Prior literature suggests that to operate successfully in these types of environments and grow, new ventures must engage in rapid innovation and experimentation and develop broad repertoires of actions (Ashby, 1956; Miller et al., 1996; Weick, 1979).

Another common theme is that cognition is strongly associated with the timing and content of organizational action. Prior research has revealed that effective responses in contexts characterized by unpredictability and uncertainty are tied to specific attributes of managerial

cognition. This stream of research has found that firm action diversity and timing, but also corporate diversification, is linked to cognitive complexity (Bogner and Barr, 2000; Calori, Johnson and Sarnin, 1994; Ford and Baucus, 1987; Ginsberg, 1990; Smith and Tushman, 2005). The range of actions in which individuals and firms engage has been linked to schema focus (Dutton, Fahey and Narayanan, 1983; Eden et al., 1992; Keisler and Sproull, 1982; Fiol and O'Connor, 2003; Nadkarni and Narayanan, 2007) and fast, experimental actions have been linked to proactive causal logic (Eden et al; 1992; Fahey and Narayanan, 1989; Nadkarni and Barr, 2008).

In conclusion, a major contribution of this stream of studies on cognition and adaptation is that it brings forward the idea that across firm variation in successful adaptation in environments characterized by high levels of uncertainty, dynamism and unpredictability – characteristics common to most growth oriented new ventures – may be the result of a complex process in which the cognitive attributes of the top managers influence the speed, frequency and diversity of organizational actions. I argue that while the links between cognition and organizational actions are important to consider in all models of organizational adaptation, they are even more important for models of new venture adaptation, which puts the entrepreneur at the heart of this process.

3.2 THE MODEL OF OPPORTUNISTIC ADAPTATION

As is evidenced in the discussion above, previous research on organizational adaptation taking a cognitive approach has succeeded in revealing important links between managerial cognition and action. I suggest that by linking these findings to findings of the entrepreneurship literature on growth and the literature on adaptation in high velocity environments we gain a better understanding of the model associated with new venture growth (Figure 1).

The model presented in Figure 1 rests on several assumptions based on this prior work. First, opportunistic adaptation and subsequent growth is strongly influenced by the entrepreneur and his or her cognitive attributes (Cooper et al., 1991), which are fundamentally shaped by past experiences and perceptions (Klepper, 2002). In a review of the entrepreneurial cognition literature, Forbes (1999) argues that the effects of managerial cognition are likely to be more direct and immediate in new venture contexts than in the context of large, established organization. This suggests that entrepreneurial cognition may be a strong driver of new venture adaptation and growth. This dissertation aims to investigate the link between the content and structure of entrepreneurial schemas and organizational actions taken by their new ventures.

Second, successful adaptation in contexts characterized by unpredictable and/or uncertain changes hinges on a firm's ability to rapidly introduce a variety of new products and technologies and engage in frequent and diverse organizational changes (Brown and Eisenhardt, 1997; Cottrell and Nault, 2004; Eisenhardt, 1989; Nerkar and Roberts, 2004). Thus, the speed, frequency and diversity of organizational actions are relevant dimensions to study the process of opportunistic adaptation.

Third, drawing from the literature linking context to cognition and action, the model must account for factors that previous research has shown that may influence the link between entrepreneurial cognition and various types of organizational actions. Resource availability (Cooper et al., 1994; Bamford, Dean and McDougall, 2000), social networks (Dubini and Aldrich, 1991; Lechner and Dowling) and the industry context (Eisenhardt and Schonhooven, 1990; Robinson and McDougall, 2001) are advanced as main influences (enablers) of the relationship between schema related characteristics and the types of organizational actions entrepreneurs are likely to take.

3.3 HYPOTHESES

3.3.1 The Impact of Schema Complexity on Speed, Frequency and Diversity of Organizational Actions

Schema complexity captures the breadth and variety of knowledge embedded in a schema or the total number of strategic concepts and the number of links between concepts (Calori et al., 1994; Eden et al., 1992). Complex schemas reflect an ability to differentiate and integrate various concepts that lead to understanding of an issue from a variety of perspectives and to “synthesize aspects of these perspectives in an appropriate response” (Bartunek, Gordon and Weathersby, 1983: 275). Complex schemas emerge through repeated exposure to complicated situations in a person’s life that require a multidimensional approach and call for advanced symbolic, affective, behavioral and perceptual responses (Kolb and Fry, 1975).

Keisler and Sproull (1982) were among the first to suggest that the use of simple managerial cognitive models when interpreting new and unfamiliar stimuli is associated with a failure to recognize and interpret critical changes in their environments. Complex schemas on the other hand were identified as a mechanism that promotes strategic flexibility through broad scanning, speedy diagnosis and simultaneous consideration of strategic alternatives (Dutton et al., 1983; Nadkarni and Narayanan, 2007). Complex schemas have also been linked to diversity of perspective taken into consideration and thus to *simultaneous* consideration of alternative actions (Lant et al., 1992; Lyles and Schwenk, 1992).

In contexts characterized by high uncertainty and rapid changes such as those common to new ventures, schema complexity is a precursor to experimentation on a variety of dimensions (Bogner and Barr, 2000). Complex schemas not only help entrepreneurs to make sense of their environments, they help them to engage in trial-and-error learning by experimenting along various product or service offerings and various competitive approaches to determine what does

and does not work in the new venture's particular competitive context (Hedberg, 1981; Nicholls-Nixon et al., 2003). Complex schemas help entrepreneurs make sense of the outcomes of the various actions that they take and thus provide them with a wider range of options for future actions (Bowman and Hurry, 1993). The arguments presented above suggest that:

H1a) Complexity of entrepreneurial schemas is positively related to diversity of new organizational actions

By facilitating the absorption and processing of new and diverse information, complex schemas encourage new insights and may lead to an entrepreneurial openness to reformulate an “organizational hypothesis in use” (Bartunek et al., 1983; Nicholls-Nixon et al., 2000). This is manifested not just in the diversity of actions that they take along distinct dimensions of their organization, but also in the greater frequency of new organizational actions (Evans, 1991; Hedberg, 1981). Cognitively complex entrepreneurs are more likely to initiate a larger number of organizational actions in their effort to discover the cause and effect relations between actions and their outcomes (Brown and Eisenhardt, 1997, 1998). Complex schemas encourage a dynamic learning processes aimed at determining how to best position the firm in which entrepreneurs are engaged and lead to frequent changes in various areas of their firm (Miller et al., 1996; Miller, 1993; Woo et al., 1994). The arguments presented above suggest that:

H1b) Complexity of entrepreneurial schemas is positively related to frequency of new organizational actions.

Complex schemas also lead to an increased ability of entrepreneurs to process information inputs from the environment in real-time (Bogner and Barr, 2000) and thus make

more rapid adjustments to their venture activities. The use of real-time information is at the heart of rapid decision-making processes; it provides entrepreneurs with access to richer forms of information (Daft and Lengel, 1986; Eisenhardt, 1989) that they use to continuously update their schemas of the environment (Bogner and Barr, 2000). Navigating the uncertain and rapidly changing contexts surrounding new ventures with a complex schema allows entrepreneurs to notice and respond faster to stimuli, reducing the gap between changes in the environment and their interpretations of it (Bogner and Barr, 2000; Nadkarni and Naryanan, 2007). By promoting broad scanning and speedy diagnosis complex schemas also lead to an increased awareness of new technological and product-market opportunities resulting in faster changes along various organizational dimensions. The arguments presented above suggest that:

H1c) Complexity of entrepreneurial schema is positively related to speed of new organizational actions.

3.3.2 The Impact of Schema Focus on Speed, Frequency and Diversity of Organizational Actions

Another schema attribute identified by previous research on organizational adaptation is *focus or centrality*. Focus reflects the degree to which a schema is centralized around a limited number of core concepts (Cossette and Audette, 1992; Eden et al; 1992; Nadkarni and Narayanan, 2005; 2007). Core concepts represent those concepts in the schemas which develop gradually, over a long period of time (Carley and Palmquist, 1992) and which have a significant depth of meaning for the decision-maker (Eden et al; 1992). Highly centralized or focused schemas display a hierarchical and clear sequence of relationships between concepts (Eden et al., 1992).

Early work in cognition has argued that complexity and focus are distinct dimensions of schemas (Cossette and Audette, 1992; Eden et al; 1992) however it is only recently that Nadkarni and Narayanan (2005; 2007) empirically demonstrated the distinctness of these dimensions. Drawing on work in social network theory (Carley and Palmquist, 1992; Knoke & Kuklinski, 1982), Nadkarni and Narayanan (2005) show that focus and complexity do not represent two ends of the same continuum but different facets of cognitive map organization. The nomological validity of the two constructs is established through the different patterns of relationships with academic performance (outcome) and cognitive ability (antecedent). Complexity facilitates new information acquisition and leads to conceptual performance while focus facilitates effective application of domain knowledge and is related to practical performance. In essence, complexity represents breadth of domain understanding facilitating acquisition of information in that domain while centrality (focus) facilitates application of domain knowledge to problem situations rather than domain understanding.

Focus has been associated with illusory causation biases, wherein individuals make false associations between various events based on the core concepts in their schemas (Keisler and Sproull, 1982). Illusory causation is the result of premature and inadequate causal inferences about new stimuli that are made when core concepts in their schemas prompt individuals to focus on nonexistent relationships between certain variables or events (Keisler and Sproull, 1982). Too much focus creates tunnel vision (Fiol and Huff, 1992), which occurs when core concepts lead the individuals to automatically categorize new events and opportunities instead of first conducting some type of search activity.

Focused schemas might be the result of past successful managerial experience, educational background or age, and a heavy reliance on initial recipes for success (Forbes, 2005).

Focused schemas lead to cognitive inertia because central concepts with deep historical roots are hard to discard and may lock individuals into known and historically successful courses of actions (Carley and Palmquist, 1992). Cognitive inertia has been associated with a decreased ability to absorb new knowledge and might inhibit experimentation with new and diverse alternatives (Hodgkinson, 1997; Reger and Palmer, 1996). Recent empirical work (Nadkarni and Narayanan, 2007) has also shown that focused schemas inhibit strategic flexibility by discouraging strategists from engaging in new and diverse sets of competitive actions and resource deployments. The arguments presented above suggest that:

H2a) Focus of entrepreneurial schema is negatively related to diversity of new organizational actions

Focused entrepreneurial schemas might lead to a tendency to persist with the same strategy as long as the problems or the opportunities that entrepreneurs confront are considered to be part of the same set (Gersick, 1994). The tunnel vision associated with schema focus might translate not just into a more narrow range of organizational actions but also into a more limited number of organizational actions in a given time frame (Fiol and Huff, 1992). The cognitive inertia induced by focused entrepreneurial schemas might prevent entrepreneurs from identifying and taking advantage of opportunities in the marketplace which is also translated in a lower likelihood, and thus a more limited number, of organizational actions. The arguments presented above suggest that:

H2b) Focus of entrepreneurial schema is negatively related to frequency of new organizational actions

Prior research on entrepreneurial decision-making speed has highlighted the fact that entrepreneurs with domain-relevant experience are more likely to possess focused schemas that facilitate the storage, recall and interpretation of data specific to that domain (Forbes, 2005; Walsh, 1988). Prior experience as an entrepreneur or as a manager in a domain related to that where entrepreneurs operate their new ventures makes it more likely that they will recognize opportunities and changes that are related to their central subjective representations of that domain (Fiol and O'Connor, 2003; Lant et al., 1992). Thus, entrepreneurs who have faced similar previous challenges will be able to direct their attention to areas that are familiar to them, but are going to be less likely to recognize and initiate actions in entirely new domains (Forbes, 2005; Nadkarni and Barr, 2008). Focused entrepreneurial schemas are associated with less extensive information search (Reger and Palmer, 1996) and thus with a slower speed of new organizational actions.

H2c) Focus of entrepreneurial schema is negatively related to speed of new organizational actions.

3.3.3 The impact of Proactive Causal Logic on Speed, Frequency and Diversity of Organizational Actions

The cause-effect beliefs about the environment-strategy relationship have been extensively investigated in the managerial cognition literature. Previous research in this area has found that these particular sets of beliefs affect issue framing and thus the timing of strategic actions (Barr et al, 1992; Barr and Huff, 1997; Eden et al, 1992; Fahey and Narayanan, 1989). Building on Daft and Weick's (1984) model of interpretive organizations, scholars have focused on environment driven and interpretation driven cause-effect beliefs about the environment.

Fahey and Narayanan (1989) define proactive logics as the linkage between strategy (action) and environments in which strategy influences environmental elements and deterministic logics as environments influencing strategy. Managers operating with deterministic logics usually undertake actions to realign the environment-strategy fit after changes (events) occur in their firm's environments; they will first try to understand what the events mean so that they can develop appropriate responses and then engage in actions (Miller, 1987; Wooldridge and Floyd, 1989;). Gaining an adequate understanding of what certain events mean requires extensive intelligence gathering and market surveillance activities (Daft and Weick, 1984) and significant time and resource investments.

Proactive causal logics are not associated with extensive efforts to understand events in their environments prior to undertaking an action: instead, organizations will usually engage in sensemaking activities *after* an action has been taken (Daft and Weick, 1984; Weick, 1995). The survival and growth of new ventures places a premium on quickly anticipating the market with its emerging opportunities and implementing actions that take advantage of these opportunities (West and Meyer, 1997). Entrepreneurs with proactive causal logic are more likely to experiment, test and probe their environments through a variety of actions and use the action outcomes as feedback about the various events in their environments (Bingham and Eisenhardt, 2008; Chakravarthy, 1982; Eisenhardt and Martin, 2000). The arguments presented above suggest that:

H3a) Proactive causal logic is positively related to diversity of new organizational actions.

By putting less emphasis on getting specific feedback from various environmental changes before undertaking organizational actions, entrepreneurs with a proactive causal logic may engage in a greater number of organizational actions (Fahey and Narayanan, 1989). Entrepreneurs with proactive causal logics are more likely to engage in multiple/frequent iterations and realignments of already implemented actions and already existing products in an attempt to increase their chances for a hit (Eisenhardt and Tabrizi, 1995). Proactive causal logic is associated with more flexibility in understanding and an increased cognitive ability to shift with new information (Weick, 1995): this makes it less likely that entrepreneurs become attached to a limited set of actions or that they procrastinate (Eisenhardt, 1989), but it makes it more likely that they engage in multiple organizational actions.

The arguments presented above suggest that:

H3b) Proactive causal logic is positively related to frequency of new organizational actions.

Entrepreneurs with proactive causal logic are more likely to aggressively pursue various opportunities in their environment (Lumpkin and Dess, 1996) and be the first among competitors to initiate actions (Dess, Lumpkin and Covin, 1997). By not engaging in extensive information searches and not waiting for feedback information on various environmental changes, entrepreneurs with a proactive causal logic will engage in organizational actions with considerably higher speed (Nadkarni and Barr, 2008; West and Meyer, 1997). The arguments presented above suggest that:

H3c) Proactive causal logic is positively related to speed of new organizational actions.

3.3.4 The Moderating Effect of Resource Availability on the Influence of Schema Attributes on Organizational Actions

Penrose (1959, p: 129) argues that a firm's growth is limited by the ability of the manager or the managerial team to coordinate resources. She suggests that growth is the result of the interaction between the manager's expectations for the firm and the firm having access to the appropriate resources. For entrepreneurs to engage in various growth related organizational actions, it is necessary that he or she attracts and allocates the right fit of resources to that endeavor (Arthurs and Busenitz, 2006; Chandler and Hanks, 1994). Thus, theory suggests that resources are important moderators of the relationship between managerial schemas and organizational actions.

Previous research that explores the role of resources on new venture growth has generated mixed results, especially when coupled with various growth strategies that firms might pursue. For example, some studies report that access to resources such as human and financial capital enhances firm growth (Bamford, et al., 2000; Cooper et al., 1994; Lee et al., 2001) while others have found that resource differences are unrelated to variation in growth (Shrader and Simon, 1997) even when strategy interactions are considered (Chandler and Hanks, 1994).

Building on Penrose (1959), recent research designed to address weaknesses related to inconsistencies in the results of past research on the relationship between resources and new venture growth, has suggested that a better indicator of a firm's growth and innovation outcomes is its level of slack resources rather than the total resources possessed (Mishina, Pollock and Porac, 2004; Nohria and Gulati, 1996, 1997). The primary argument is that differences in the resources possessed by the venture might impact firm growth differently based on their level of

“stickiness” or other variables jointly taken into consideration. Slack resources represent the “difference between the resources currently possessed by the firms and the resource demands of their current business” (Mishina et al., 2004 p: 1182) and may be either *available* or *unavailable* for use (Mone et al, 1998; Smith, McKinely and Barker III, 1991). Available slack resources are immediately available to an organization to support initiatives while unavailable slack resources are resources that are already committed and reflected in the organization’s cost structure. Consistent with prior research on organizational adaptation (Chattopadhyay et al. 2001; Nohria and Gulati, 1996) I focus on available slack resources as a dimension of interest in this study.

Higher levels of available slack resources coupled with entrepreneurial schema complexity may give entrepreneurs more freedom and flexibility to pursue actions (Mone et al., 1998). For example, human resource slack provides the entrepreneurs with the means necessary to make strategic choices and increases the chances that they make correct decisions and proper choices (Boone et al., 1996; Wiklund and Shepherd, 2003). Financial resource slack enhances the range of possible organizational actions by allowing entrepreneurs to engage in more experimentation, implement new strategies and pursue vigorous actions to grow their businesses (Cooper et al., 1994; Mullins, 1996; Penrose, 1959). A complex cognitive schema coupled with available slack may also enable entrepreneurs to engage in faster actions and thus capture more growth related opportunities in their environment than they would otherwise (Jackson and Dutton, 1988; Bhide, 1992). The arguments presented above suggest that:

H5a) Available slack resources moderate the relationship between complexity of entrepreneurial schema and diversity of new organizational actions such that when the level of available slack resources is high the relationship is stronger and more positive.

H5b) Available slack resources moderate the relationship between complexity of entrepreneurial schema and frequency of new organizational actions such that when the level of slack resources is high the relationship is stronger and more positive

H5c) Available slack resources moderate the relationship between complexity of entrepreneurial schema and speed of new organizational actions such that when the level of slack resources is high the relationship is stronger and more positive.

When coupled with focus in entrepreneurial schemas, availability of slack resources, is likely to contribute to the lack of diversity and experimentation in the actions that entrepreneurs take. Previous research has shown that it is only when critical financial shortages occur and targeted performance levels are not reached that managers consider experimentation with a greater variety of activities (Hedberg, 1981; Lant, 1992). Significant resource shortages represent hard to ignore situations of urgency that elicit changes in actions (Hambrick & D'Aveni, 1988; Miller et al., 1996) and an update of schemas used (Reger and Palmer, 1996) even from risk-averse entrepreneurs. However, when available slack resources are combined with focus of entrepreneurial schemas the effect of focused schemas on diversity of organizational actions is accentuated such that entrepreneurs are less likely to engage in diverse actions and more likely to automatically engage in historically proven courses of action (Reger and Palmer, 1996; Shaw, 1990). The arguments presented above suggest that:

H6a) Available slack resources moderate the relationship between focus of entrepreneurial schema and diversity of new organizational actions such that when the level of available slack resources is high the relationship is stronger and more negative.

H6b) Available slack resources moderate the relationship between focus of entrepreneurial schema and frequency of new organizational actions such that when the level of available slack resources is high the relationship is stronger and more negative.

H6c) Available slack resources moderate the relationship between focus of entrepreneurial schema and speed of new organizational actions such that when the level of available slack resources is high the relationship is stronger and more negative.

Availability of slack resources coupled with proactive causal logic might increase the likelihood that entrepreneurs engage in “venturesome” actions such as entry into new or existing markets and the frequency and speed with which they pursue these actions (Miller, 1987; Mintzberg, 1973). The existence of available resources creates the conditions necessary to encourage organizational actions in anticipation of emerging opportunities in the marketplace (Oviatt and McDougall, 1994; 2005; West and Meyer, 1997). Proactive entrepreneurs perceive their environments as a dimension they can control (Daft and Weick, 1984) and have a higher level of comfort with unanticipated outcomes (Bird, 1988). Availability of slack resources allows them to quickly engage in new and innovative actions (Castrogiovanni, 1996; Zahra, 1991). The arguments presented above suggest that:

H7a) Available slack resources moderate the relationship between proactive causal logic and diversity of new organizational actions such that when the level of available slack resources is high the relationship is stronger and more positive.

H7b) Available slack resources moderate the relationship between proactive causal logic and frequency of new organizational actions such that when the level of available slack resources is high the relationship is stronger and more positive.

H7c) Available slack resources moderate the relationship between proactive causal logic and speed of new organizational actions such that when the level of available slack resources is high the relationship is stronger and more positive.

3.3.5 The Moderating Effect of Industry Context on the Influence of Schema Attributes on Organizational Actions

The stage of the industry in which a new firm competes might also interact with entrepreneurial schema attributes and influence the types of actions that entrepreneurs are likely to take. The emerging stage of the industry life-cycle may create opportunities for a new

venture's products and services to be adapted for new markets (Koberg, Uhlenbruck and Sarason, 1996). An emerging or growing industry is more rewarding for entrepreneurs that have a better understanding of a greater number of opportunities and provide new products or services to fill various niches in the market than a more mature industry (Siegel et al; 1993). Entrepreneurs who navigate growing industries with complex schemas are thus able to engage in broader and faster actions to capture these opportunities and transform them in higher levels of growth for their firms (Sandberg and Hofer, 1987). Although emerging or growing industries are more uncertain and ambiguous and require more complicated understandings (Calori et al., 1994; Weick, 1979), they are also more munificent and are less taxing of risky actions. In mature industries entrepreneurs might engage in more limited, safer and less diverse of actions as they would be pressured to follow the behavior of more successful organizations (DiMaggio and Powell, 1983; Haveman, 1993; Huff, 1982). The arguments presented above suggest that:

H8a) Industry growth moderates the relationship between complexity of entrepreneurial schema and diversity of new organizational actions such that when industry growth is high the relationship is stronger and more positive.

H8b) Industry growth moderates the relationship between complexity of entrepreneurial schema and frequency of new organizational actions such that when industry growth is high the relationship is stronger and more positive.

H8c) Industry growth moderates the relationship between complexity of entrepreneurial schema and speed of new organizational actions such that when industry growth is high the relationship is stronger and more positive.

The higher levels of uncertainty and ambiguity that characterize emerging and growing industries might strengthen the relationship between focus and lack of action diversity by emphasizing illusory causation biases and cognitive inertia associated with schema focus (Carley and Palmquist, 1992; Keisler and Sproull, 1982). In uncertain and rapidly changing situations,

entrepreneurs navigating their environments with focused schemas might resort to following the actions of more prominent firms, using their status or prior performance as proxies for the efficacy of the actions taken by these firms (DiMaggio and Powell, 1983; Fombrun and Shanley, 1990). At a cognitive level, this is usually translated, in a heavy reliance on historical categories (Dutton, 1993) and in rapid, automatic responses even in situations which require more controlled information processing (Forbes, 2005; Reger and Palmer, 1996). Entrepreneurs with focused schemas might also interpret actions taken by a large number of firms as the right course of action and consequently not engage in new information search or experimentation (Reger and Palmer, 1996). Frequency of action adoption by others becomes thus an indicator of the level of perceived consensus within the industry (Meyers and Rowan, 1977; Tolbert and Zucker, 1983): in turn such consensus might perpetuate the heavy reliance on historically proven types of actions. The arguments presented above suggest that:

H9a) Industry growth moderates the relationship between focus of entrepreneurial schema and diversity of new organizational actions such that when industry growth is high the relationship is stronger and more negative.

H9b) Industry growth moderates the relationship between focus of entrepreneurial schema and frequency of new organizational actions such that when industry growth is high the relationship is stronger and more negative.

H9c) Industry growth moderates the relationship between focus of entrepreneurial schema and speed of new organizational actions such that when industry growth is high the relationship is stronger and more negative.

Growing industries characterized by stronger product demands from customers, more rapid movements of products through their life cycles and more aggressive competitor forays into various markets are likely to enhance the positive relationship between proactive causal

logics and the speed, diversity and amount of risk involved in the organizational actions that entrepreneurs undertake (Khandwalla, 1977; Miller and Friesen, 1983). Environments that are more complex and heterogeneous imply shorter decision windows and less extensive information searches putting a premium on anticipatory actions aimed at constructing the environment in which new ventures compete and thus on proactive logics (Lyles and Schwenk, 1992; Stevenson, Roberts and Grousbeck, 1994). As growing industries are more munificent than more mature industries entrepreneurs operating with proactive causal logics will feel more comfortable taking the lead and initiating numerous actions in various areas of their firms including entering risky and unfamiliar markets. The arguments presented above suggest that:

H10a) Industry growth moderates the relationship between proactive causal logic diversity of new organizational actions such that when industry growth is high the relationship is stronger and more positive.

H10b) Industry growth moderates the relationship between proactive causal logic frequency of new organizational actions such that when industry growth is high the relationship is stronger and more positive.

H10c) Industry growth moderates the relationship between proactive causal logic speed of new organizational actions such that when industry growth is high the relationship is stronger and more positive.

3.3.6 The Moderating effect of Social Networks on the Influence of Schema Attributes on Organizational Actions

Previous empirical work on new venture growth has highlighted the fact that growth can rarely be achieved through available resources or through attractive positioning in a growing industry exclusively: external networking activity plays an important role as well (Baum, Calabrese and Silverman, 2000; Chell and Baines, 2000; Johannisson, 1998; Nohria, 1992). The role of the entrepreneurs is critical in building both personal networks (relationships of

individuals with other individuals) and organizational networks (relations between organizations) (Dubini and Aldrich, 1991; Lechner and Dowling, 2000; Ostgaard and Birley, 1994). Although in new ventures personal and organizational networks often converge, it is believed that personal networks are more important in the venture creation phase and organizational networks are important in the subsequent stages of the venture life-cycle (Johannisson, 1998; Zhao and Aram, 1995). The role of organizational networks has also been recently emphasized in the adaptation literature where a growing number of researchers have analyzed how ongoing social ties between various organizations can strongly influence their actions and outcomes (Davis, 1991; Granovetter, 1985; Haunschild, 1993, Kraatz, 1998; Uzzi, 1996).

In both streams of the literature the breadth and the heterogeneity of an organization's social ties have often been advanced as important variables to consider as they may determine access to different types of information and thus affect an organization's ability to recognize and respond to various threats and opportunities in the environment and its subsequent growth (Baum et al; 2000; Kraatz, 1998; Lechner and Dowling, 2003). Although the size of a firm's network might have direct effects on new venture growth (Baum et al. 2000; Zhao and Aram, 1995) it is the heterogeneity of network contacts that seems to provide an organization with fundamentally new and foreign ideas (Granovetter, 1973) which combined with various attributes of entrepreneurial schemas, may facilitate organizational actions and subsequent growth.

Heterogeneous (diverse) network ties coupled with complexity of entrepreneurial schemas may allow entrepreneurs to identify more implications of growth opportunities and thus a better evaluation of the necessary actions to achieve growth (Birley, 1985; Johannisson, 2000). Diverse network ties may also broaden the entrepreneur's awareness of various environmental trends and opportunities and expose them to a variety of new organizational responses or

responses being employed elsewhere in the industry (Rogers, 1995). Heterogeneous networks provide access to higher quality and volume of information (Granovetter, 1973; 1982) which, can contribute to the process of opportunity identification (Singh, 2000). Entrepreneurs navigating their environments with complex schemas and located within heterogeneous networks are better able to discern and discriminate between various sources of information (Bartunek et al; 1983): such entrepreneurs may select or initiate faster and more frequently a multitude of organizational actions (Bandura, 1986; Miner and Haunschild, 1995). The arguments presented above suggest that:

H11a) Network heterogeneity moderates the relationship between complexity of entrepreneurial schema and diversity of new organizational actions such that when network heterogeneity is high the relationship is positive and strong.

H11b) Network heterogeneity moderates the relationship between complexity of entrepreneurial schema and frequency of new organizational actions such that when network heterogeneity is high the relationship is positive and strong.

H11c) Network heterogeneity moderates the relationship between complexity of entrepreneurial schema and speed of new organizational actions such that when network heterogeneity is high the relationship is positive and strong

As noted earlier, entrepreneurial schema focus might drive a new venture to quickly adopt the same types of actions adopted by other players in the market relatively indiscriminately and thus engage in limited experimental activities (Abrahamson and Rosenkopf, 1993). Focused schemas often lead to cognitive inertia which locks individuals into known and historically successful courses of actions (Carley and Palmquist, 1992). This increases the likelihood that entrepreneurs driven by focused schemas engage in actions taken by large or prestigious peers with limited attention to other new alternatives (Haveman, 1993; Miner and Haunschild, 1995).

However, heterogeneous networks provide access to higher diversity and volume of information. This could improve the entrepreneur's ability to recognize and act on various opportunities in the environment (Lechner and Dowling, 2003; Baum et al; 2000). The existence of a highly heterogeneous network exposes entrepreneurs to a greater variety of actions taken by firms located elsewhere in the industry and might prompt them to align their strategies and views with those of other players in the industry (Geletkanycz and Hambrick, 1997) Thus, a heterogeneous network might weaken the effects of entrepreneurial schema focus on diversity, frequency and speed of organizational actions. The arguments presented above suggest that:

H12a) Network heterogeneity moderates the relationship between focus of entrepreneurial schema and diversity of new organizational actions such that when network heterogeneity is high the relationship is weaker and less negative.

H12b) Network heterogeneity moderates the relationship between focus of entrepreneurial schema and frequency of new organizational actions such that when network heterogeneity is high the relationship is weaker and less negative.

H12c) Network heterogeneity moderates the relationship between focus of entrepreneurial schema and speed of new organizational actions such that when network heterogeneity is high the relationship is weaker and less negative.

Previous research on the topic of boundary spanning activities at the executive level has shown that executives who have more diverse ties that span domains outside their immediate organization or industry are more likely to be exposed to new information that can potentially lead to more creative and diverse strategies (Aldrich, 1979; Geletkanycz and Hambrick, 1997). Access to information that often challenges conventional wisdom has been linked to an increased ability of individuals to take actions that deviate from the norm (Scott, 1985). For entrepreneurs this might mean that they are better able to envision, create and engage in actions that depart from typical industry practices (Geletkanycz and Hambrick, 1997). Highly heterogeneous

networks may thus enhance the strength of the relationship between proactive causal logic and organizational actions by exposing entrepreneurs to new and divergent insights and perspectives which prompt them to engage more quickly and frequently in a variety of organizational actions (Geletkanycz and Hambrick, 1997; Hambrick, Geletkanycz and Fredrickson, 1993). The arguments presented above suggest that:

H13a) Network heterogeneity moderates the relationship between proactive causal logic and diversity of organizational actions such that when network heterogeneity is high the relationship is strong and positive.

H13b) Network heterogeneity moderates the relationship between proactive causal logic and frequency of organizational actions such that when network heterogeneity is high the relationship is strong and positive

H13c) Network heterogeneity moderates the relationship between proactive causal logic and speed of organizational actions such that when network heterogeneity is high the relationship is strong and positive

3.3.7 The Impact of Speed, Frequency and Diversity of Organizational Actions on New Venture Growth

The speed with which organizations initiate actions has received increasing attention in both strategic management and entrepreneurship literatures. A firm's speed in taking actions allows it to achieve competitive advantages in its initiatives and puts its competition in a defensive position (D'Aveni, 1994; Eisenhardt, 1989; Forbes, 2005; Smith and Grimm, 1991; Makadok, 1998). Especially in dynamic environments, firms that take actions faster may exploit opportunities such as dramatic increases in demand or the application of new technological advancements before they disappear (Brown and Eisenhardt, 1997; Stevenson and Gumpert, 1985). Thus for new ventures which frequently operate in environments that are uncertain and

unpredictable, high on product differentiability or low in capital intensity, speed of organizational actions becomes extremely important (Forbes, 2005).

Past research on the topic of speed has often focused on the speed of decision making processes and their links to firm performance in a variety of environmental contexts (Baum and Wally, 2003; Eisenhardt, 1989; Judge and Miller, 1991). This body of work also builds strong links between speed of decision making and speed of action. In addition to the notion that fast actions may have a direct impact on new venture performance they can also have other important strategic implications which, taken together, may contribute to overall new venture growth. For example, fast actions may strengthen commitment from potential investors, employees and other stakeholders by signaling that the firm is proactive and adaptable (Langley, 1995). Organizations that value 'doing' over 'playing' encourage employees to exploit their available knowledge by imposing a cultural tone that action is valued and that talk and analysis without action are not acceptable (Pfeffer and Sutton, 2000). Fast actions might also lead to early adoption and/or launch of successful new products and technologies and preemptive resource combinations that enable economies of scope and knowledge synergies (Jones, Lanetot and Teegen, 2000). The arguments presented above suggest that:

H14a) Speed of new organizational actions is positively related to new venture growth.

Environments characterized by uncertainty and ambiguity often require multifaceted strategies and multiple adjustments to these strategies (Miller et al., 1996). Previous research has shown that in conditions of rapid changes and uncertainty, increased innovation and performance levels are often associated with frequent changes in strategy-making behavior (Miller and Friesen, 1983). Frequent organizational actions reflect a high degree of fluidity and

responsiveness to the market and are often the result of an aggressive monitoring posture adopted by entrepreneurs (Nicholls-Nixon et al., 2000). Unlike large or established organizations, new ventures are not constrained by norms, identity or well established routines which can limit their capacity for action (Woo et al., 1994) and are more likely to frequently engage in organizational actions which lower their “hazard of death” (Singh, House and Tucker, 1986).

Previous research on adaptation in high velocity settings has also shown that frequent, time-paced changes in product portfolios are positively related to performance (Brown and Eisenhardt, 1997; Galunic and Eisenhardt, 1996). Frequent and rhythmic changes are extremely appropriate in uncertain environments because they provide more opportunities to reassess actions, limit excessive commitment to obsolete courses of action and lead to a better synchronization of a firm with its environment (Brown and Eisenhardt, 1997; Gersick, 1994).

The arguments presented above suggest that:

H14c) Frequency of new organizational actions is positively related to new venture growth.

A focus on diverse organizational actions enhances the learning processes in which new ventures are involved. Entrepreneurs might launch experimental products, engage in strategic partnerships, implement forecasting systems or pursue international opportunities in an attempt to grow their firms. By engaging in a variety of organizational actions, entrepreneurs can rely on a more extensive set of interactions with their environment and subsequently on more experiential data from which to learn and on which to base future actions (Eisenhardt, 1989; Mosakowski, 1997). Engaging in a variety of actions involving different parts of an organization might create “small losses” (Brown and Eisenhardt, 1997, p: 21) in the short term. However

these become powerful learning mechanisms, making it easier for entrepreneurs to anticipate and potentially create the future (Brown and Eisenhardt, 1997; Sitkin, 1992).

A *mix* consisting of a wide variety of organizational actions targeting both internal and external dimensions of the organization is more likely to enhance learning about the effectiveness of future actions and contribute to overall new venture growth (Eisenhardt and Schoonhoven, 1990). Internally directed actions - actions that target the internal environment of the new venture (changes in staffing, structure, administrative procedures, resource allocation etc) - are less risky and are easier to implement and control but might lead only to incremental growth of the firm (Cook et al., 1983; Dutton and Jackson, 1987; Pitt, 2000). Externally directed actions that target the external environment of the firm (changes in products, markets, partners and customers) require that entrepreneurs act in areas where they have less control than they have within the firm: as a result these actions are more difficult to implement, and are generally riskier yet they might lead to increases in the scope of the organization and thus to changes of a larger magnitude in growth (Chattopadhyay et al., 2001; Dutton and Jackson, 1987; Pitt, 2000). However, it is the diversity of internally and externally directed actions that is likely to provide the new venture with a wide range of options for future actions, and might lead to improvements in performance and growth (Bowman and Hurry, 1993; Miller and Chen, 1993; Nicholls-Nixon et al. 2000). The arguments presented above suggest that:

H14b) Diversity of new organizational actions is positively related to new venture growth.

3.4 SUMMARY

This chapter introduced the process of opportunistic adaptation to address outstanding research questions in the literature on new venture growth. Various cognitive attributes are linked were linked to specific organizational actions in a model in which moderating influences such as resources, industry context and network heterogeneity were also considered.

Section 3.1 provided an overview of the current organizational adaptation literature with a focus on the cognitive view of organizational adaptation on which this study also builds. Section 3.2 introduced the model of opportunistic adaptation as an integrative model in which individual, firm and industry related factors were linked, section 3.3 examined how complexity and focus of entrepreneurial schema as well as proactive causal logic influence speed, diversity and frequency of organizational actions. Section 3.3 also examined how resources, industry context and social network heterogeneity impact the relationships between entrepreneurial schema attributes and organizational actions. The next chapter introduces the research methods and the sample of the population used to test the hypotheses introduced in this study

CHAPTER IV: RESEARCH METHOD

This chapter introduces the research sample, data collection methods, measurement, and analysis used to test the hypotheses introduced in Chapter III. Section 4.1 identifies the population of interest and highlights factors influencing sample selection. The next section (4.2) describes the data collection methods used as well as the procedures undertaken to insure the rigor and integrity of the data collection processes. Section 4.3 discusses the measurement of constructs.

4.1 POPULATION AND SAMPLE

The aim of this dissertation is to develop and test a model of new venture growth by explaining the link between entrepreneurial cognition, entrepreneurial action and new venture growth. Issues associated with the research questions asked and with the data used to test the hypotheses, placed several constraints on the selection of the population of interest and of the final sample for this study. The guidelines used to collect the data were based on a review of existing research in the new venture growth literature (Mishina et al., 2004; Hmieleski and Baron, 2008; Baum, Locke and Kirpatrick, 1998), and prior managerial cognition literature that has studied the nature and influence of managerial cognition in organizational adaptation processes (Barr et al., 1992; Barr and Huff, 1997; Kaplan, 2008; Nadkarni and Barr, 2008).

First, to investigate the topic of new venture adaptation and growth, requires the identification of a sample of firms that meet the criteria of new venture in terms of age (i.e. they are ten years old or younger) (Brush and Chaganti, 1996; Zahra, 1996; Yli-Renko, Autio and Sapienza, 2001). Firms that are ten years or younger need to meet critical developmental milestones during the first ten years of their existence. Thus, evaluating objective performance

outcomes such as revenue and employment growth towards the end of the ten years mark is particularly relevant as growth related criteria may be less relevant earlier in the firm's existence when survival might be the only outcome achieved (Hmieleski and Baron, 2008).

Second, since the focus of this project is new venture growth, the sample had to include firms with clear growth objectives. Two criteria have been used in selecting a sample of firms with clear growth objectives: the industry criterion (new ventures founded in technology intensive industries) and the initial public offering (IPO) criterion.

The principal goals of technology-intensive or high-technology ventures are profitability and growth, and the businesses are likely to compete on the basis of innovation (Gilbert et al., 2006), an important hallmark of an entrepreneurial organization. The emergence of most technology intensive industries rests on radical processes of innovation which broke the barriers of entry into these industries (Rothaermel and Deeds, 2004). For high-technology ventures, the commercialization of their technical ideas is fundamental to the realization of the business strategy and for firm growth (Anderson and Kleingartner, 1987). This dissertation follows previous management research which uses high-technology ventures to investigate various entrepreneurial phenomena (Deeds and Hill, 1996, George, Zahra and Wood, 2002; Rothaermel and Deeds, 2004; Stuart and Sorenson, 2000; 2003). The sample was therefore drawn from a limited number of technology-intensive industries. The benefit of limiting the sample to a narrow range of industries is the ability to control for industry effects.

One of the most important events in a new venture's life is its initial public offering (IPO), which has been long considered an important indicator that firms are on a path that leads to growth and performance (Arthurs and Busenitz, 2006; Gilbert et al., 2006; Kelley and Rice, 2002). The IPO can be used as an indicator that a firm has clear performance objectives and has

achieved sufficient success to attract important investors to finance their growth objectives (Shrader, Oviatt and McDougall, 2000; Jain and Kini, 1994). Thus, the sample used in this study consists of firms that underwent an IPO during the first ten years of their existence.

Third, a primary goal of the research design was to capture cognition data unobtrusively. As explained later, the data collection method employed to accomplish this is content analysis of official public statements made by the firms' chief executives or lead entrepreneurs regarding their firm and environment. This required that the population of interest for this study consist of firms for which a sufficient number of publicly available documents that contain such statements exist. Fourth, this study attempts to control, to the maximum extent possible, for variations in the dependent variable introduced by institutional and other country level factors that are not the principal goals of this investigation. Using a sample restricted to U.S., non-subsidary, publicly traded firms, ensures that new venture growth outcomes are not subject to variations in national laws, regulations, or customs and that the data derived from firms' public documents is uniformly reported. Although such influences are important to understand, it is best that these factors are controlled in the initial test of the study's hypotheses.

After considering the initial sampling criteria described above, a search for firms founded during the 1996-2006 time period that undertook an IPO during the same period was performed in Dunn and Bradstreet's Hoover's database and in Mergent Online database. This time period was chosen to ensure availability and reliability of public information presented in the databases used: Mergent Online stores information on company annual reports starting with 1995. The Hoover's database offers comprehensive company, industry, and market intelligence information for 12 million companies. Users can obtain information on public and private companies, including information on the company's history, products, officers and employees, industry,

financials, and key competitors. Also included are stock quotes, business news, industry information, and links to company web pages. Additional searches to identify companies were performed in the Mergent Online database. Mergent Online provides access to both U.S. and international company data, including U.S. company data for over 15,000 public companies and their SEC filings, U.S. annual reports, international company data for approximately 17,000 companies, international annual reports, FactSheets, and country information.

To ensure that the firms included in the final sample met the new venture criteria, factors such as size (less than 300 employees at the date of founding), founder (lead entrepreneur) presence, and ownership structure, which have been utilized in previous research, were also taken into consideration (Autio, Sapienza and Almeida, 2000). Subsidiaries, firms founded for the exclusive purpose of acquiring other companies, firms resulting from mergers, and spin-offs were not included in the sample.

The initial search for new ventures operating in technology intensive industries founded between 1996 and 2006 resulted in 445 firms. Of these firms, 110 firms met the characteristics mentioned above and had publicly available annual reports which included letters to shareholders for the year of IPO. The final sample consisted of 110 firms operating in the following four industries: pharmaceuticals (61 firms), medical instruments (23 firms), electronics (18 firms), and computers (9 firms).

Since IPO firms represent an elite sample of firms that might have a larger resource base and perform better than other firms in the industry, I considered how these firms compare to all other firms with less than 1000 employees listed in Compustat for the industries used in this study. I compared their size (number of workers) and sales (Gilbert et al., 2008). The average number of employees for the firms included in this sample, 135.27 for the year of IPO was not

significantly different ($p=0.810$) from 140, the average number of employees for all other similar firms competing in the same industries. The average sales for the firms included in the sample, \$44.4 million, was not significantly different ($p=0.818$) from \$ 55.2 million, the average sales for all other similar firms competing in the same industries. The ventures included in this dissertation study appeared to be representative of the average publicly-held firms in these industries.

By using IPO firms, I recognize that my measures of growth and performance are restricted in range due to the fact that I have excluded firms that did not undertake an IPO (Winship and Mare, 1992), which might result in values that are skewed towards higher rather than lower values. However, variability in performance and growth for IPO firms ensures sufficient variance in these measures of growth and performance (Ritter, 1991; Gilbert et al., 2006, 2008).

4.2 DATA COLLECTION METHODS

This section outlines the methods by which the data utilized to test the hypotheses were collected. To maintain consistency in the overall statistical analyses for all the firms included in the final sample, the cognitive variables were captured from the annual reports released in the year of the IPO, the dependent variables (organizational actions) were captured in the year following the year of IPO, and growth related variables were captured from the year of IPO through the second year after IPO (Gilbert et al, 2006; Mishina et al., 2004). The moderating variables were captured for the year of IPO.

This dissertation argues that a key component in the process of opportunistic adaptation is the schemas that entrepreneurs develop about various dimensions of their firms. More

specifically, the research questions addressed in this dissertation require the collection of two distinct types of beliefs:

a) Entrepreneurs' stated beliefs concerning the link between certain types of organizational actions and new venture growth (performance);

b) Entrepreneurs' stated beliefs concerning the cause-effect relationships between environment and strategy (action) variables.

Prior research focusing on the role of entrepreneurial cognition in various stages of a new venture life-cycle has mainly used two methods of capturing entrepreneurial cognition: content analysis of entrepreneur-written documents (e.g. Mishina et al., 2004) and script-scenario cue approaches administered through surveys (e.g. Mitchell et al., 2000; Mitchell et al., 2002). This dissertation follows previous research in managerial cognition and adaptation (Barr et al, 1992; Barr and Huff, 1997; Nadkarni and Narayanan, 2007; Nadkarni and Barr, 2008) and uses the first type of approach to capture entrepreneurial cognition. There are several advantages associated with the use of content analysis techniques which contributed to selecting this method for my study. First, content analysis allows me to unobtrusively observe and measure entrepreneurs (founders) who might no longer be with an organization (Krippendorf, 2004). Second, content analysis allows me to objectively quantify through empirical measures large amounts of unstructured data related to activities undertaken by entrepreneurs at a certain point in time (Erdener and Dunn, 1990; Krippendorf, 2004). Third, content analysis allows me to objectively study subjects that are otherwise inaccessible due to time and location constraints (Lee and Peterson, 1997). Fourth, the data generated through content analysis may be statistically analyzed in procedures than examine performance related outcomes and it is thus particularly useful for conducting retrospective research (Erdener and Dunn, 1990; Lee and Peterson, 1997).

Finally, by using content analysis of archival documents I avoid the recall bias associated with interviews (Axelrod, 1976).

Content analysis represents a “systematic, objective, quantitative analysis of message characteristics” (Neuendorf, 2002:1), and is a “research method that uses a set of procedures to make valid inferences from text” (Weber, 1985: 9). Content analysis techniques have been particularly useful for capturing the cognitive activity of individuals. Berelson (1952) highlights the usefulness of content analysis to reveal focus of attention, to reflect attitudes, interests and values of persons or groups, to determine the psychological state of individuals, and to identify the intentions of the communicators. In strategic management, content analysis has been used to retrospectively measure cognitive variables such as managerial beliefs (Barr et al., 1992; Barr and Huff, 1997; Nadkarni and Barr, 2008), direction of managerial attention (D’Aveni and MacMillan, 1990; Kaplan, 2008), managerial values (Kabanoff, Waldersee and Cohen, 1995) and cognitive group membership (Osborne, Stubbart and Ramaprasad 2001). Content analysis techniques have also been used in competitive dynamics research (Chen and Hambrick, 1995; Ferrier, 2001), notably to measure organizational strategies (Miller et al., 1996) and public relations efforts (Arndt and Bigelow, 2000). In parallel, content analysis has been widely used in various literatures including communication, political science, sociology, psychology and business (Erdener and Dunn, 1990).

This dissertation follows previous research in strategic management (Barr et al., 1992; Huff, 1990; Eden et al; 1992; Nadkarni and Narayanan, 2007; Nadkarni and Barr, 2008) and uses a specific form of content analysis: *causal mapping*. Causal mapping isolates causal assertions within a document (Axelrod, 1976) and has been used to capture various aspects of managerial schemas such as attention focus, complexity, and causal logics (Barr et al., 1992; Huff, 1990;

Eden et al; 1992; Nadkarni and Narayanan, 2007; Nadkarni and Barr, 2008). Causal mapping provides detailed and rigorously collected information about cognitive structures that is not usually found through other data collection methods. Causal mapping is consistent with the assumption that causal reasoning is the primary way in which strategic decisions are developed and understood and it is thus the appropriate methodology to be employed to capture entrepreneurs' schemas (Barr, 1998; Barr et al., 1992; Huff, 1990).

The next section offers more details concerning the particular data collection methods used to capture organizational actions and structural aspects of entrepreneurial schemas from textual documents.

4.2.1 Data Collection: Entrepreneurial Cognition

To capture entrepreneurial schema complexity and focus, I utilized structured content analysis of letters to shareholders to identify causal assertions concerning the link between specific types of organizational actions and new venture growth (Markoczy, 1997; Nadkarni and Narayanan, 2007). To capture proactive causal logics, I used content analysis of the same documents to identify assertions concerning the causal relationship between the environment and organizational actions (Fahey and Narayanan, 1989; Nadkarni and Barr, 2008; Nadkarni and Narayanan, 2007). The following paragraphs discuss the rationales underlying these methodological choices.

The selection of archival sources to be used in content analysis is an important element to consider in the process of methodological design. The archival sources used to capture entrepreneurial cognition need to be as reliable as possible to allow generalizations across the sample and their content needs to reflect the issues this study attempts to investigate (i.e. the content of the documents should be focused on firm actions, firm environment and firm growth).

Several alternative archival sources have been considered: transcripts of media interviews with firm founders, written documents that focus on the firm founders and their vision for the firm (e.g. Ernst and Young's Entrepreneur of the Year entries), business plans written by entrepreneurs, and letters to shareholders. Of all the data sources considered, only the letters to shareholders consistently and reliably provide the type of information needed in this study: causal assertions regarding the environment in which the firm competes and regarding the firm's trajectory (specific types of organizational actions employed) to growth. Furthermore, letters to shareholders have been previously used in management research (e.g. (Barr et al., 1992; D'Aveni and MacMillan, 1990; Kaplan, 2008; Nadkarni and Barr, 2008; Nadkarni and Narayanan, 2007) to capture cognition and thus represent a data source on which a considerable and reliable body of knowledge has been built.

Letters to shareholders are public, official statements made by chief executives or lead-entrepreneurs regarding the future of their companies and discuss the strategic themes that top managers believe are important to the firm (Osborne, Stubbart and Ramaprasad, 2001). Other kinds of statements made by the chief executives of the firm, such as those obtained through interviews and surveys, might initially appear to be attractive sources, but they are impractical for a large sample of firms over long time periods due to the inherent risk of retrospective bias. By using letters to shareholders this dissertation manages to capture schemas in use during the time period of interest while avoiding the unintentional imposition of the principal investigator's beliefs about the issues that are considered important (Nadkarni and Barr, 2008).

Despite the widespread use of letters to shareholders as sources of data for content analysis techniques, several criticisms have been raised. The issue of authorship has been questioned by scholars who argue that letters to shareholders are the result of input from many

organizational representatives. While there is no direct evidence that these documents are written by chief-executives or lead entrepreneurs, it is widely presumed that they reflect and are fair representations of their perceptions (Barr et al., 1992; Petzinger, 1982). Furthermore, the emphasis in this dissertation on young and small firms run by lead-entrepreneurs mitigates the risk of uncertainty in authorship. Letters to shareholders, and in particular the letters to shareholders written for the year the firms went public, are closely scrutinized by financial analysts, institutional investors and the business press which makes it highly likely that lead-entrepreneurs (founders) are involved in their preparation (Clapham and Schwenk, 1991).

Another criticism of the use of letters to shareholders is related to their target audience and thus to impression management attempts (Abrahamson and Hambrick, 1995). Risks associated with impression management attempts have been previously addressed in the literature. First, several studies suggest that while letters to shareholders might contain some elements of persuasion, such elements are legitimate messages from which beliefs can be inferred (Barr et al; 1992; Barr and Huff, 1997). Second, prior literature on managerial cognition and adaptation has established important links between organizational actions and outcomes and cognitive constructs derived from letters to shareholders (Barr et al., 1992; Bowman, 1984; Nadkarni and Narayanan, 2007; Nadkarni and Barr, 2008) which establishes the predictive validity of letters to shareholders. Finally, prior research (Fiol, 1995) compared internal strategic planning documents and annual reports and has established that the two forms of documents did not differ significantly in terms of strategic issues and facts presented.

To check for the biases and criticisms mentioned above, I used the 10K reports – the management discussion section- for comparison (Glueck and Willis, 1979; Nadkarni and Narayanan, 2007; Nadkarni and Barr, 2008). 10K reports are required to be filed with the

Securities and Exchange Commission within 90 days of the company's fiscal year end, and present more detailed information than annual reports on the company's most recent business activities. To match the contents of the letters and the management discussion section I randomly selected 5 firms from the sample and divided the number of common concepts for the two documents with the total number of concepts in the letters. The number of shared concepts between the two documents ranges from 61 percent to 80 percent suggesting an acceptable level of convergence between the two documents (Carley and Palmquist, 1992; Nadkarni and Narayanan, 2007).

4.2.2 Constructing causal maps

In order to obtain valid and reliable representations of CEO's causal maps, I followed the four step procedure advocated by (Axelrod, 1976).

1. In the first step statements that clearly imply a cause-effect relationship between the environment and actions and between actions and their importance were identified. Examples of key words used are: 'if-then,' 'because,' 'so', 'as.' Two coders (the author and a PhD student trained in strategic management, blind to the study's hypothesis) independently conducted the coding of letters to shareholders. The two coders began by coding a letter together and discussed every aspect of the coding procedure. They then coded three letters independently and met to discuss the coding procedure again. Having agreed on what constitutes a causal statement and what constitutes a cause or an effect the two coded all letters separately (an example of the coding sheet used is included in the Appendix, Table 1). Consistent with the standards of content analysis (cf. Krippendorff, 2004; Neuendorf, 2002) inter-rater reliability

was assessed for both identification of statements to code and the coding of the statements into causes and effects. The initial level of agreement between the two coders for the identification of the statements to be coded was 89.7%. The remaining disagreements were discussed until both coders agreed on all statements to be coded. The initial level of agreement for the identification of statement causes and effects was 94 % (Cohen's κ 0.88). The remaining disagreements were discussed until both coders agreed on all causes and all effects.

2. In the second step I separated the statements identified in the first step into 'causes' and 'effects' to build the 'raw causal maps.' Carley and Palmquist (1992) suggest that raw statements in a text can be aggregated into generalized concepts that transform explicit ideas into implied or tacit ideas. Aggregation reduces the risk of misclassification of concepts due to different wording used by individuals. Three strategy and/or entrepreneurship scholars (experts) were consulted to ensure that the identified concepts were distinct and at the same level of abstraction. This procedure generated 110 raw concepts.
3. In the third step, the raw concepts were classified into theoretically grounded, broad conceptual categories representing concepts of interest (i.e. actions, environment). Generalization of similar concepts in documents makes the concepts comparable across individuals and firms (Carley and Palmquist, 1992) and ensures that the categories are distinct and uniform in breadth and abstraction (Carley and Palmquist, 1992; Fahey and Narayanan, 1989; Nadkarni and Narayanan, 2007). Aggregation or exploratory filtering (Carley and Palmquist, 1992) was used to generalize raw cause-effect concepts into broad categories. The categories I have identified and consulted

on with the academic experts were tied to entrepreneurship and strategic management literature textbooks (e.g. Hitt et al., 2008; Timmons and Spinelli, 2006). This procedure generated 23 distinct categories. Of the 23 categories identified, 3 reflect the environment, 15 reflect organizational actions, and 5 reflect various dimensions of performance.

4. In the fourth step the categorization scheme was validated using a panel of five academic experts (i.e. strategic management and entrepreneurship scholars). The use of expert panels has a long tradition in management research (Dean and Snell, 1996; Detert, Schroeder and Mauriel, 2000). Experts were first given a document with definitions for each category included in the categorization scheme. Experts were then showed individual categories of actions and randomly selected raw concepts and were asked whether they agree/disagree that a particular concept corresponded to the category in which it had been placed. After the assignment has been made the raters were asked to go back and read each concept again and make any changes that they considered were needed. This procedure did not ask raters to determine what the appropriate number of categories was or to create labels and descriptions for each category. This item-sort task is not only less effortful for the judges, but also allows the data to be easily aggregated across judges (Anderson and Gerbing, 1991). Reliability was assessed (average percent agreement 88.6%) across the judges and only items agreed on by 3 or more raters were classified into categories. This reduced the number of raw concepts from 110 to 98. The final categorization scheme (included in the Appendix, Table 2) is similar to categorization schemes previously developed in

the literature, which further validates the approach taken in this dissertation (e.g. Nadkarni and Barr, 2008).

4.2.3 Data Collection: Organizational Actions

To identify new organizational actions in a specific time period (the year after the IPO), media announcements were analyzed for each firm in the final sample. This analysis resulted in a total of 2239 actions taken by the 104 firms included in the final sample for this study. There are several different types of organizational actions that researchers can analyze. Previous research has identified organizational actions ranging from pricing, advertising, promotion to corporate level actions such as diversification, vertical integration and research and development (Porter, 1980; Khandwalla, 1981). The competitive dynamics (Ferrier, 2001) research has often focused on actions specific to certain types of industries (e.g. the airline industry). Studies on strategic change have usually focused on the strategic repertoires of the firms (e.g. Miller et al., 1996; Nadkarni and Narayanan, 2007) as well as on actions related to various characteristics of the organization such as changes in organizational structure, power distribution or ownership status (e.g. Lant, Milliken and Batra, 1992). Studies in entrepreneurship have focused on actions related to the core or the periphery of the firm (e.g. Nicholls-Nixon et al, 2000)

This prior research provides some guidance as to the types of organizational actions that we are likely to see, but it might not account for specialized actions that might arise in the specific industries included in this study. Therefore, rather than imposing an existing typology, this research followed the procedure used in prior research (Dean and Snell, 1996; Detert et al., 2000) and used typology of actions that was developed through the content analysis of the letters to shareholders and validated by an expert panel to categorize all the actions collected. This categorization scheme included 15 types of actions: new product, marketing, service, human

resources, top management team changes, finance, corporate social responsibility, capacity, low cost/pricing, competitive, cooperative alliances, international, IPO, structural and restructuring. Following the principles of content analysis (cf. Krippendorff, 2004; Neuendorf, 2002) two independent coders (not the author or the initial coder) were selected and trained to conduct the coding. The coders, two recent graduate students enrolled at the author's university, were completely blind to the theoretical rationales and the hypotheses of the study. They were first provided with detailed definitions of the 15 types of organizational actions identified through the content analysis of the letters to shareholders (a copy of the coding sheet used is provided in the Appendix, Table 3 and a copy of the definitions is provided in the Appendix, Table 4). They were then asked to code the actions for two of the firms. The author met with each student individually to discuss any definition misunderstandings and coding language issues raised by the students. The students were then asked to independently code all the actions. Inter-coder reliability was computed (percent agreement 96.5% and Cohen's κ 0.95) and remaining disagreements were discussed to achieve consensus. Table 5 (Appendix) summarizes the count and percentages from total number of actions for each category of actions.

The next section details the specific measurement of constructs and the collection of other data used in the dissertation.

4.3 MEASUREMENT

4.3.1 Dependent Variables

- Speed of organizational actions: As noted earlier, organizational actions refer to actions that were undertaken by the new venture within one year following their IPO. The speed of organizational actions was measured in days and represents the period of time from the

media announcement of an action to its implementation as mentioned in subsequent announcements or in the 10 Ks. Factiva and LexisNexis Academic databases were used to identify dates of announcements for actions. LexisNexis Academic provides access to thousands of publications that include full texts such as: newspapers (in English, other languages, and translations of international dissertations), legal news, general interest magazines, trade publications, company financial information, transcripts, wire service reports, government publications (such as the federal case law, U.S. Code, Code of Federal Regulations, Congressional Testimony, etc.), law reviews, and reference works (such as the Forbes Annual Directory, the Official Guide/American Marketplace and the US Global Trade Outlook). Similarly, Factiva provides access to global business information from 8,000 sources from 118 countries, including more than 120 continuously updated newswires. Same-day and archival coverage of the following newspapers is included: The Wall Street Journal, New York Times, Washington Post, The Globe and Mail, Financial Times, Straits Times and other international newspapers. Magazine coverage includes The Economist, Forbes, Fortune, Time, Newsweek, Finanz & Wirtschaft, Satellite News, BusinessWeek, and more. TV and radio transcripts are also available from BBC, ABC, CBS, NBC, Fox, CNN, NPR and more. These data sources were supplemented by searches on company websites and firm public documents whenever missing dates or discrepancies on dates were identified. This insured the reliability of the data collected.

- Diversity of organizational actions: To capture the degree to which actions initiated by new ventures consist of a diverse range of action types, I used Ferrier et al.'s (1999) Herfindhal-type index of competitive simplicity. This measure is useful for capturing diversity because it doesn't just take into account the number of different categories of actions a given firm has

taken but also the number of agreements included in each category. This measure is useful in cases in which there is variability in firm size and thus in the number of categories of actions initiated in a given time period because it takes these factors into account. Once the typology of actions was identified and the actions categorized as explained in section 4.3, I calculated the ratio of actions in each of the 15 identified categories to total actions and squared each proportion. Following Ferrier (1999, 2001), I summed these squared proportions to arrive at a measure of diversity of organizational actions. Diversity of organizational actions = $\sum (N_a/NT)^2$, where N_a/NT is the share or proportion of organizational actions in the a th category. Low scores represent firms that engage in highly diverse actions while high scores represent firms that engage in a limited diversity of actions.

- Frequency of organizational actions: To capture frequency of organizational actions I counted the number of different actions initiated by a firm in a given one year period (Derfus et al., 2008).
- New venture growth: This secondary dependent variable was captured through two different measures of growth (Hmieleski and Ensley, 2007; Hmieleski and Baron, 2008): the absolute level of sales growth and the absolute level of employment growth. Recent research (Shepherd and Wiklund, 2009) that analyzes the concurrent validity of growth related measures across a variety of studies argues for the high concurrent validity of the absolute measures of both sales and employment growth. By using these measures, this dissertation's findings can be tied to and compared with previous research on firm growth.

4.3.2 Independent Variable

In order to capture the three cognitive attributes of entrepreneurial schemas, the *configuration*¹ of the maps generated through content analysis techniques was analyzed. The analysis of the structural properties of the maps is particularly useful in large sample studies such as this dissertation because they are amenable to quantitative representation using social network methods. A focus on the structural properties of the map also allows for standardization and comparisons across individuals (Eden et al. 1992; Nadkarni and Narayanan, 2005). Consistent with the model developed in Chapter III, I analyzed three structural attributes of the causal maps embedded in the letters to shareholders: complexity, focus and proactive causal logic.

- Complexity of entrepreneurial schema: Following prior research, I used two measures to capture schema complexity: *comprehensiveness* and *connectedness* (Carley and Palmquist, 1992; Calori et al., 1994; Eden et al., 1992). Comprehensiveness was measured by adding the total number of concepts in a casual map (Nc) and connectedness was measured by dividing the total number of linkages (NI) in a causal map by the total number of concepts in that map (N/Nc). A composite measure of complexity was computed by averaging the two standardized individual measures.
- Focus of entrepreneurial schema: Following recent research (Nadkarni and Narayanan, 2007; Nadkarni and Barr, 2008) on managerial cognition I computed focus using a network based measure of centrality. Previous research (Nadkarni and Narayanan, 2007) uses two measures of centrality: degree and closeness. Closeness centrality can be obtained by using the shortest

¹ Text based causal maps, or maps derived from systematic coding of documents and transcripts, have been described as content-free maps because they represent the organization and structure of cognition. Text based causal maps are designed primarily to assess the causal structures and not the cognitive content (cf. Mohammed, Klimonski and Rentsch, 2000)

path from the focal concept to other concepts in the network (Freeman, 1978; Nieminen, 1974) and it captures the most central concept in the map. Degree centrality focuses on direct and adjacent paths of a concept with other concepts in the network and is a measure of the overall centrality of the map. This study uses degree centrality to capture focus because it does not take into account the centrality or the importance of a unique concept for all firms involved in the study but the overall centrality of the maps. The formula to compute degree centrality follows:

$$C_D(P_k) = \frac{\sum_{i=1}^n a(p_i, p_k)}{n-1}$$

Where: $C_D(P_k)$ = number of concepts connected to concept k and $a(p_i, p_k)$ = connection from concept p_i to concept p_k (either 0 or 1) and n = number of concepts in the causal map.

- Proactive causal logic: Previous research on managerial cognition has defined deterministic logics as environment → strategy (action) in the causal map and proactive logics as strategy (action) → environment links in the causal map (Eden et al., 1992; Fahey and Narayanan, 1989). To capture this variable I relied on in-degree analysis of the causal links between environment and strategy (action) (Eden et al.; 1992; Knoke and Kuklinski, 1982; Nadkarni and Barr, 2008). In-degree refers to the number of direct and indirect causal links going into a concept and reflects the degree to which the concept is contingent on a variety of factors that influence it (Nadkarni and Barr, 2008). The formula to compute this indicator follows (Freeman, 1978; Scott, 2000):

$$C_{DI}(P_k) = \sum_{i=1}^n \left[\frac{DI(p_i, p_k)}{n-1} \right]^{-1}$$

Where: $C_{DI}(P_k)$ = number of concepts going into concept k; $DI(p_i, p_k)$ = distances: shortest paths through which concepts in the network go into concept pk, and n = number of concepts in the causal map. A high number of in-degrees for environmental concepts from action concepts would suggest that strategy (actions) influence the environment suggesting a proactive causal logic, whereas high number of in-degrees for strategy concepts from environmental concepts would suggest that the environment influences strategy.

The out-degree indicator captures the extent to which concepts are causal or influential variables. The formula for out-degrees follows (Freeman, 1978; Scott, 2000):

$$C_{DO}(P_k) = \sum_{i=1}^n \left[\frac{DO(p_i, p_k)}{n-1} \right]^{-1}$$

Where: $C_{DO}(P_k)$ = number of concepts coming out of concept k; $DO(p_i, p_k)$ = distances: shortest paths through which concept pk goes into other concepts in the map; n = number of concepts in the causal map. High out-degrees for strategy would suggest that strategy influences the environment and is indicative of proactive causal logic (Nadkarni and Barr, 2008). To build the composite measure of proactive logics I also added the relative importance of the proactive causal links in the overall causal map (Carley and Palmquist, 1992; Knoke and Kuklinsky, 1982). The final composite measure of proactive logics was obtained by averaging the z-scores of in-degree environment, out-degree of strategy and percentage of strategy – environment links (Nadkarni and Barr, 2008).

4.3.3 Moderators

This section introduces the measures used to capture the moderating variables described in Chapter III (Figure 1): resource slack, social network heterogeneity and industry growth. The measures used for the moderating variables were selected based on a thorough review of the

literature on new venture growth and are thus appropriate given the model introduced in this dissertation and the sample used.

- Available resource slack: Following recent research on new venture growth (Mishina et al., 2004) I computed two measures of resource slack: financial resource slack and human resource slack. Previous research has advanced a number of measures for resource slack and has generated a lot of debate as to the most appropriate measure to capture resource slack (Bromiley, 1991; March and Shapira, 1987; Miller and Leiblein, 1996). This stream of research argues for two important aspects that need to be taken into consideration when measuring slack. First, slack is a quantity that is relative to a target level. Second, slack may be measured over time or at a given point in time. I follow recent work on new venture growth (e.g. Mishina et al., 2004)) and use the static measure of slack. The static measure of slack is appropriate when the construct of interest is the deployment of resources in the short term. Financial slack was calculated as the difference between working capital available and working capital required (Brealy and Myers, 1996). Working capital available is defined as the firm's current assets (e.g. cash and cash equivalents, accounts receivable, inventory, marketable securities). Working capital required is defined as a firm's current liabilities (e.g. accounts payable and accrued expenses). The difference between working capital available and working capital required is a measure of short term financial resource utilization (Bromiley, 1991; March and Shapira, 1987; Miller and Leiblein, 1996). Positive financial slack signals that the firm has excess resources or that its resources are underutilized. Negative financial slack signals that the firm is stretching its resources further than expected. Data needed to compute financial slack was obtained from Compustat database.

Human resource slack was calculated according to the following equation (Mishina et al., 2004): $Human\ resource\ slack = Firm\ employees/Firm\ sales - Industry\ employees/Industry\ sales$. Large values of the firm employees/firm sales ratio indicate greater levels of slack. As previously mentioned, this needs to be compared to a target level (Mishina et al., 2004). The industry employees/industry sales ratio represents an approximation of the target level of human resources in the firm's industry. The industry employees/industry sales ratio was also computed based on data collected from the Compustat database for all firms within a company's four-digit SIC code for the same year for which entrepreneurial cognition was captured (the year of the IPO).

- Industry growth : This variable was measured as yearly percentage change in industry gross sales (Dess and Beard, 1984). I computed the growth rate for the year of IPO by the percentage increase (decrease) in sales from the previous year (Eisenhardt et al., 1990). Data to compute this measure was obtained from Compustat database.
- Network heterogeneity: There are several dimensions that can be used to capture diversity in a firm's network such as: network formality, scope (local, national and international) and participation (industry, customers etc) (Macpherson and Holt; 2007). For the purposes of this study, partner firm industry affiliation is the most appropriate measure of heterogeneity as it is indicative of the diversity of knowledge available to the new firm (Cooke and Wills, 1999; Robson and Bennett, 2000). To capture heterogeneity in a firm's network I used a Herfindahl-type index. This measure is useful for capturing heterogeneity because it doesn't just take into account the number of different categories of agreements a given firm has reached but also the number of agreements included in each category. I first determined the number of different strategic partnerships and agreements that a firm has reached from

founding up to the year of IPO. I then categorized these agreements based on the partner firm's industry (SIC code) and computed the number of agreements in each category (industry). Finally, I divided the number of agreements within each category by the total number of agreements, squared each proportion and summed all the proportions. A number closer to zero is indicative of a firm that has more partnerships across different industries and thus has a more heterogeneous network. This data was obtained from Mergent online (the company 'History' and 'Joint Ventures' sections), company websites, company annual reports, Factiva and LexisNexis Academic databases.

4.3.4 Control Variables

This section introduces the measures used to capture the firm, year and industry related control variables included in this study. The measures employed for the control variables were selected based on a thorough review of the literature on new venture growth and are thus appropriate given the model introduced in this dissertation and the sample used.

- Industry type: Previous research has shown that the diversity, frequency and speed of actions taken by entrepreneurs are likely to be influenced by the type of industry in which the firm competes (Eisenhardt, 1989; Nadkarni and Narayanan 2005). Growth effects are also likely to vary with the type of industry in which the firm competes (Hmieleski and Baron, 2008; Mishina et al. 2004). Dummy variables were constructed to control for broad industry effects (4 digits SIC code). This approach is consistent with prior research (Certo, Daily and Dalton., 2001; Mishina et al., 2004) that has attempted to define a parsimonious set of industry controls that still accurately reflect the industry composition in the sample.
- Industry concentration: Previous research argues that industry concentration limits competitive actions among firms and reduces the amount of revenue that new ventures can

derive from their markets by creating high barriers to entry and yielding higher profits to established firms (Porter, 1985). Industry concentration was measured as the ratio of sales for the industry's top four companies to total industry sales.

- Industry dynamism: Past research on organizational adaptation has revealed the important impact of industry level variables such as dynamism, on strategic actions and their firm level outcomes (Barr and Nadkarni, 2008; Dess and Beard, 1984; Hmieleski and Baron, 2008; Sharfman and Dean, 1991). The industry-level rate of unpredicted change may be measured as the standard errors of four regression slopes in which the independent variable is time and the dependent variable may be either industry revenues, number of industry establishments, number of industry employees, or research and development intensity (Dess and Beard, 1984; Keats and Hitt, 1988, Sharfman and Dean, 1991; Castrogiovanni , 2002). In this dissertation I follow previous research focusing on new venture performance (Keats and Hitt, 1988; Sharfman and Dean, 1991) and use the standard error of the regression equation for industry revenues. Industry revenues have been used a measure of uncertainty and change in studies focusing on new businesses (Keats and Hitt, 1988; Sharfman and Dean, 1991). This variable was measured for the five years preceding the year for which the cognitive variables were measured using data from Compustat.
- Firm age: Because older companies have greater opportunities to develop their resource base and pursue a variety of strategic actions than younger firms I also control for firm age (Keats and Hitt, 1988). Firm age was measured as the number of years since the company was founded. Data to compute this measure was obtained from Mergent online and Hoover's databases.

- Firm size: Following previous research measuring new venture growth I included firm size as a control variable (Hmieleski and Baron, 2008; Keats and Hitt, 1988; Mishina et al., 2004). Larger companies have more developed market positions which might allow them to pursue more varied strategies leading to growth (Mishina et al., 2004). Firm size was measured as firm's total employment for the year in which the cognitive variables were measured. Data to compute this measure was obtained from Compustat, Hoovers and Mergent online databases.
- IPO year: Since the final sample of firms that used in this study is drawn from a population of firms that completed their IPO over a period of five years (1999-2004) I included five indicator variables to control for any systematic differences across these years that could influence new venture actions and growth.

4.4 SUMMARY

This chapter introduced the research sample, the data collection methods and measurement of constructs. In introducing the research sample a series of factors ranging from constraints implied by the independent and dependent variables to attempts to isolate to the maximum extent possible the effects of cognition on actions, which contributed to sample selection, were presented. In introducing the data collection methods this chapter described the steps taken to ensure the rigor and integrity of the data collection process. Finally, measurement of constructs and constructs' suitability for this study were also discussed.

CHAPTER V: RESULTS

This chapter presents the data analysis process and the results of the statistical tests performed. The chapter is organized into three main sections. The first section (5.1) presents the data screening steps, the second section (5.2) presents the results for the first set of dependent variables (i.e. diversity, frequency and speed of organizational actions) and the third section (5.3) presents the results for the second set of dependent variables (i.e new venture growth).

5.1 DATA SCREENING AND DESCRIPTIVE STATISTICS

The data set was first screened for missing data. There were no missing data for the dependent, moderator or control variables. However, there were six missing data points for the independent variables (schema attributes) that resulted when annual reports for these companies revealed that the founding process for these firms involved a spin-off or a merger. Although a cautious approach was taken when selecting the original dataset so as not to include firms that were born through spin-offs, these firms had been misclassified in the databases used to build the dataset. Several alternatives were considered in dealing with the missing data.

The first alternative considered was the replacement of these firms with new firms from the same industry. However, the database search performed with the specific criteria used to select the original dataset (i.e. founding date between 1996 and 2006, an IPO undertaken during this period and size less than 300 employees) revealed that there were no other firms in the initial set of industries selected that met these criteria.

The second alternative considered was the replacement of these firms with firms from a new industry. However, this alternative would have implied the introduction of a new control

variable in an already complex model and thus a reduction in the power of the overall sample. It would have also resulted in a new source of industry variation, for which this dissertation attempts to control to the maximum extent possible so as to isolate the effect of cognition on organizational actions.

Given the unsatisfactory consequences of each of these alternatives, I decided to take a conservative approach and treat these missing cognition data as missing data, and exclude them from the analysis. Exclusion of the six firms reduced the overall sample size from 110 firms to 104 firms.

The second step in the data screening process was related to screening of the organizational actions data and more specifically of the data used to compute the speed of organizational actions variable. This step was taken because the organizational actions data collection process revealed inconsistencies in the dates at which companies announced organizational actions taken (marketing, financial, service etc). There was one exception to this inconsistency: new product related actions. By triangulating various sources of data (company websites, media announcements and company annual reports) it became obvious that new product related actions were the only types of actions for which a relatively accurate measure of speed (measured as the number of days from when action is announced until action is implemented) could be computed.

There were several companies (10 of the 104) that did not undertake new product related actions in the years in which actions were captured. Data that are absent because these actions were not used in the time period of interest for this study is treated as missing data during statistical analyses even though, from a theoretical perspective, they are different from missing data. Statistical analyses involving the speed of organizational actions variable were performed

on a sample of 94 observations. Power analyses performed on this sample size revealed that the reduction in sample size did not threaten the generalizability of findings to the broader population of interest.

The third step in screening the data was related to screening all variables to examine the extent to which they meet the assumptions of multivariate normality. To assess normality, descriptive statistics and the shape of distributions were examined. The histograms indicated a potential problem: a skewed distribution for the organizational size variable. A logarithmic transformation was performed for the organizational size variable. Subsequent screening of the data showed that the distribution for this variable was significantly improved and that the rest of the variables did not exhibit excessively abnormal patterns.

The fourth step in screening the data was related to examination of the correlation matrix to determine the extent to which multicollinearity was a problem for the regression equations used in this study. Correlations between independent variables in excess of 0.5 can bias parameter estimates (Cohen et al., 2003). None of the independent variables exhibited correlations greater than 0.5. However, one of the control variables, Industry Dynamism, was strongly correlated with Industry Type (0.924). Any regression analyses performed with Industry dynamism in the model revealed strong multicollinearity patterns ($VIF > 10$, large standard errors). Given the results of the tests performed, I decided to eliminate Industry Dynamism from any subsequent analyses and control only for Industry Type. The full correlation table of the remaining variables is included in the Appendix (Table 7).

The fifth step in screening the data related to a series of tests for outliers conducted after the main effects regressions were run. Guidelines were calculated and followed for each model according to standard practice. Scatterplots were created mapping Predicted Values vs,

Unstandardized Residuals, Centered Leverage, Studentized Deleted Residuals, Studentized DFFIT, and DFBETAs. Several observations, although within the normal range, were quite distant from other observations for the sales variables. However, I maintained a conservative approach to deleting outliers as the observation had to be significantly outside the normal range or other data points in at least four of the five scatterplot tests. None of the potential outliers met this condition and observations were not removed from the dataset.

The final data screening step involved checking for violation of regression model assumptions. For this I used residuals, formal statistical tests and graphical displays, as noted below, to detect possible problems with the model.

a) Form of the relationship

Most of the residual plots did not exhibit serious deviations from the zero line when a loess line was added. This was due to the transformation performed to correct for skewness.

b) Omitted independent variables

In specifying the regression models I included all the independent variables (IVs) specified in the hypotheses.

c) Measurement error

Two factors point to high reliability of the data. First, the sources of my data, company annual reports and 10-K forms filed with SEC, Compustat for the financial data, have been utilized extensively in prior research and have been found to be reliable (Fiol, 1995; McElreath and Wiggins, 1984). Second, I screened the data for coding errors and nonsensical entries.

d) Homoscedasticity of residuals/nonconstant variance

Plotting the residuals against the independent variables and the predicted values did not reveal major problems of heteroscedasticity. Subsequent (Durbin-Watson tests) did not signal major autocorrelation problems.

e) Normality of residuals

The histograms of the residuals and the q-q plots indicated that distributions of the unstandardized residuals were within normal range.

The data screening steps undertaken revealed that there are no major problems associated the data that could potentially impact the analysis and the results. The results of the hypotheses regarding diversity, frequency and speed of organizational actions are presented in the next section.

5.2 TESTS OF HYPOTHESES - INFLUENCE OF ENTREPRENEURIAL COGNITION ON DIVERSITY, FREQUENCY AND SPEED OF ORGANIZATIONAL ACTIONS

The hypotheses introduced in this study were tested using multivariate regression analysis. Multivariate regression analysis is a useful method of analysis when the models tested contain multiple dependent variables and any number of predictors. Moderated regression analysis was used to test the hypotheses that introduce the industry growth, resource slack and network heterogeneity variables

Hypotheses 1 through 3a-c predicted the impact of complexity, focus and proactive causal logic on diversity, frequency and speed of organizational actions. These hypotheses were simultaneously tested in Models 2 included in Table 8 in the Appendix.

Hypotheses 1a, 1b and 1c predicted that complexity of entrepreneurial schema is positively related to diversity, frequency and speed of organizational actions. Close examination

of the regressions coefficients for the complexity variable reveals that although some are close to significance ($p=0.148$ for diversity and $p=0.210$ for frequency) these hypotheses are not supported. Several alternative measures of complexity (i.e comprehensiveness, connectedness, and density) were used to estimate the coefficients but none of the measures yielded significant results. Furthermore, the positive sign of the complexity coefficients for both diversity and speed of organizational actions seems to suggest that, contrary to what the hypotheses predicted, complexity of entrepreneurial schema hinders diversity and speedy organizational actions in the context of new ventures. Hypotheses 1a, 1b and 1c are thus not supported.

Hypotheses 2a, 2b and 2c predicted that focus of entrepreneurial schema is negatively related to diversity, frequency and speed of organizational actions. Examination of the regression coefficients reveals that focus does not have a statistically significant relationship with diversity ($p<0.05$) and speed ($p<0.1$) of organizational actions. However, the sign of the regression coefficients reveals that focus of entrepreneurial schema is *positively* related to diversity and speed of organizational actions. The alternative measures of focus (i.e maxeigenvalue) used to capture focus yielded similar results. Taken together these findings suggest that the directionality of Hypotheses 2a and 2c is not supported but that an important, significant relationship exists between entrepreneurial schema focus and diversity and speed of organizational actions. I will return to this point in the discussion of the results.

Examination of the regression coefficients for the model that uses frequency as a dependent variable reveals that focus does not have a significant effect on frequency of organizational actions. Hypothesis 2b is thus not supported.

Hypotheses 3a, 3b and 3c predicted that proactive causal logic is positively related to diversity, frequency and speed of organizational actions. Examination of the regression

coefficients reveals that proactive causal logic does not have a significant relationship with any of the organizational actions attributes.

When computing the proactive causal logic measure, the deterministic causal logic measure was also computed. Entrepreneurs navigating their environments with a deterministic causal logic believe that the environment in which their firm competes determines to a large extent the actions that they take (Fahey and Narayanan, 1989). The predictions regarding deterministic causal logic would thus be in the opposite direction of those made regarding proactive causal logic as deterministic causal logic has been found to negatively impact speed of organizational actions and strategic flexibility (Nadkarni and Barr, 2008; Fahey and Narayanan, 1989). An alternative set of hypotheses was thus considered:

H3 a) Deterministic causal logic is negatively related to diversity of new organizational actions.

H3 b) Deterministic causal logic is negatively related to frequency of new organizational actions.

H3 c) Deterministic causal logic is negatively related to speed of new organizational actions.

Post-hoc analyses of the alternative hypotheses using the deterministic causal logic measure revealed that although proactive causal logic does not exert a positive significant relationship on diversity of organizational actions, deterministic causal logic exerts a negative, significant ($p < 0.1$) relationship with diversity of organizational actions but not with speed and frequency of organizational actions. The alternative model tested is included in the Appendix (Table 10).

Examination of the regression coefficients for the control variables reveals additional information regarding the factors that impact diversity, frequency and speed of organizational actions. Frequency of organizational actions is strongly driven by industry factors and the conditions surrounding the date of the IPO and not by cognitive attributes. This pattern of

relationships reveals the fact that the frequency with which new ventures take actions is, to a great extent, a function of the industry in which the firms are housed and of the unidentified events that surround the date the firms become public. In the models testing diversity and speed of organizational actions external factors are less important and the individual level variables, primarily focus, explain most of the variance.

Hypotheses 4 through 12 introduce the moderating effects of resource slack, industry growth and network heterogeneity on the relationship between complexity of entrepreneurial schema, focus of entrepreneurial schema and proactive causal logic. Prior to running any analysis to detect interaction effects the data was mean centered. This insures that all non-essential relationships between the independent variables are eliminated (Cohen et al., 2003). Mean-centering also simplifies the interpretation of the results but allowing one to more effectively capture effects for the average firm and contrast them with firms that depart from this average. The effects of the three moderating variables were simultaneously tested for each dependent variable in Models 4 included in Table 8 in the Appendix.

Hypotheses 4 through 6 introduced the moderating effect of resource slack on the relationship between complexity, focus of entrepreneurial schema and proactive causal logic, and diversity, frequency and speed of new organizational actions. Examination of the regression coefficients for Model 4 reveals that resource slack does not significantly alter the effect of any of the entrepreneurial schema attributes on any of the dependent variables used in models 4. Each measure of resource slack (i.e financial slack and human resource slack) was independently tested; significance, however, was not achieved in either circumstance. Descriptive statistics for HR slack show that many firms have zero HR slack and there is little variation in the sample on this measure for the year for which it is captured (the end of the IPO year). The finding that the

interaction terms with HR slack are not significant is thus not surprising. The second measure captures financial slack (the difference between current assets and current liabilities). This measure exhibits a relatively normal distribution within the sample but it does not impact significantly organizational actions.

Alternative forms of the relationship between resource slack and various types of actions were considered and transformations (i.e. logarithm and squared term) of the resource slack variable were performed. None of these transformations significantly improved the model. Hypotheses 4 through 6 are thus not supported.

Hypotheses 7a, 7b and 7c predicted a positive moderating effect of industry growth on the relationship between complexity of entrepreneurial schema and diversity, frequency and speed of new organizational actions. Examination of the regression coefficients for model 4 reveals that industry growth significantly influences the relationship between complexity of entrepreneurial schema and diversity of new organizational actions ($p < 0.05$) and the relationship between complexity of entrepreneurial schema and frequency of organizational actions ($p < 0.05$). Interaction plots illustrate the nature of the moderating effect. As illustrated in Figure 4, for low values of industry growth complexity has a negative impact on diversity while for high values of industry growth complexity has a positive effect on diversity and the relationship between complexity and diversity of new organizational actions is strengthened. Hypothesis 7a is thus supported. For low values of industry growth as complexity increases frequency also increases and for high values of industry growth as complexity increases frequency decreases (Figure 5). Hypothesis 7b is thus supported for significance but not for directionality. Hypothesis 7c is not supported as industry growth does not have a significant impact on the relationship between complexity of entrepreneurial schema and speed of new organizational actions.

Hypotheses 8a, 8b, and 8c predicated a negative moderating effect of industry growth on the relationship between focus of entrepreneurial schema and diversity, frequency and speed of new organizational actions. Examination of the regression coefficients for Model 4 reveals that industry growth significantly influences ($p < 0.05$) only the relationship between entrepreneurial schema focus and frequency of organizational actions (Hypothesis 8b). For low values of industry growth as focus increases frequency decreases and for high values of industry growth as focus increases frequency also increases (Figure 6). This effect is different from the one originally predicted in Hypothesis 8b. Although focus has a significant direct positive effect on diversity and speed of organizational actions, this relationship does not seem to be sensitive to external industry influences such that the moderating effect of industry growth is not supported for hypotheses 8a and 8c.

Hypotheses 9a, 9b and 9c predicted a positive moderating effect of industry growth on the relationship between proactive causal logic and diversity, frequency and speed of organizational actions. Examination of the regression coefficients for Model 4 reveal that industry growth significantly influences ($p < 0.05$) only the relationship between proactive causal logic and frequency of organizational actions (Hypothesis 9b). Industry growth plays a very similar role in this case to its role in moderating the relationship between focus and frequency of organizational actions (i.e. industry growth significantly interacts with proactive causal logic only when using frequency as a dependent variable as this is the dependent variable most strongly impacted by industry level effects) (Figure 7). The lack of significant effects for the other interactions with proactive causal logic could also be due to the issues identified at Hypotheses 3a and 3b. Post-hoc analysis performed with deterministic causal logic also reveals a

significant interaction with industry growth (Table 8). Thus, hypotheses 9a and 9c are not supported in their original form.

Hypotheses 10a, 10b and 10c predicted a positive moderating effect of social network heterogeneity on the relationship between entrepreneurial schema complexity and diversity, frequency and speed of new product related actions. Examination of the regression coefficients for Model 4 reveals that social network heterogeneity does not significantly impact the relationship between entrepreneurial schema complexity and organizational actions diversity. Although the interaction term has a positive coefficient, the term is not significant when introduced in a model that simultaneously considers the effect of proactive causal logic and entrepreneurial schema focus. Thus, hypothesis 10a is not supported. Network heterogeneity positively moderates ($p < 0.05$) the relationship between complexity of entrepreneurial schema and frequency of new organizational actions such that when network heterogeneity is low as complexity increases frequency of organizational actions decreases and when network heterogeneity is high as complexity increases frequency of organizational actions increases (Figure 8). Hypothesis 10b is thus supported.

Social network heterogeneity has an interesting effect on the relationship between entrepreneurial schema complexity and organizational actions speed. For low levels of social network heterogeneity as complexity increases speed increases and for high values of social network heterogeneity as complexity increases speed decreases (Figure 9). This effect suggests that high levels of network heterogeneity strengthen the negative relationship between complexity and speed. Hypothesis 10c is thus not supported in its original form.

Hypotheses 11a, 11b and 11c predicted a positive moderating effect of social network heterogeneity on the relationship between entrepreneurial schema focus and diversity, frequency

and speed of organizational actions. Examination of the regression coefficients for model 4 reveals that for hypothesis 11a, when social network heterogeneity is high the relationship between entrepreneurial schema focus and organizational actions diversity is more positive ($p < 0.1$) (Figure 10). Thus, hypothesis 11a is not supported in its original form.

Social network heterogeneity does not impact significantly the relationship between entrepreneurial schema focus and frequency of organizational actions. Given that the models using frequency as a dependent variable reveal strong direct and indirect industry effects, it is not unexpected to see that all other effects become nonsignificant. Thus, hypothesis 11b is not supported.

For hypothesis 11c, for low levels of social network heterogeneity as entrepreneurial schema focus increases speed of organizational actions decreases and for high values of social network heterogeneity as entrepreneurial schema focus increases speed of organizational actions increases (Figure 11). Thus, network heterogeneity supports and strengthens ($p < 0.05$) the direct, positive relationship found between entrepreneurial schema focus and speed of organizational actions. However, hypothesis 11c is not supported in its original form.

Hypotheses 12a, 12b and 12c predicted the positive negative moderating effects of social network heterogeneity on the direct relationships between proactive causal logic and diversity, frequency and speed of organizational actions. Examination of the regression coefficients for Model 4 reveals that social network heterogeneity significantly impacts ($p < 0.1$) the relationship between proactive causal logic and both diversity and frequency of organizational actions but that this effect is in the opposite direction of what was predicted in hypotheses 12a and 12b. For low levels of social network heterogeneity as proactive causal logic increases diversity and frequency of organizational actions increase and for high levels of social network heterogeneity

as proactive causal logic increases, diversity and frequency of organizational actions decreases (Figure 12 and Figure 13). The lack of a significant interaction effect when using speed of organizational actions as a dependent variable suggests that having a heterogeneous network of partners does not bring the expected benefits when associated with proactive causal logic and might even hinder speedy decision making by exposing entrepreneurs to divergent insights and perspectives which could increase vacillation. Thus, hypothesis 12c is not supported.

Examination of the regression coefficients for the remaining variables included in the models that test the moderating effects of resource slack, industry growth and social network heterogeneity reveals additional information regarding the factors that impact diversity, frequency and speed of organizational actions. First, just as in the case of the models that introduced main effects, frequency of organizational actions is again strongly driven by industry factors and the conditions surrounding the date of the IPO in addition to the interaction effects that schema attributes have with the moderating variables. This pattern of relationships reinforces the fact that the frequency with which new ventures take actions is strongly influenced by the industry in which the firms compete and by the events that surround the date the firms became public. Second, in the models testing diversity and speed of organizational actions external (i.e industry level) factors are less important and the interactions explain most of the variance.

5.3. TESTS OF HYPOTHESES - NEW VENTURE GROWTH

The last set of hypotheses (13a, 13b and 13c) tested the direct relationship between diversity, frequency and speed of new organizational actions and new venture growth. These hypotheses were simultaneously tested in Model 2 (Table 9 included in the Appendix) using the absolute levels of sales growth and employment growth as dependent variables.

Hypothesis 13a predicted a direct, positive effect of new organizational actions diversity on new venture growth. Examination of the regression coefficients for model 2 for both sales growth and employment growth reveals that diversity of new organizational actions has a positive effect on both sales growth ($p < 0.1$) and employment growth ($p < 0.1$). Hypothesis 13a is thus supported.

Hypothesis 13b predicted a direct, positive effect of frequency of new organizational actions on new venture growth. Examination of the regression coefficients for model 2 for sales growth and employment growth reveals that, although positive, the coefficient for frequency of organizational actions is not significant. This suggests that growth in new ventures is more strongly impacted by new organizational actions diversity and speed than by frequency. Thus, hypothesis 13b is not supported.

Hypothesis 13c predicted a direct, positive effect of new organizational actions speed on new venture growth. Examination of the regression coefficients for model 2 reveals that speed of new organizational actions has a significant, negative impact on sales growth ($p < 0.1$) and it does not have a significant effect on employment growth. Hypothesis 13c is thus not supported in its original form.

Overall examination of the regression coefficients for the rest of the models that test the effect of new organizational actions diversity, frequency and speed reveal additional and interesting information. Consistent with prior research on new venture performance, I find that new venture growth is negatively impacted by high levels of industry concentration ($p < 0.05$). I also find that the type of industry in which a firm competes also affects the degree to which a new venture grows. Firms from the semiconductors and computers industries have significantly higher levels of growth ($p < 0.05$) than firms in other industries. Firm size is also positively

associated with new venture growth ($p < 0.1$) revealing that larger firms may expect higher levels of sales growth. However, firm age and the year of IPO do not impact significantly new venture growth.

A summary of all supported and unsupported hypotheses is included in the Appendix (Table 6).

5.4 SUMMARY

This chapter introduced the results of the study. In summary, this study found only partial support for the notion of opportunistic adaptation. The results also suggest that entrepreneurial cognition has a significant direct impact on some types of organizational actions. However, the results do indicate that the effect of entrepreneurial cognition on various organizational actions is significantly influenced by industry growth and social network heterogeneity. In regard to new venture growth, this study finds that diversity of new organizational actions is positively related to new venture growth and that speed of new organizational actions is negatively related to growth. The implications of these findings and also of the nonsignificant findings are discussed at greater length in the following chapter.

CHAPTER VI: DISCUSSION

The last chapter provides an overview of the findings presented in Chapter V and discusses their implications for theory, practice and future research. The chapter is organized into three parts. In section 6.1, I discuss the results of the study and their specific implications for management theory. In section 6.2, I discuss the general implications of the study for theory and practice. Section 6.3 presents limitations of the study and directions for future research.

6.1 DISCUSSION OF THE RESULTS AND THEIR SPECIFIC IMPLICATIONS

In this section I discuss the results of the study by focusing on three overarching themes that this dissertation has introduced. Section 6.1.1 discusses the results from the perspective of the model of growth introduced. Section 6.1.2 discusses the findings related to the relationship between entrepreneurial cognition and organizational actions. Section 6.1.3 discusses the results related to the contextual influences of the relationship between entrepreneurial cognition and organizational actions.

6.1.1 How do new ventures grow? The model of opportunistic adaptation

The main goal of this dissertation was to explore the extent to which new venture growth can be explained through a model of opportunistic adaptation . Prior research suggests that to understand new venture growth we need holistic models in which individual, firm and industry level factors are simultaneously considered (Sandberg and Hofer, 1987; Chrisman, Bauerschmidt and Hofer, 1999; Wiklund, Patzelt and Shepherd, 2009). Further, most prior works on new venture growth pay limited attention to the adaptation process through which growth is achieved. This study builds on prior works on organizational adaptation in high velocity environments and argues that in the context of new ventures surrounded by uncertainty and ambiguity, growth is

achieved through a process in which proactive entrepreneurs take fast, diverse and frequent organizational actions based on how they interpret information from the environment. The model of opportunistic adaptation is a departure from prior works, which view adaptation as responses to threats in the environment (e.g. Dutton and Dukerich, 1991; Kraatz and Zajac, 2001); it is grounded in opportunity logic (Bingham and Eisenhardt, 2008) in which firm action is driven by the entrepreneurs' constant search for opportunities.

By putting the entrepreneur at the center of the model of opportunistic adaptation and taking a cognitive view of this process, this dissertation explores how entrepreneurial cognition gives rise to different patterns of proactive, opportunity-oriented organizational actions and how these patterns are linked to growth. More specifically, this study finds that new ventures grow through a process in which *diversity* of organizational actions is driven by the combined influence of entrepreneurial schema attributes, industry growth and social network heterogeneity. Furthermore, this study finds that although entrepreneurial cognition has limited direct influences on new venture actions, when the influence of contextual factors such as industry growth and degree of social network heterogeneity is considered, cognitive attributes have important and significant effects. Thus, this dissertation finds support for the assertion that new venture growth occurs through opportunistic adaptation in which individual, firm and industry level factors *cannot* be studied in dissociation from one another.

The finding that *diversity* of organizational actions is significantly influenced by cognitive attributes and, in turn, significantly impacts growth offers some support to the notion of opportunistic adaptation as a process in which entrepreneurs explore a wide variety of alternative goals, activities and modes of operation (Miller and Friesen, 1982; Miller et al., 1996) and engage in strategic experimentation (Nicholls-Nixon et al., 2000) in an attempt to learn about

their environments. However, this study also shows that not all types of organizational actions in which entrepreneurs engage as part of the opportunistic adaptation process lead to growth.

The finding that frequent and fast organizational actions play a small role in the new venture growth process, or that they may negatively influence it, brings new insights for the literature on new venture growth in general, and the literature on organizational adaptation in particular. One of the main assumptions on which models of continuous adaptation (Eisenhardt and Tabrizi, 1995; Brown and Eisenhardt, 1997), from which the core arguments of this dissertation have been developed, rest is that in contexts characterized by high levels of uncertainty and ambiguity, such as the new venture context, frequent actions aimed at probing the environment and fast decision making processes are associated with higher levels of performance. Yet, this study finds that when diversity, frequency and speed of organizational actions are simultaneously analyzed, only diversity of organizational actions is associated with new venture growth. This implies that future research that studies models of continuous adaptation needs to take into account the multifaceted nature of organizational actions and their different impact on firm outcomes.

For example, *frequency* of organizational actions is largely driven by industry level factors, as captured by the industry control variables. This raises the possibility that the results of prior studies (e.g. Eisenhardt and Tabrizi, 1995; Brown and Eisenhardt, 1998; Nicholls-Nixon et. al 2000) may have been biased by the use of a single industry context, a narrower range of organizational actions (e.g. new product related actions only), and/or firm size (multi-business firms with sales larger than \$50 millions). This dissertation shows that by increasing the range of actions for which frequency is assessed and by varying industry contexts and focusing exclusively on new and small firms, the results point in a somewhat different direction. The

coefficient for frequency has the predicted sign but it is not significant in the model that simultaneously includes speed and diversity.

These results suggest that adopting an aggressive monitoring posture and frequently probing the environment (Brown and Eisenhardt, 1998; Nicholls-Nixon et al. 2000) fails to provide the expected outcomes. This might be due to the new venture context, where resources are limited, frequent action may disperse attention and resources toward unproductive or unnecessary adjustments. The results also point to the possibility that, while frequency of actions may lower the hazard of death for the organization (Singh, House and Tucker, 1986), they do not necessarily translate into growth in the way that a diverse repertoire of actions does.

The finding that *speed* of organizational actions is negatively related to new venture growth not only highlights the influence of industry and firm age, but also the effects of different operationalizations of the speed construct. In many of the early studies (e.g. Bourgeois and Eisenhardt, 1988; Eisenhardt, 1989; Judge and Miller, 1991; Baum and Wally, 2003) that find support for a positive relationship between speed of decisions making and performance, speed of decision making is measured through survey instruments that retrospectively capture the amount of time required by executives to *reach a decision*. This dissertation measures speed as the amount of time needed to *implement a previously reached decision* and thus focuses only on materialized actions (decisions). Although prior research (e.g. Baum and Wally, 2003) implies a positive relationship between speed of decisions and performance, this dissertation observes a negative relationship between speed of decision implementation and performance. Possible explanations for the opposite finding might stem from organizational and team related issues and conflicts (Forbes, 2005) that can significantly delay decision implementation and thus have a negative effect on new venture growth.

Another source of explanations for this dissertation's finding related to speed might stem, as current debates in the literature also suggest, from firm age and industry particularities. Studies by Forbes (2005) and Perlow, Okhuysen and Repenning (2002) support the proposition that fast decision making can lead new firms to a 'speed trap' that is ultimately detrimental to new firm performance. Both studies use new ventures in the computer industry as their population of interest and show that a pattern of quickly adopting a new technology or quickly signing a major strategic alliance is often followed by problems such as insufficient decision analysis, alliance conflicts etc. Thus, there seem to be limits to the value of fast decisions/actions for new ventures regardless of environmental pressures for speed (Forbes, 2005).

The results may also be context specific. The majority of the firms in the sample used in this dissertation are biotech firms, an industry where speed of new product related actions has different connotations given the multiple levels of approval that new products, trials and manufacturing technologies need to go through. Given the three-year time frame when growth was assessed, the negative effect of speed on sales growth could be the result of allowing an insufficient time period for new product related actions to be reflected on sales.

In sum, the findings provide some support for the proposed model of opportunistic adaptation. For the new ventures included in the sample, growth was influenced by a complex, integrative process in which opportunity focused actions that lead to growth were driven by a combination of individual, firm and industry related factors. This dissertation shows that in order for new ventures grow, entrepreneurs need to engage in a variety of organizational actions; actions covering a broad spectrum of domains signal the constant search for opportunities in which entrepreneurs are engaged. They also function as learning mechanisms and aid entrepreneurs in updating their schemas so that they can later engage in a new, diverse set of

organizational actions. However, opportunistic adaptation is more than a relationship between certain attributes of entrepreneurial schema and organizational actions: it is also a process that assumes the combined influence of industry and firm related variables. Industry growth and social network heterogeneity function both as catalysts and suppressors of the relationship between entrepreneurial cognition and organizational actions and need to be taken into consideration to fully understand the notion of opportunistic adaptation. The next sections discuss in more detail the significance of each of the direct and indirect relationships between the various components of the model of opportunistic adaptation.

6.1.2 The relationship between entrepreneurial cognition and new organizational actions

The second goal of this dissertation was to identify the role of entrepreneurial cognition in opportunistic adaptation. In more specific terms, this research sought to examine the impact that three different types of cognitive attributes, complexity, focus and proactive causal logic have on diversity, frequency and speed of organizational actions.

The results of this study provide some support for the notion that entrepreneurial cognition has a direct impact on organizational actions, but stronger support for the notion that its effect is influenced by contextual factors. This is an important finding because it shows that, in the context of new ventures, entrepreneurial cognition “works” in conjunction with firm and industry related factors to explain organizational actions. This is an important departure from prior research on managerial cognition and adaptation that has often investigated only the direct links between managerial cognition and action (e.g. Barr et al., 1992; Barr and Huff, 1997; Calori et al., 1994) because it sheds new light on the nature of this relationship, especially in the rarely researched context of new ventures.

The results of this study provide insight into causes of variation across new ventures in the speed and diversity of their actions. Prior research in entrepreneurship has examined the role of entrepreneurial cognition in start-up processes (e.g. Mitchell et al, 2001) and has recognized the potentially important role that it plays in other new venture related processes. However, this assertion has largely been theoretical and empirical tests remain uncommon. Furthermore, although prior research in strategic management has drawn important links between various aspects of managerial cognition and firm action and outcomes (e.g. Barr et al, 1992; Barr and Huff, 1997; Calori et al., 1994) it has often studied attributes of managerial cognition independently from each other. This dissertation shows that when the effects of three distinct cognition attributes - complexity, focus and proactive logic - are simultaneously considered, certain attributes have a consistently more significant impact on organizational actions than others. Further, this research finds that these impacts are in a different direction in the new venture context than current theory, developed in the context of established businesses, predicts it to be. These results are discussed in detail below.

a) The nonsignificant effect of entrepreneurial schema complexity

This study did not find support for the anticipated direct, positive links between entrepreneurial schema complexity and diversity, frequency or speed of organizational actions. Prior research emphasizes the role of complexity as an antecedent to efficient information-processing capacity; highly complex individuals seek more information, make more causal attributions and in essence acquire, understand and articulate conceptual knowledge better than lower complexity individuals. Thus, it was expected that this more efficient information processing capacity would lead to faster, more diverse, and more frequent organizational actions. The nonsignificant results observed in the dissertation underscore the fact that, although the links

from complexity to knowledge acquisition and processing are clear, the links from complexity to individual or firm level actions are less well understood.

b) The unexpected effect of entrepreneurial schema focus

A second unexpected result was that focus has a strong positive effect on diversity of actions when a negative effect was predicted by prior research. There are several possible causes for this result. One possible explanation is based on differences in the operationalization of the focus/centrality variable and the firm level outcomes to which it is linked. Two empirical studies have used the focus concept to predict firm level action. In Nadkarni and Barr (2008) focus is not measured at the overall level of the map, but rather on the direction of focus (type of environment), and it is linked to speed of response to a specific event a more precise reference point than that utilized in the present study. Nadkarni and Narayanan (2005) operationalize focus at the level of the map but link it to shifts in six different categories of actions over a three years time period. This dissertation uses 15 categories of actions, covering a broader spectrum of activity but over a period of just one year. By using a broader set of organizational actions this dissertation is more likely to have captured those actions, for example all new product related actions, that are more likely to be encountered in technology intensive industries and have a positive relationship with focus. By analyzing organizational actions over a short period of time, this study has captured those actions that are of immediate concern for entrepreneurs and thus represent the focus of their attention. Furthermore, prior works sampled larger, established firms rather than new ventures. The results of this study suggest that in the context of newly founded firms, which lack the sophisticated action identification/implementation mechanisms that mature firms have, entrepreneurs need to rely on schemas that help them clearly identify and implement a variety of organizational actions.

Another possible explanation for the unexpected positive relationship comes from the literature in cognitive psychology (Marek, Griggs and Koenig, 2000; Newstead and Griggs, 1992; Hong and O'Neil, 1992). This research shows that centrality/focus facilitates information processing and application in various problem-solving situations. Individuals with clear and logically sequenced cognitive structures are better able to arrive at accurate and effective problem solutions by channeling attention to the appropriate combination of hypotheses (Nadkarni and Narayanan, 2005). Thus, focus may actually promote diversity by allowing individuals to sequentially examine and find solutions to multiple issues. This might also explain why, when the effects of complexity and focus are simultaneously analyzed for diversity and speed of organizational actions, focus has a significant effect while complexity does not. Both diversity and speed of actions are a direct and immediate result of the accuracy and speed with which possible courses of actions and their consequences are evaluated. Thus, even though complexity might suggest a breadth of domain understanding, centrality/focus is more closely related to application of domain knowledge (Nadkarni and Narayanan, 2005).

c) Proactive vs. deterministic causal logic

This study's results did not find support for the anticipated positive links between proactive causal logic and diversity, frequency, and speed of organizational actions. However, a closer look at the data, the operationalization of the variable, and a thorough consideration of other aspects of the industry not captured in the existent control variables, provide important explanations. The pharmaceutical industry, from which 58% of the sample was drawn, is a highly regulated environment to which all firms and new firms/entrepreneurs in particular, might feel constrained to conform. Both proactive causal logic and deterministic logic are computed as the number of links between actions and environment (including the regulatory environment).

However, only deterministic causal logic has an effect on diversity of actions (negative), which might suggest that the sample used in this study includes more individuals that score high on deterministic causal logic than on proactive causal logic. A possible solution to this problem, as suggested in Chapter V, is the inclusion of an alternative set of hypotheses that link deterministic causal logic to diversity/frequency/speed of actions. The negative effect of deterministic causal logic on diversity of actions might suggest that proactive causal logic could have a significant effect on diversity should the level of regulation in the industry be controlled for.

d) The effect of entrepreneurial cognition is heavily influenced by external context

A more complete view of the role that entrepreneurial cognition plays in the new venture growth process is revealed when the moderating role of firm and industry related variables are considered. Specifically, entrepreneurial schema complexity and proactive causal logics do not have an independent effect on organizational actions. However when industry growth and social network heterogeneity are considered, the effect of cognition on the extent to which firms engage in diverse, frequent or fast organizational actions becomes significant. For example, when estimating the effects of cognition and context on speed of organizational actions, the results show that for high levels of network heterogeneity, entrepreneurial schema complexity leads to a delay in action implementation.

These findings contribute to two different streams of research. First, they contribute to the new venture growth literature (e.g Sandberg and Hofer, 1987; Chrisman, Bauerschmidt and Hofer, 1999; Wiklund, Patzelt and Shepherd, 2009) by emphasizing the importance of an integrative approach to explain new venture growth and by clearly delineating the circumstances under which cognitive variables play a significant role in the new venture growth process. Second, they contribute to the cognitive view of adaption (Barr et al.,1992; Bogner and Barr,

2000; Meyer, 1982; Dutton and Jackson, 1987) by analyzing the effects that cognition has on action when different industry and firm related variables are simultaneously considered. These contributions underscore the fact that cognition should be analyzed in the contexts in which it is formed and not in isolation from it. The moderating effects on the relationship between entrepreneurial cognition and new organizational actions are further discussed in the next section.

6.1.3 The effect of resource slack, industry growth and social network heterogeneity on the relationship between cognitive characteristics and new venture action

The third goal of this dissertation was to analyze the role that factors such as slack resources, industry growth and social network heterogeneity play in the process associated with new venture growth. In more specific terms, the goal was to explore the effect that these factors have on the relationship between entrepreneurial cognition and organizational actions. The results of this study suggest that contextual factors have a significant effect on the relationship between cognitive capacities and the actions associated with opportunistic adaptation and new venture growth. Thus, this dissertation offers a more complete picture of how cognition, firm and industry context work together to influence new venture growth. The specific impact of each of these factors is discussed in the next sections.

a) The nonsignificant effect of resource slack

The first moderating effects investigated were those of human and financial *resource slack*. The finding that available resource slack did not have a moderating effect on the link between cognition and action was unexpected in light of literature that argues for such a relationship. A source of explanation for these results might lie in the fact that, the relationship

between available/unavailable resources, cognition and firm growth might be more direct than this dissertation presumes it to be. A closer look at this study's correlation matrix reveals that resource slack is correlated significantly with new venture growth. However, this relationship does not seem to work in combination with the cognitive attributes and the types of organizational actions I investigate in this dissertation.

The results regarding resource slack mirror the current debates and the conflicting findings of the literature that seeks to link resource slack to exploratory activities (such as new product related actions) and exploitative activities. Some (Kraatz and Zajac, 2001; Nohria and Gulatti, 1996) argue that resource slack encourages exploratory activities and innovation, others (Mishina, Pollock and Porac, 2004; Tang and Peng, 2003) argue that slack, and in particular HR slack, has a negative effect on exploration and leads to cautious decision-making and risk aversion, yet others fail to find significant effects when focusing on financial slack and its relationship to both exploratory and exploitative actions (Voss et al. 2008; Mishina et al., 2004). Thus, the effect that resource slack has on new venture related outcomes is still a topic that deserves further investigation.

b) Industry growth influences the effect of cognition on action

The second moderating influence considered was that of *industry growth* and results indicate that it has a significant influence on the relationship between cognitive attributes and new venture action. First, industry growth plays the expected role in influencing the relationship between schema complexity and diversity of organizational actions: for low levels of industry growth the relationship is weaker and more negative and for high levels of industry growth the relationship is stronger and more positive. This suggests that as the level of industry growth

increases, entrepreneurs with complex schemas are better able to understand, discern and act on a variety of opportunities.

Second, industry growth moderates the relationship between schema complexity and frequency of organizational actions: for low levels of industry growth this relationship is stronger and more positive and for high levels of industry growth this relationship is weaker and more negative. This suggests that complexity might be a valuable attribute to possess when the environment is more hostile (low levels of industry growth). Under adverse conditions, entrepreneurs may need to engage in frequent organizational actions in an attempt to learn about their environments. As the industry reaches high levels of growth, high levels of complexity might actually be detrimental because they increase vacillation and are negatively related to frequency of organizational actions.

Third, the results also indicate that the relationship between schema complexity and speed of organizational actions is not sensitive to industry growth. Consistent with a lack of a significant, direct relationship between entrepreneurial schema complexity and speed of organizational actions, this result suggests that complexity might not be the most important attribute to possess when the outcome of interest is speed of organizational actions regardless of the context in which it is observed. Complex schemas may increase the amount of time required to implement action by introducing vacillation. Industry growth plays a significant, direct role on speed of organizational actions as prior research (e.g, Eisenhardt and Schoonhoven, 1990) has also found but it does not significantly alter the relationship between complexity of entrepreneurial schema and speed of organizational actions.

Fourth, the results indicate that the relationship between schema focus and both diversity and speed of organizational actions is not sensitive to industry growth. This result is consistent

with prior research in cognitive psychology that shows that focus is a more stable schema attribute than other schema attributes including cognitive complexity (Marek, Griggs and Koenig, 2000; Newstead and Griggs, 1992; Hong and O'Neil, 1992). This stream of research also suggests that the relationship between focus and various individual related outcomes (problem solving tasks) is less influenced by environmental (external) factors and more influenced by the characteristics of the task itself.

Fifth, industry growth significantly influences the relationship between schema focus and frequency of organizational actions: for low levels of industry growth the relationship between entrepreneurial schema focus is weaker and more negative and for high levels of industry growth the relationship is stronger and more positive. These results are consistent with the more general finding of this dissertation that frequency of organizational actions is strongly driven by industry effects (i.e. this dissertation did not find a direct, significant relationship between any of the cognitive attributes and frequency of organizational actions). In this particular case, they suggest that high levels of industry growth provide more opportunities and are more rewarding for focused entrepreneurs to than low levels of industry growth.

Sixth, the results also indicate that the relationship between proactive causal logics and both diversity and speed of organizational actions is not sensitive to industry growth. These results are consistent with the lack of a significant direct relationship between proactive causal logic and speed and diversity of organizational actions. As it was argued earlier, *deterministic causal logic* is a cognitive attribute that better explains variations in diversity of organizational actions. As the results of the alternative models that were ran also suggest, industry growth significantly interacts with deterministic causal logic to predict diversity of organizational actions. These results show that for high levels of industry growth the relationship between

deterministic causal logic become stronger and more negative. This suggests that deterministic causal logic is incompatible with diversity in organizational actions in contexts that require actions that test and probe the environment, such as in high growth industries.

Finally, industry growth moderates the relationship between proactive causal logic and frequency of organizational actions: for low levels of industry growth, the relationship is weaker and more negative and for high levels of industry growth the relationship is stronger and more positive. These results suggest that higher levels of industry growth put a premium on anticipatory actions aimed at influencing the environment in which new ventures compete and thus on proactive causal logic.

The findings related to the impact of industry growth on the cognition-action relationships emphasize the importance of the industry environment for new firms that are set on a path to growth. By combining industry growth with entrepreneurial schema attributes and showing the conditions under which the relationship between cognition and action is enhanced or, on the contrary, weakened, this study extends prior literature on new venture growth (Covin et al., 1990; Eisenhardt and Schoonhoven, 1990; Robinson and McDougall, 2001) that has often argued that high levels of industry growth are always beneficial for new ventures. The results of this study show that there are limits to the benefits provided by a high growth industry when the cognitive complexity of the entrepreneur is low. This adds to the debate on industry effects on new venture performance (Short et al., 2009) by lending support to the notion that industry related factors do not explain exclusively performance: individual and firm related factors also matter.

c) Heterogeneity in partners matters

The last moderating influence considered was that of *social network heterogeneity*. This study finds that access to a heterogeneous network of partners enhances the positive effects that

some entrepreneurial schema attributes have on organizational actions (Granovetter, 1973; Singh, 2000). It also finds that social network heterogeneity plays an unexpected role for some of the relationships between entrepreneurial schema attributes and growth.

First, the results of this study indicate that the relationship between entrepreneurial schema complexity and diversity of organizational actions is not sensitive to social network heterogeneity. Thus, entrepreneurs with complex schemas may not need access to a heterogeneous network of partners to the same extent that entrepreneurs with a proactive causal logic or focused schema do because they are better able to discern and discriminate between various sources of information, which leads to more diversity in organizational actions.

Second, the results suggest that social network heterogeneity moderates the relationship between entrepreneurial schema complexity and frequency of organizational actions: for low levels of social network heterogeneity the relationship between entrepreneurial schema complexity and frequency of organizational actions is weaker and more negative and for high levels of social network heterogeneity the relationship is stronger and more positive. These findings support the notion that entrepreneurs navigating their environments with a complex schema benefit from access to a heterogeneous network of partners by broadening their awareness of trends and opportunities and providing access to higher quality and volume of information which leads to more frequent organizational actions (Granovetter, 1973; Singh, 2000).

Third, the results indicate an unexpected effect of social network heterogeneity on the relationship between complexity of entrepreneurial schema and speed of organizational actions: For low levels of social network heterogeneity, the relationship between complexity of entrepreneurial schema and speed of organizational actions is stronger and more positive and for

high levels of social network heterogeneity the relationship is weaker and more negative. These results suggest that high levels of social network heterogeneity increase the diversity of information and stimuli that entrepreneurs receive and need to process to the point that it increases the amount of time required to implement organizational actions, despite complexity of schema.

Fourth, the results of the study suggest that social network heterogeneity moderates the relationship between entrepreneurial schema focus and both diversity and speed of organizational actions: for low levels of social network heterogeneity the relationship between entrepreneurial schema focus and both diversity and speed of organizational actions is weaker and more negative and for high levels of social network heterogeneity the relationship between entrepreneurial schema focus and both diversity and speed of organizational actions is stronger and more positive. These findings underscore the role that a diverse network of partners plays in helping entrepreneurs recognize a large variety of opportunities in the environment by being exposed to strategies and views of other industry players (Baum et al., 2000; Geletkanycz and Hambrick, 1997). The results suggest that focused entrepreneurs benefit from being situated within heterogeneous networks of partners because they increase their abilities to discern and discriminate between various sources of information (Bartunek et al; 1983) and thus may engage faster in a multitude of organizational actions (Bandura, 1986; Miner and Haunschild, 1995).

Fifth, the moderating hypotheses tests also indicate that the relationship between entrepreneurial schema focus and frequency of organizational actions is not sensitive to social network heterogeneity. These results suggest that for entrepreneurs who navigate their environments with a focused schema, being part of a heterogeneous social network is not as important as being part of a growing industry. As emphasized earlier, frequency of

organizational actions is strongly driven by industry effects, which seem to overpower other moderating influences.

Sixth, the results of the study suggest that social network heterogeneity plays an unexpected role in the relationships between proactive causal logic and both diversity and frequency of organizational actions: for high levels of social network heterogeneity the relationship between proactive causal logic and both diversity and frequency of organizational actions is weaker and more negative, and for low levels of social network heterogeneity the relationship between proactive causal logic and both diversity and frequency of organizational actions is stronger and more positive. These results may be industry specific. High levels of network heterogeneity equal a diversity of partners mostly located outside a firm's industry. Given the sample used in this study (the highly regulated biotech industry environment) it may be that diversity and frequency of organizational actions are a consequence of following what happens inside the industry and thus having a homogenous network or partners, and not of what happens outside of a firm's immediate network of partners. It might also mean that social network heterogeneity hinders proactive entrepreneurs in their attempts to test and probe the environment by dispersing their attention and prompting them to follow other players in the industry which might have a more limited and less frequent repertoire of actions (Geletkanycz and Hambrick, 1997).

Finally, the relationship between proactive causal logic and speed of organizational action is not significantly influenced by social network heterogeneity. This result suggests that for proactive entrepreneurs, being part of a heterogeneous network of partners does not bring any benefits with regard to speed and that based on some of the results discussed earlier, it might

even hinder speedy action by exposing entrepreneurs to divergent insights and perspectives that could increase vacillation.

In sum, the findings related to the impact of social network heterogeneity on the cognition-action relationships show that the social network of a firm can have important implications for adaptive action by new firms that are set on a path to growth. By revealing the effect of network heterogeneity on the relationship between entrepreneurial schema attributes and action, this study contributes to the literature that uses a social network approach to explain new venture growth (Yli-Renko, Autio and Sapienza, 2001; Dubini and Aldrich, 1991; Lechner and Dowling, 2000). The results of this study show that there are limits to the benefits provided by social network heterogeneity. In essence, this study shows that to understand the benefits associated with access to a diverse network of partners we need to consider it in conjunction with cognitive and other firm and industry level attributes. .

In addition to the contributions discussed above, this research also makes several broader contributions to theory, methods and practice.

6.2 GENERAL CONTRIBUTIONS

6.2.1 Contributions to the New Venture Growth Literature

This dissertation makes several important contributions to the literature on new venture growth. The first contribution to the new venture growth literature is the development of a process model of opportunistic adaptation that explains growth. Although prior research has identified several broad factors that influence new venture growth such as resources, industry growth or strategic postures, these factors have been studied independently so we have little understanding of how they work together to influence new venture growth. Further, the model

developed in this dissertation goes beyond current firm level constructs, such as entrepreneurial orientation (Covin and Slevin, 1991; Lumpkin and Dess, 1996), used in prior research to capture a venture's propensity to act on market opportunities and reveals the important role of the interpretation and information processing capabilities of the entrepreneur in the process of adaptation.

Most research on new venture growth (e.g. Sandberg and Hofer, 1987; Chrisman, Bauerschmidt and Hofer, 1999; Wiklund, Patzelt and Shepherd, 2009) has exhibited a bias toward ecological models that take a deterministic stance on the growth issue with limited interest towards the adaptation process that precedes growth and to cognitive variables in particular. Population ecology models (Freeman et al., 1983; Hannan and Freeman, 1977; 1984) provide potentially powerful explanations for organizational birth, evolution and mortality. Central issues in these models are the role of structural inertia in constraining adaptation, the classification of organizational species and the important role of the environment in determining organizational survival and growth.

Although literature in the ecological perspective has contributed to our understanding of new venture growth by establishing its importance and by identifying the two major liabilities to the process of growth, smallness and newness, it overlooks the role of organizational actions, choices and decisions related to growth (Child, 1972). It cannot, therefore, explain variation in growth across new ventures, especially the success of firms that proactively pursue opportunities in their environments.

By developing a theoretically grounded model of opportunistic adaptation in which new ventures actively seek to test their environments through rapid, diverse and frequent action and testing it within the context of growth oriented new ventures, this dissertation begins to uncover

the characteristics and processes associated with variation in new venture performance. Further, by putting the entrepreneur at the heart of this process, this dissertation addresses the disconnect between various streams of the literature on new venture growth and points toward a possible resolution to debates between deterministic versus a choice perspectives on growth (Hrebiniak and Joyce, 1985). This dissertation shows that both perspectives are critical to understand new venture growth. More specifically, the results of the study show that although industry context predicts the extent to which new ventures initiate frequent actions, these actions do not translate into growth. However together, cognitive and industry level variables play a significant effect in predicting diversity and speed of organizational action which do significantly impact significantly new venture growth. This suggests that new venture growth results from the combined effects of cognition, industry and firm related variables. Thus, this study answers recent calls in the literature (e.g. Nadkarni and Barr, 2008; Johnson and Hoopes, 2003) for studies that take into account context when analyzing the relationship between entrepreneurial cognition and action.

A second important contribution to the research stream on new venture growth is that the model developed in this dissertation recognizes entrepreneurial cognition as a key precursor to adaptive actions and growth in new ventures and thus extends prior research on entrepreneurial schemas. Extant research has argued that entrepreneurial cognition is at the heart of various entrepreneurial processes including growth (Mitchell et al., 2004). Yet there has been little attention to how exactly cognition influences these important outcomes. In a fashion similar to the upper echelons perspective in which corporations are regarded as a reflection of their top managers (Hambrick and Mason, 1984; Child, 1972), new ventures are often regarded as extensions of the entrepreneurs. The entrepreneur's personality traits, motivations, attitudes and

intentions have all been linked to growth. However, as prior research in strategic management has shown (West and Schwenk, 1996), demographic characteristics do not always capture managerial (entrepreneurial) mindsets and alternative approaches that capture mindsets in use are needed.

This dissertation identifies specific cognitive attributes and links them to specific organizational actions to explain growth. This approach is useful as the results of this dissertation show that not all cognitive characteristics play an equal role in growth related actions. It also shows that the role of cognition on firm action is best understood when firm and industry related influences are also considered. Furthermore, by examining cognition while simultaneously considering contextual influences this dissertation captures mindsets in use.

This study also highlights the usefulness of bringing methods of capturing cognition that are currently used in strategy and organization adaptation research to the new venture growth literature in general and the cognitive perspective in entrepreneurship in particular. Prior research that has sought to link the effect of the entrepreneur on new venture growth has used gross level proxies for cognition. By capturing a complex set of entrepreneurial schema attributes through cognitive mapping techniques, and by analyzing them in the context of new venture growth this study extends prior entrepreneurship research on entrepreneurial schemas.

At a more general level, this dissertation contributes to ongoing efforts to develop theoretical and practical models of growth that specify how microlevel variables (e.g. schema attributes) are linked to macrolevel outcomes such as firm growth. Revealing the mechanisms behind these links is a key task in entrepreneurship as a field that ascribes a central role to the individual entrepreneur (Hmieleski and Baron, 2009). In addition, this dissertation recognizes the complex and often indirect relationships between microlevel and macrolevel variables and

considers environmental and firm level moderating factors. By focusing on the contextual influences of the relationship between entrepreneurial cognition and organizational actions, this dissertation does not only reveal a more complete picture of the links between cognition and actions, but it also identifies variations in the effects that contextual variables such as industry growth and social network heterogeneity play in the process associated with new venture growth.

6.2.2 Contributions to the Organizational Adaptation Literature

This dissertation also makes contributions to the organizational adaptation literature. The introduction of a cognitive model of adaptation grounded in opportunity logic represents a departure from prior research on organizational adaptation, which often views adaptation as a reaction to specific environmental threats. By introducing a model that focuses on processes associated with more proactive adaptive actions (fast, frequent and varied), this dissertation highlights the differences between proactive and reactive adaptation. Further, the model focuses on links between specific attributes of managerial schema and patterns of organizational actions that prior research suggests lead to firm adaptation in high velocity environments (Barr and Bogner, 2000; Brown and Eisenhardt, 1997; Nadkarni and Narayanan, 2007). It therefore extends this stream of research by simultaneously considering a variety of industry and firm related factors that moderate these links. At a more general level, this dissertation uncovers the cognitive, firm and industry level foundations on which models of continuous adaptation rest. This approach is useful for understanding the extent to which the model of opportunistic adaptation developed in this dissertation may be extended to other contexts characterized by uncertainty and unpredictability.

This work builds on and extends recent work that integrates industry and cognitive based views to explain firm adaptation. For example, Nadkarni and Barr (2008) study adaptation processes in established businesses and find that managerial cognition mediates the relationship between industry context and firm action. However, prior research (Forbes, 1999; 2005) suggests that in the context of new ventures, cognition has a more direct effect on firm actions and outcomes, and industry effects have a limited importance on new venture performance, especially when firm effects are also considered (Short et al. 2009). The model of opportunistic adaptation builds on these findings and considers the direct links between entrepreneurial cognition using industry context as a moderating factor. The results of the study show that while some cognitive attributes such as schema focus have direct links to organizational actions others such as complexity and proactive causal logic impact actions only indirectly. This suggests that, in the context of new ventures, the relationship between entrepreneurial cognition and organizational actions is not as direct as prior research in both entrepreneurship and strategic management imply and that industry and firm related influences should always be considered. Thus, this dissertation extends prior research on firm adaptation by shedding light on a variety of “boundary conditions” (Nadkarni and Barr, 2008 p:1419) that define the relationship between managerial cognition and firm action.

The ultimate goal of strategic management research is to explain firm performance and growth. By clearly identifying the antecedents of rapid, diverse and frequent organizational actions that represent the core of the process of opportunistic adaptation this dissertation contributes to a better understanding of the process that firms might need to pursue if they seek to adapt to their competitive contexts in order to achieve long term growth.

6.2.3 Practical Implications

New ventures make significant contributions to GDP and employment growth, and this is especially true for high-growth new ventures. Entrepreneurship is the mechanism through which economic growth takes place, but institutions (such as the policy environment) shape entrepreneurial decisions and influence the extent to which entrepreneurs allocate efforts toward productive or unproductive activities (North, 1990). Seen in this light, understanding the individual, firm and industry level mechanisms through which growth occurs is thus not only important for firm level outcomes, but also for the economy as a whole. From a policy perspective, if we know more about the processes through which growth occurs, we can better advise current and would-be entrepreneurs, potential investors and consultants, and also governments about how to help contribute to this growth. The most important prescription to be made is that

The model introduced in this dissertation provides important insights for practice concerning the industry and firm level conditions (the moderating factors) which have the potential to enhance or weaken the relationship between the various cognitive attributes of entrepreneurial schemas and growth related actions. The model reinforces the important role that policy makers may assume in facilitating entrepreneurs' access to valuable network partners. However, it also highlights the facts that under certain circumstances, for example when social network heterogeneity is paired with proactive causal logic, and firms are competing in highly regulated industries such as the biotech industry, diversity of organizational actions and subsequent growth are more likely to be impacted positively by access to a homogenous network of partners. Also, when advising entrepreneurs to engage in fast action implementation, caution should be used as to the type of industry in which they will compete and their overall

level of cognitive complexity: in high growth industries fast action implementation is more likely to be negatively influenced by complexity.

By identifying the cognitive characteristics associated with opportunistic adaptation, one can develop programs aimed at creating these characteristics in aspiring entrepreneurs, enhancing both the likelihood that opportunistic adaptation-type activities will be undertaken, and the likelihood that the firm will be able to make use of the learning opportunities that they provide. For example, we can advise entrepreneurs on whether they should focus on a well-structured growth plan that lays out specific courses of actions to be undertaken, or whether they should develop cognitive frameworks and contextual characteristics that lead to a more emergent, diverse and learning oriented type of approach.

6.3 LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

Although the results presented in this dissertation are encouraging, a number of theoretical and empirical limitations in the analysis call for further research.

First, the goals of capturing entrepreneurial cognition unobtrusively and of controlling for variations in institutional contexts and industries to the maximum extent possible, required that the sample be limited to a relatively small number of publicly traded firms competing in the United States. While the theoretical model and hypotheses apply to all growth oriented new ventures, the extent to which empirical findings generalize to firms that are not publicly traded or compete in other types of industries is an empirical question that should be addressed in future work. For example, future research might want to investigate the extent to which the results found in this dissertation are common to firms competing in highly regulated environments such as the biotech industry. The relationship between schema attributes, in particular the proactive –

deterministic causal logic divide, and organizational actions might be strongly influenced by the type of industry in which half of the firms included in the study sample compete in.

Second, this study captured entrepreneurial schema focus by using content free analysis (i.e. it did not capture focus on a specific type of action or on a specific component of the general environment). Thus, the methodology did not distinguish between various types of organizational actions and various dimensions of performance and the environment, which could potentially influence the types of adaptive actions that entrepreneurs take. For example, future studies could look at the extent to which focus on new product related actions only leads to variations in diversity, frequency and speed of organizational actions. This approach might reveal if illusory causation biases and cognitive inertia, often found by studies which use focus on specific firm and environmental elements, appear in the new venture context as well.

Third, this study introduced a model of new venture growth that uses resource slack, industry growth and social network heterogeneity as possible contextual influences of the opportunistic adaptation process. The evidence presented here shows that the influence of entrepreneurial cognition is highly contextual. However, parsimony and sample size related issues precluded me from introducing other contextual influences that could contribute to understanding how and when entrepreneurial cognition influence action. Future research that more closely analyzes the relationship between entrepreneurial cognition and new venture growth could focus on identifying the effect of other contextual influences.

Fourth, although this dissertation finds important links between cognition, action and new venture growth, its findings might be affected by the exclusive use of a sample of IPO firms. IPO new ventures are an elite sample of firms which must overcome a number of difficulties before becoming public (Gilbert et al., 2008). However, the tests performed to find significant

differences in sales and size for these firms compared to other players in the industry, as well as the variations in firm performance observed immediately after the IPO process, do not seem to indicate major issues associated with the sample selected. Future research should however, test the hypotheses developed in this dissertation on a sample of non-IPO firms competing in other industries.

Fifth, while this study did not find significant direct or indirect effects of resource slack on growth related actions, resources are very likely to impact the extent to which new ventures grow. Prior research on firm growth (Penrose, 1959; Mahoney, 1992) argues for the need to have a better appreciation of how cognition and resources- two important sources of firm heterogeneity- are intertwined. As post-hoc analyses performed in this study suggest, a mediating relationship between resources, cognition and new venture growth might exist and could be investigated in future works.

Sixth, future studies could also look at the nature of changes that variations in institutional and cultural settings may bring to the patterns discovered in this dissertation. Prior research on entrepreneurial cognition (Mitchell et al, 2002) argues for differences in new venture initiation scripts induced by institutional and cultural norms. It is very likely that institutional and cultural norms will interact with various cognitive attributes and further impact growth related actions.

This research also prompts several questions related to the types of actions that new ventures pursue as part of the opportunistic adaptation process. The present study aggregates the various types of actions that entrepreneurs take. However focusing on particular types of actions such as international actions or alliances that new firms engage in, and investigating their links to entrepreneurial cognition might contribute to a better understanding of the born-global

phenomena or the strategic alliances phenomena. Linking cognition to specific types of organizational actions could provide more insight into the *antecedents* of fast internationalization or alliance partner selection at the new venture level.

Finally, this study raises several issues of interest for the literature on managerial cognition and organizational adaptation. Future studies could investigate the extent to which the simultaneous consideration of several different cognitive attributes leads to new sources of variation in outcomes such as organizational actions speed, diversity, scope or level of organizational diversification. As this research has shown, boundary conditions such as industry growth or social network heterogeneity reveal unique patterns in the outcomes that cognition has on organizational actions. However, other boundary conditions such as top management team characteristics or firm age might also reveal unique effects of cognition on organizational actions and deserve further investigation.

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APPENDIX

Figure 1: A model of opportunistic adaptation and new venture growth

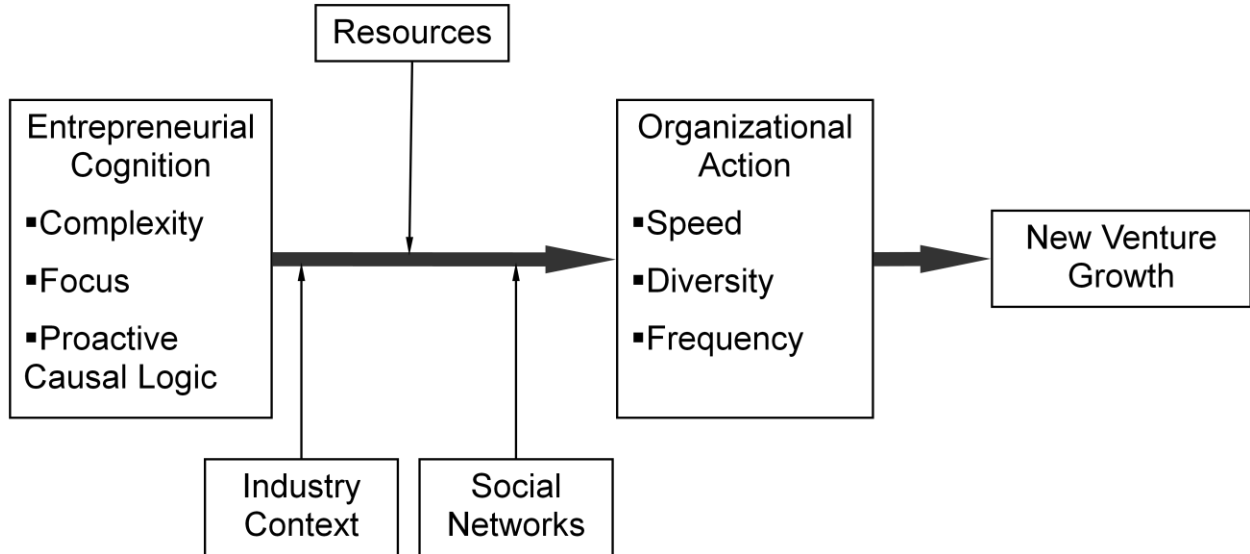
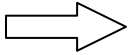


Figure 2: An illustration of the causal mapping procedure (adapted from Nadkarni and Narayanan, 2007)

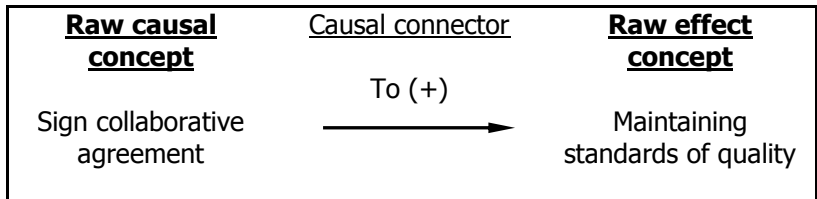
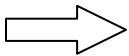
STEP 1
Identification of causal statements



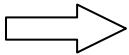
Example of a causal statement:

'To maintain our standard of providing excellent oral drug delivery technology we signed our first collaborative product development agreement with Bristol-Myers'

STEP 2
Constructing raw causal maps



STEP 3
Developing raw concepts and organizing them into broad conceptual categories



<u>Raw concept</u>	<u>Broad conceptual category</u>
1. Maintaining standards of quality	Product performance
2. Signing collaborative agreements	Cooperative alliances

STEP 4
Recast raw concepts into conceptual categories to construct coded causal map

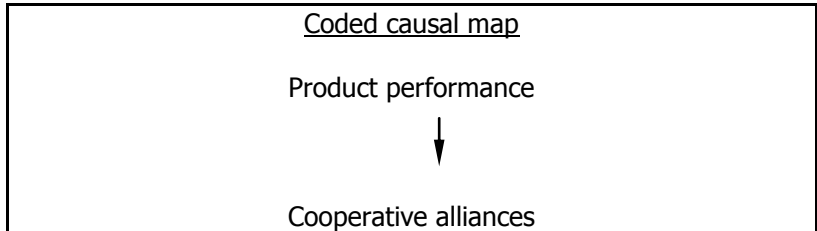
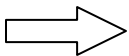


Table 1: Example of causal mapping coding sheet

a	Causal concept	CODE	Object concept	Page	Paragraph	Repeat CC	Repeat OC	Comments
	Sign collaborative agreement	+	Maintain standards of quality	2	4			
	Customer demand	+	R&D resources enhancement	2	5			
	Changes in the market	-	Sales and revenues	2	5		1	
	Improve product development	+	Sales and revenues	2	6		1	

Table 2: Categorization scheme

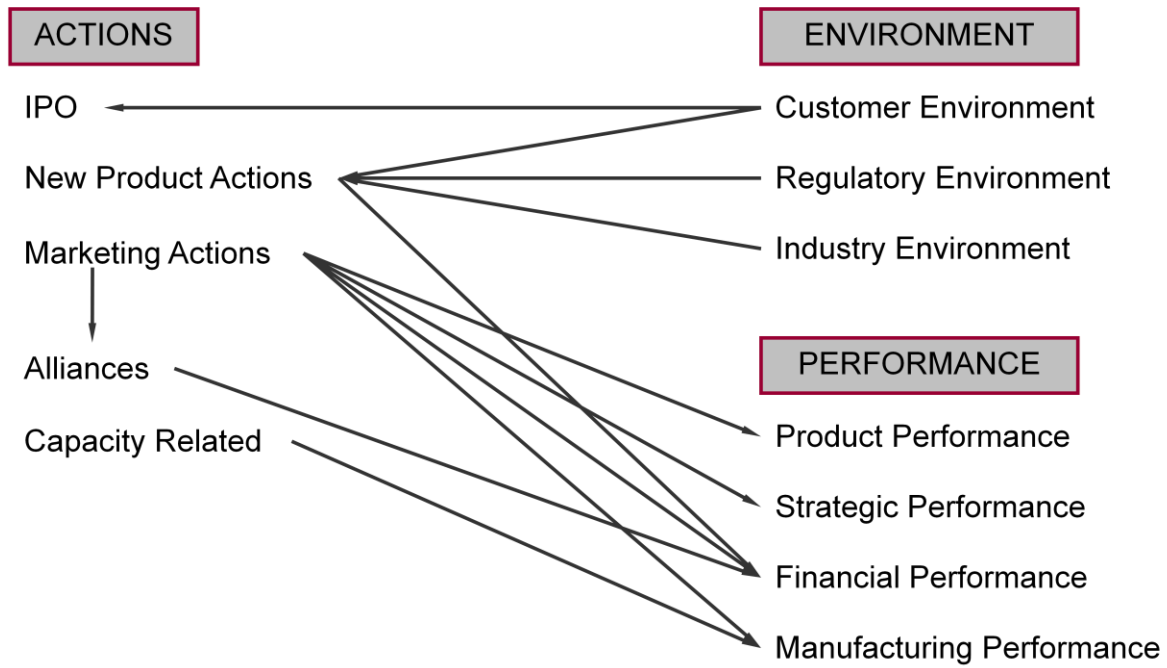
<p>1. <u>Macro-environment</u></p> <ul style="list-style-type: none"> • Economic conditions • Change in legislation • Regulatory bodies • September 11 • Global recession • Change in government administration • U.S. recession 	<p>2. <u>Customer/market environment</u></p> <ul style="list-style-type: none"> • Changes in the industry • Customer demand • Customer need • Market convergence • Emerging market segment • Growth of specific market 	<p>3. <u>Competitor environment</u></p> <ul style="list-style-type: none"> • Imitators • Complementors • New entrants • Market saturation
<p>4. <u>New product related</u></p> <ul style="list-style-type: none"> • New product development • New product introduction • New drug application • Clinical trials/studies • R&D expenditures 	<p>5. <u>Marketing related</u></p> <ul style="list-style-type: none"> • Advertising • New distribution channels • Product sale • Direct sale • Company presentation • Product mix 	<p>6. <u>Service related</u></p> <ul style="list-style-type: none"> • Customer service • Product repair • Product upgrade • Training for customers
<p>7. <u>HR related</u></p> <ul style="list-style-type: none"> • Hiring new employees • Firing employees • Jobs cut • Training for employees • Support for employees 	<p>8. <u>TMT related</u></p> <ul style="list-style-type: none"> • New CEO • New VP • Change in board 	<p>9. <u>Finance related</u></p> <ul style="list-style-type: none"> • Sells/buys shares • Debt financing • Private placement • Loan/credit • Investor presentation
<p>10. <u>IPO</u></p> <ul style="list-style-type: none"> • Initial public offering 	<p>11. <u>Cooperative alliances</u></p> <ul style="list-style-type: none"> • Alliances • Acquisitions • Mergers • Joint ventures 	<p>12. <u>Restructuring actions</u></p> <ul style="list-style-type: none"> • Divestiture • Sale of business • Consolidation • Realignment
<p>13. <u>Structural actions (informal)</u></p> <ul style="list-style-type: none"> • New stockholder plan • New payroll system • New rules (internal) 	<p>14. <u>Low cost/pricing actions</u></p> <ul style="list-style-type: none"> • Lower cost • Lower waste • Product delivery on time • Low inventory levels 	<p>15. <u>Capacity related</u></p> <ul style="list-style-type: none"> • New facility • Expansion of facility • New technology • Outsourcing
<p>16. <u>Competitive actions</u></p> <ul style="list-style-type: none"> • Patents • Certifications • Intellectual property rights • Legal actions • Awards 	<p>17. <u>CSR actions</u></p> <ul style="list-style-type: none"> • Community programs • Environmental protection • Donations • Technology available for universities/schools 	<p>18. <u>International actions</u></p> <ul style="list-style-type: none"> • New office abroad • Exports • International partners
<p>19. <u>Financial performance</u></p> <ul style="list-style-type: none"> • Shareholder value • Profit margins • Revenue/loss • Cash flow 	<p>20. <u>Strategic performance</u></p> <ul style="list-style-type: none"> • Market share • Market position • Long term growth • Strong product portfolio • Differentiation from others 	<p>21. <u>Manufacturing performance</u></p> <ul style="list-style-type: none"> • Productivity • Quality of production
<p>22. <u>Product performance</u></p> <ul style="list-style-type: none"> • Product quality • Value added • Versatility • Safety • Affordability 	<p>23. <u>Employee performance</u></p> <ul style="list-style-type: none"> • Quality of work performed • Innovativeness • Motivated • Hard-working people • Experienced 	

Table 3: Example of organizational action coding sheet

Name	Actions	Announced	Implemented	Coded Category Student 1	Coded Category Student 2
DepoMed Inc.	IPO announced	18-Apr-97	5-Nov-97	IPO	IPO
	new CEO	31-Dec-96	4-Feb-97	TMT action	TMT action
	new CFO	31-Dec-96	4-Feb-97	TMT action	TMT action
	starts phase I for Depomorphine	25-Mar-97	9-Dec-97	new product development	new product development
	starts phase II trial for DepoMorphine	9-Dec-97		new product development	new product development
	new drug application	30-Apr-97	7-Jul-97	new product development	new product development
	completes private placement	1-Jun-97	2-Feb-98	financial action	financial action
	new VP for Pharma development	31-Dec-96	23-Jan-97	TMT action	TMT action
	phase 1 Depocyt initiated	26-Feb-97	18-Dec-97	new product development	new product development
	repurchasing marketing rights for 2 products		6-Jun-97	marketing action	marketing action
	signed distribution agreement w Pharma		7-Jul-97	alliance	alliance
	new patents approved	18-Jun-05	9-Jul-97	competitive action	competitive action
	sell stock to Ross Group	11-Sep-97		financial action	financial action
	agreement with RW Johnson	1-Jun-97	1-Jan-98	alliance	alliance
	move to a new facility	31-Dec-97	1-Apr-98	capacity related action	capacity related action
	hire new personnel	31-Dec-97	1-Jun-98	HR action	HR action
	common stock and warants separated	1-Dec-97		financial action	structural action

Figure 3: Causal map example

Pacific Health Laboratories



Complexity: 12
Focus: 71.9%
Proactive: -1.26

Table 4: Environment, Actions, Performance – Definition of terms

ENVIRONMENT

Macro-environment: The macro-environment or the general environment is composed of dimensions in the broader society that influence the industry and the firms within it. It consists of the demographic, economic, political-legal, sociocultural, technological and the global segments. Firms cannot directly control the general environment or its components.

Customer/Market Environment: The customer/market environment or the environment that directly influences a firm's commercial actions (new product development, sale, distribution, marketing, service etc). It refers to the specific segment of the market (industry) in which the firm operates. Changes in the customer/market environment refer to changes in customer needs/demand, diversity of market segments served, fragmentation, emergence, convergence and growth of specific market segments.

Competitor environment: The competitor environment refers to all the firms (incumbents and new entrants) that have the potential to influence a firm's competitive actions and responses: imitators, firms offering complementary/substitute products, direct competitors.

ACTIONS

New product related: New product related actions refer to all the actions a firm undertakes regarding the creation, development and commercial launch of a product (up to the moment when mass production and commercialization start). These activities include: the research and discovery of a product, the clinical trials and studies associated with it, new product applications and new product introductions.

Marketing related: Marketing actions refer to actions related to the commercialization, distribution and promotion of a product. These activities include company presentations, conference and show exhibits and presentations, access to new distribution channels (traditional, electronic etc), product mix, advertising campaigns etc.

Service related: Service related actions refer to actions taken to customize, repair or upgrade a product and actions related to training and education regarding the use of a specific product.

HR related: HR related actions refer to actions taken to hire/fire, promote, train, motivate and retain employees (it does not include the hiring and firing of top executives and board members).

TMT (Top management team) related: TMT actions refer to actions taken to hire, fire or promote top level executives (VPs, CEOs) and members of the board.

Finance related: Financial actions refer to actions with an immediate impact on a firm's financial performance. These actions include the buying/selling of shares, investments, debt financing, loans, credit lines open, investor incentives etc.

IPO: The initial public offering is an important event in a new venture's life; it is the first sale of stock by a company to the public.

Cooperative alliances: Cooperative alliances refer to actions through which firms combine, acquire or merge parts of their activities, resources, capabilities to create/acquire/distribute their goods and services. These actions include alliances, mergers, acquisitions, joint ventures and license agreements.

Restructuring actions: Restructuring actions refer to actions meant to change the initial structure of an organization through the sale (divestiture), dissolution or consolidation of certain activities.

Structural actions (Informal): Structural actions refer to actions targeting the informal organizational structure of an organization (incentives, controls, regulations, policies).

Low cost/Pricing actions: Low cost/pricing actions refer to actions taken to lower the overall cost of producing a good/service. These actions may refer to lowering inventory levels, increasing productivity, lowering waste, lowering costs/prices and achieving economies of scale.

Capacity related: Capacity related actions refer to actions taken to meet production demands. These actions include adjustments made to the manufacturing capacity, equipment acquisition, relocation or outsourcing activities.

Competitive actions: Competitive actions refer to actions taken to protect and signal a firm's competitive position/advantage. These actions include licensing rights, patents, certifications, accreditations etc.

CSR (Corporate Social Responsibility) actions: CSR actions refer to actions taken by a firm for the benefit of the community in which it is embedded (donations, community programs, environmental protection, recycling etc).

International actions: International actions refer to action taken to extend a firm's geographical reach beyond domestic markets. These actions include exports, joint-ventures, international subsidiaries etc.

PERFORMANCE

Financial performance: Financial performance is an indicator of a firm's policies and operations in monetary terms. Financial performance is reflected in ROI, ROA, profit margins, revenues (losses), cash flow, etc.

Strategic performance: Strategic performance is an indicator of how well the company meets its objectives, mission and strategy. It is captured through critical success factors such as increase (loss) of market share, long-term growth, customer satisfaction, sustainability etc.

Manufacturing performance: Manufacturing performance is an indicator of how well a company meets its production demand by adjusting its design and production systems and processes. It is captured through productivity, time to market, quality of output etc.

Product performance: Product performance is the entirety of properties of a technical product or system which contribute to meet its function. Product performance is a measure of how well the product meets customer needs. It is captured through quality, value-added, versatility, safety etc.

Employee performance: Employee performance is an indicator of the quality and quantity of work performed by employees.

Table 5: Organizational Actions - Descriptives

Action Type	Count	Percentage
Capacity Related	34	1.52%
Competitive Related	272	12.15%
Cooperative Alliances	345	15.41%
CSR Actions	7	0.31%
Finance Related	379	16.93%
HR Related	35	1.56%
International Actions	24	1.07%
IPO	11	0.49%
Low Cost/Pricing	5	0.22%
Marketing Related	499	22.29%
New Product Related	371	16.57%
Restructuring Actions	8	0.36%
Service Related	8	0.36%
Structural Actions	9	0.40%
TMT Related	232	10.36%
Total	2239	100.00%

Table 6: Summary of hypotheses

HYPOTHESIS	SUPPORTED/NOT SUPPORTED
MAIN EFFECTS: COGNITION ON ACTIONS	
H1a) Complexity of entrepreneurial schemas is positively related to diversity of new organizational actions.	NS
H1b) Complexity of entrepreneurial schemas is positively related to frequency of new organizational actions.	NS
H1c) Complexity of entrepreneurial schema is positively related to speed of new organizational actions.	NS
H2a) Focus of entrepreneurial schema is negatively related to diversity of new organizational actions.	Yes-opposite effect
H2b) Focus of entrepreneurial schema is negatively related to frequency of new organizational actions.	NS
H2c) Focus of entrepreneurial schema is negatively related to speed of new organizational actions.	Yes-opposite effect
H3a) Proactive causal logic is positively related to diversity of new organizational actions.	NS
H3b) Proactive causal logic is positively related to frequency of new organizational actions.	NS
H3c) Proactive causal logic is positively related to speed of new organizational actions.	NS
MODERATING EFFECTS OF RESOURCE SLACK	
H4a) Available slack resources moderate the relationship between complexity of entrepreneurial schema and diversity of new organizational actions such that when the level of available slack resources is high the relationship is stronger and more positive.	NS
H4b) Available slack resources moderate the relationship between complexity of entrepreneurial schema and frequency of new organizational actions such that when the level of slack resources is high the relationship is stronger and more positive.	NS
H4c) Available slack resources moderate the relationship between complexity of entrepreneurial schema and speed of new organizational actions such that when the level of slack resources is high the relationship is stronger and more positive.	NS
H5a) Available slack resources moderate the relationship between focus of entrepreneurial schema and diversity of new organizational actions such that when the level of available slack resources is high the relationship is stronger and more negative.	NS
H5b) Available slack resources moderate the relationship between focus of entrepreneurial schema and frequency of new organizational actions such that when the level of available slack resources is high the relationship is stronger and more negative.	NS
H5c) Available slack resources moderate the relationship between focus of entrepreneurial schema and speed of new organizational actions such that when the level of available slack resources is high the relationship is stronger and more negative.	NS
H6a) Available slack resources moderate the relationship between proactive causal logic and diversity of new organizational actions such that when the level of available slack resources is high the relationship is stronger and more positive.	NS
H6b) Available slack resources moderate the relationship between proactive causal logic and frequency of new organizational actions such that when the level of available slack resources is high the relationship is stronger and more positive.	NS
H6c) Available slack resources moderate the relationship between proactive causal logic and speed of new organizational actions such that when the level of available slack resources is high the relationship is stronger and more positive.	NS
MODERATING EFFECTS OF INDUSTRY GROWTH	
H7a) Industry growth moderates the relationship between complexity of entrepreneurial schema and diversity of new organizational actions such that when industry growth is high the relationship is stronger and more positive.	Yes
H7b) Industry growth moderates the relationship between complexity of entrepreneurial schema and frequency of new organizational actions such that when industry growth is high the relationship is stronger and more positive.	Yes-opposite effect
H7c) Industry growth moderates the relationship between complexity of entrepreneurial schema and speed of new organizational actions such that when industry growth is high the relationship is stronger and more positive.	NS
H8a) Industry growth moderates the relationship between focus of entrepreneurial schema and diversity of new organizational actions such that when industry growth is high the relationship is stronger and more negative.	NS

HYPOTHESIS	SUPPORTED/NOT SUPPORTED
H8b) Industry growth moderates the relationship between focus of entrepreneurial schema and frequency of new organizational actions such that when industry growth is high the relationship is stronger and more negative.	Yes-opposite effect
H8c) Industry growth moderates the relationship between focus of entrepreneurial schema and speed of new organizational actions such that when industry growth is high the relationship is stronger and more negative.	NS
H9a) Industry growth moderates the relationship between proactive causal logic and diversity of new organizational actions such that when industry growth is high the relationship is stronger and more positive	NS
H9b) Industry growth moderates the relationship between proactive causal logic and frequency of new organizational actions such that when industry growth is high the relationship is stronger and more positive.	Yes
H9c) Industry growth moderates the relationship between proactive causal logic speed of new organizational actions such that when industry growth is high the relationship is stronger and more positive.	NS
MODERATING EFFECTS OF NETWORK HETEROGENEITY	
H10a) Network heterogeneity moderates the relationship between complexity of entrepreneurial schema and diversity of new organizational actions such that when network heterogeneity is high the relationship is positive and strong.	NS
H10b) Network heterogeneity moderates the relationship between complexity of entrepreneurial schema and frequency of new organizational actions such that when network heterogeneity is high the relationship is positive and strong.	Yes
H10c) Network heterogeneity moderates the relationship between complexity of entrepreneurial schema and speed of new organizational actions such that when network heterogeneity is high the relationship is positive and strong.	Yes-opposite effect
H11a) Network heterogeneity moderates the relationship between focus of entrepreneurial schema and diversity of new organizational actions such that when network heterogeneity is high the relationship is weaker and less negative.	Yes
H11b) Network heterogeneity moderates the relationship between focus of entrepreneurial schema and frequency of new organizational actions such that when network heterogeneity is high the relationship is weaker and less negative.	NS
H11c) Network heterogeneity moderates the relationship between focus of entrepreneurial schema and speed of new organizational actions such that when network heterogeneity is high the relationship is weaker and less negative.	Yes
H12a) Network heterogeneity moderates the relationship between proactive causal logic and diversity of organizational actions such that when network heterogeneity is high the relationship is strong and positive.	Yes-opposite effect
H12b) Network heterogeneity moderates the relationship between proactive causal logic and frequency of organizational actions such that when network heterogeneity is high the relationship is strong and positive .	Yes-opposite effect
H12c) Network heterogeneity moderates the relationship between proactive causal logic and speed of organizational actions such that when network heterogeneity is high the relationship is strong and positive.	NS
MAIN EFFECTS: ACTIONS ON GROWTH	
H13a) Diversity of new organizational actions is positively related to new venture growth.	Yes
H13b) Frequency of new organizational actions is positively related to new venture growth.	NS
H13c) Speed of new organizational actions is positively related to new venture growth.	Yes-opposite effect

Table 7: Descriptive statistics and correlations

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1. Sales growth																							
2. Employment growth	0.87**																						
3. Diversity	-0.14	-0.17																					
4. Frequency	0.24*	0.19	-0.18																				
5. Speed	0.20	0.13	-0.18	0.19																			
6. Complexity	0.02	-0.04	0.10	-0.03	-0.12																		
7. Focus	0.12	0.11	-0.08	0.01	-0.18	0.46**																	
8. Proactive	0.01	0.02	0.10	-0.12	0.15	0.38**	0.44**																
9. Industry growth	-0.08	-0.13	0.00	-0.04	0.15	0.09	0.03	-0.20*															
10. Resource slack	0.21*	0.22*	0.07	0.17	0.01	0.06	0.16	0.08	-0.21														
11. Network heterogeneity	0.07	-0.02	0.08	-0.20*	0.15	-0.10	-0.13	0.09	-0.10	0.08													
12. Industry concentration	0.00	0.00	-0.02	0.15	-0.24*	-0.17	0.05	-0.08	0.04	0.29**	-0.33**												
13. Firm age	0.12	0.17	-0.02	0.10	-0.02	-0.09	-0.17	-0.02	-0.17	0.08	0.13	-0.14											
14. Firm size	0.25*	0.31**	0.03	0.07	-0.03	0.04	0.16	-0.07	-0.04	0.29**	-0.20	0.13	0.08										
15. IPO1	-0.05	-0.07	-0.03	-0.24*	-0.10	-0.07	-0.14	-0.07	0.10	-0.29**	0.02	0.03	-0.29**	-0.11									
16. IPO2	-0.04	-0.09	0.05	0.02	-0.08	0.22*	0.09	0.01	0.30**	0.08	-0.09	0.19	-0.36**	0.02	-0.19								
17. IPO3	0.00	-0.03	-0.09	0.01	0.00	-0.08	-0.03	-0.02	-0.09	0.01	0.08	-0.03	0.19	-0.11	-0.25*	-0.13							
18. IPO4	0.00	-0.03	-0.09	0.01	0.00	-0.08	-0.03	-0.02	-0.09	0.01	-0.08	-0.03	0.19	-0.11	-0.10	-0.30**	-0.13						
19. IPO5	0.09	0.19	-0.01	0.17	0.08	-0.12	-0.09	-0.02	-0.23*	0.05	0.00	-0.13	0.46**	0.17	-0.18	-0.55**	-0.24*	-0.29**					
20. Industry1	-0.20*	-0.24*	0.09	-0.19	0.16	0.00	-0.06	0.07	-0.17	-0.16	0.57**	-0.49**	0.11	-0.34**	-0.02	-0.27*	0.23*	0.02	0.13				
21. Industry2	-0.01	0.13	-0.12	-0.07	-0.01	-0.04	-0.05	0.09	-0.03	-0.09	-0.22*	-0.16	0.10	0.16	-0.04	0.02	-0.06	-0.03	0.04	-0.51**			
22. Industry3	0.10	0.02	0.14	0.25**	-0.16	0.10	0.03	-0.12	-0.05	-0.07	-0.23*	0.41**	-0.16	0.06	0.07	0.34**	-0.10	-0.12	-0.22	-0.34**	-0.14		
23. Industry4	0.18	0.16	-0.10	0.13	-0.08	-0.03	0.21*	-0.19	0.27**	0.24*	-0.34**	0.47**	-0.12	0.23*	0.016	0.09	-0.16	0.09	-0.05	-0.54**	-0.22*	-0.150	
Mean	13.70	49.40	0.27	22.23	29.69	11.28	3.20	0.01	8.80	3.66	0.51	0.42	4.38	135.27	0.06	0.37	0.10	0.13	0.35	0.55	0.17	0.09	0.190
Standard deviation	64.75	184.10	0.10	12.14	25.29	2.33	0.17	1.65	10.89	1.31	0.25	0.13	2.30	118.22	0.23	0.48	0.30	0.34	0.48	0.50	0.38	0.28	0.296

Table 8: Direct and moderated effects of schema attributes on organizational actions²

	Diversity				Frequency				Speed			
	M1	M2	M3	M4	M1	M2	M3	M4	M1	M2	M3	M4
<u>Control variables</u>												
Firm age	-0.02	0.00	-0.02	0.00	-0.13	-0.22	-0.18	-0.18	-1.71	-2.19	-2.55 *	-1.96
	0.01	-0.01	0.01	-0.01	-0.62	-0.62	0.63	-0.62	-1.48	-1.49	1.51	-1.58
Firm size	0.02 *	0.02 *	0.02	0.01	0.30	0.42	0.29	1.62	0.34	1.40	-0.54	-0.76
	0.01	0.01	0.01	0.01	1.04	1.07	1.22	1.22	2.55	2.56	2.93	2.99
Industry concentration	-0.05	-0.06	-0.05	-0.09	-8.52	-7.05	-9.20	-26.16 *	-51.56 *	-45.71	-30.69	-35.62
	0.11	0.11	0.12	0.13	12.17	12.14	12.57	13.63	30.28	30.30	33.56	34.11
Industry 1	0.04	-0.04	-0.05	-0.02	0.40	0.91	0.05	-1.43	-2.58	-2.19	2.04	4.49
	0.03	0.03	0.03	0.04	3.15	3.15	3.70	3.72	7.78	7.75	8.65	9.32
Industry 2	0.03	0.02	0.01	0.06	17.26 **	16.49 **	15.21 **	16.47 **	-2.51	-8.04	-4.21	4.87
	0.05	0.05	0.06	0.06	5.34	5.38	5.98	5.99	12.59	12.80	13.91	15.11
Industry 3	-0.04	-0.02	-0.03	-0.01	6.68 *	6.19	5.02	10.93 **	-0.26	-2.51	-2.95	-5.01
	0.04	0.04	0.04	0.05	4.02	4.05	4.86	5.34	9.73	9.70	11.89	12.65
IPO 1	0.02	0.03	0.02	0.05	10.87 **	10.91 **	9.75 *	9.76 *	16.16	18.65	11.50	6.91
	0.05	0.05	0.05	0.06	5.10	5.13	5.45	5.70	12.71	12.67	13.68	13.76
IPO 2	0.03	0.05	0.05	0.07	10.74 *	11.43 *	9.63	9.74	20.13	23.10	21.12	23.27
	0.06	0.06	0.06	0.06	6.05	6.08	6.49	6.47	14.86	14.72	15.70	15.49
IPO 3	0.01	0.02	0.02	0.03	14.37 **	14.99 **	13.54 **	12.70 *	19.55	21.04	16.35	13.85
	0.06	0.06	0.06	0.06	6.10	6.09	6.45	6.52	15.17	14.97	15.50	15.37
IPO 4	0.01	0.02	0.02	0.05	17.36 **	18.58 **	16.82 **	16.27 **	22.08	24.71 *	23.27	20.60 *
	0.05	0.05	0.06	0.06	5.67	5.68	6.09	6.24	14.09	14.00	14.74	14.80
<u>Direct effects</u>												
Complexity		0.01	0.00	0.08		0.42	0.39	0.19		0.02	0.15	2.22
		0.01	0.01	0.06		0.33	0.35	0.38		1.37	1.38	1.53
Focus		-0.04 **	-0.04 **	-0.02		-0.33	-0.32	-0.34		-0.82 *	-0.90 *	-0.92 *
		0.02	0.02	0.02		0.22	0.22	0.22		0.46	0.50	0.54
Proactive		0.01	0.01	0.01		-1.22	-1.22	0.04		-1.64	-1.56	-2.89
		0.01	0.01	0.09		0.85	0.72	0.99		1.84	1.84	2.14
Resource slack			0.00	0.00			0.73	1.28			2.44	3.32
			0.01	0.01			1.10	1.10			2.48	2.50
Industry growth			0.00	0.00			-0.02	0.38 *			0.45	0.57 *
			0.00	0.00			0.12	0.23			0.34	0.38
Network heterogeneity			-0.02	0.01			-3.63	-6.65			14.72	12.70
			0.06	0.06			6.27	6.18			14.44	14.64
<u>Interaction effects</u>												
Complexity X Resource slack				-0.01				-0.35				0.44
				0.01				0.31				1.35
Complexity X Industry growth				0.00 **				-0.10 **				0.00
				0.00				0.04				0.16
Complexity X Network heterogeneity				-0.01				3.74 **				13.70 **
				0.03				1.46				6.65
Focus X Resource slack				0.01				0.13				0.02
				0.02				0.23				0.46
Focus X Industry growth				0.00				0.07 **				-0.10
				0.00				0.03				0.08
Focus X Network heterogeneity				-0.13 *				0.02				-5.14 **
				0.07				0.79				2.05
Proactive X Resource slack				0.00				0.90				-0.40
				0.01				0.78				1.42
Proactive X Industry growth				0.00				0.29 **				0.11
				0.00				0.15				0.26
Proactive X Network heterogeneity				0.06 *				-5.87 *				9.64
				0.03				3.49				8.82
R square	0.09	0.13	0.13	0.23	0.21	0.25	0.25	0.40	0.10	0.15	0.19	0.32
Model F	0.87	1.00	0.82	0.93	2.50	2.26	1.84	2.06	0.88	1.11	1.13	1.30
N (sample size)	104	104	104	104	104	104	104	104	94	94	94	94

**p < 0.05, * p < 0.10

² Please note that diversity, speed and social network heterogeneity are decreasing numbers (i.e a number closer to zero is indicative of more diversity, speed or social network heterogeneity).

Table 9: Direct effects of organizational actions on sales and employment growth³

	Sales growth		Employment growth	
	M1	M2	M1	M2
<i>Control variables</i>				
Firm age	7.36	10.64	0.02	0.02
	6.59	7.22	0.02	0.02
Firm size	16.38	22.61 *	0.05	0.06 *
	11.18	12.65	0.03	0.03
Industry concentration	-305.60 **	-345.41 **	-0.54	-0.64
	130.36	150.34	0.35	0.40
Industry 1	20.13	22.76	0.16 *	0.18 *
	33.74	38.37	0.09	0.10
Industry 2	146.73 **	177.81 **	0.26 *	0.34 *
	57.21	65.84	0.15	0.18
Industry 3	118.75 **	138.03 **	0.26 *	0.32 *
	43.04	48.17	0.11	0.13
IPO 1	-5.82	-16.51	-0.01	-0.03
	54.65	63.29	0.15	0.17
IPO 2	30.86	25.06	0.06	0.05
	64.85	74.06	0.17	0.20
IPO 3	4.81	-3.87	0.02	0.02
	65.36	76.50	0.17	0.21
IPO 4	18.53	8.21	0.11	0.11
	60.76	72.47	0.16	0.19
<i>Direct effects</i>				
Diversity		-203.30 *		-0.51 *
		115.12		0.31
Frequency		0.19		0.00
		1.26		0.00
Speed		0.97 *		0.00
		0.55		0.00
R square	0.16	0.26	0.16	0.22
Model F	1.78	2.17	1.79	1.78
N (sample size)	104	94	104	94

** $p < 0.05$, * $p < 0.10$

³ Please note that diversity, speed and social network heterogeneity are reversed coded (i.e a number closer to zero is indicative of more diversity, speed or social network heterogeneity)

Table 10: Alternative models: The effect of deterministic causal logic on organizational actions diversity

	Diversity		
	M1	M2	M4
<u>Control variables</u>			
Firm age	-0.02	0.00	0.00
	0.01	0.01	0.01
Firm size	0.02 *	0.02 *	0.01
	0.01	0.01	0.01
Industry concentration	-0.05	-0.06	-0.09
	0.11	0.11	0.13
Industry 1	0.04	-0.04	-0.03
	0.03	0.03	0.04
Industry 2	0.03	0.01	0.05
	0.05	0.05	0.06
Industry 3	-0.04	-0.02	-0.01
	0.04	0.04	0.05
IPO 1	0.02	0.04	0.06
	0.05	0.05	0.06
IPO 2	0.03	0.07	0.10
	0.06	0.06	0.07
IPO 3	0.01	0.03	0.06
	0.06	0.06	0.07
IPO 4	0.01	0.05	0.07
	0.05	0.05	0.06
<u>Direct effects</u>			
Complexity		0.04	0.06
		0.01	0.06
Focus		-0.05 **	-0.03
		0.02	0.02
Deterministic		0.01 *	0.03 **
		0.01	0.09
Resource slack			0.00
			0.01
Industry growth			0.00
			0.00
Network heterogeneity			0.01
			0.06
<u>Interaction effects</u>			
Complexity X Resource slack			0.00
			0.01
Complexity X Industry growth			0.00
			0.00
Complexity X Network heterogeneity			-0.02
			0.03
Focus X Resource slack			0.01
			0.02
Focus X Industry growth			0.01
			0.00
Focus X Network heterogeneity			-0.08
			0.09
Deterministic X Resource slack			0.00
			0.01
Deterministic X Industry growth			0.00 *
			0.00
Deterministic X Network heterogeneity			0.02
			0.05
R square	0.09	0.14	0.23
Model F	0.87	1.10	0.93
N (sample size)	104	104	104

** $p < 0.05$, * $p < 0.10$

Figure 4: The effect of industry growth on the relationship between entrepreneurial schema complexity and diversity of organizational actions⁴

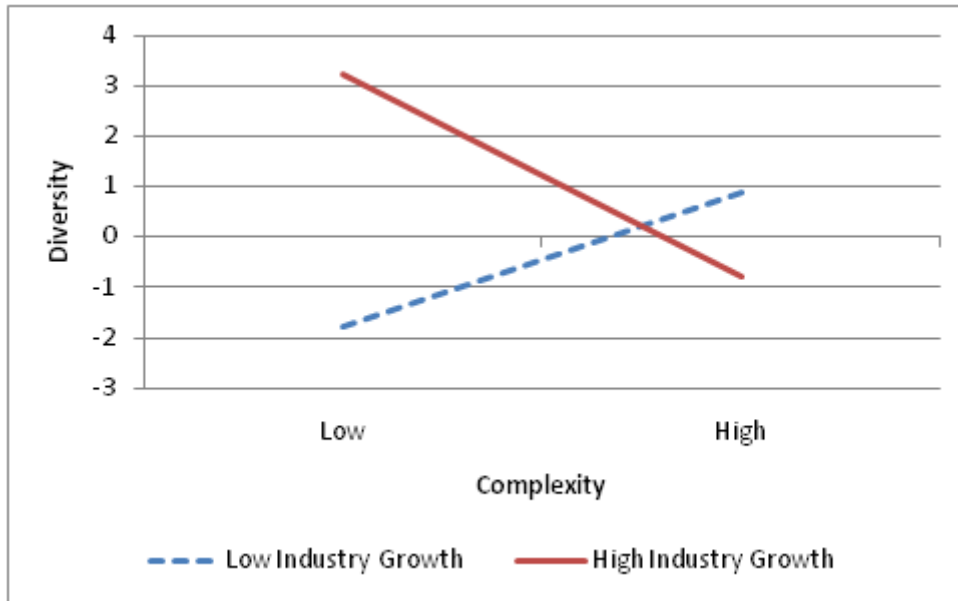
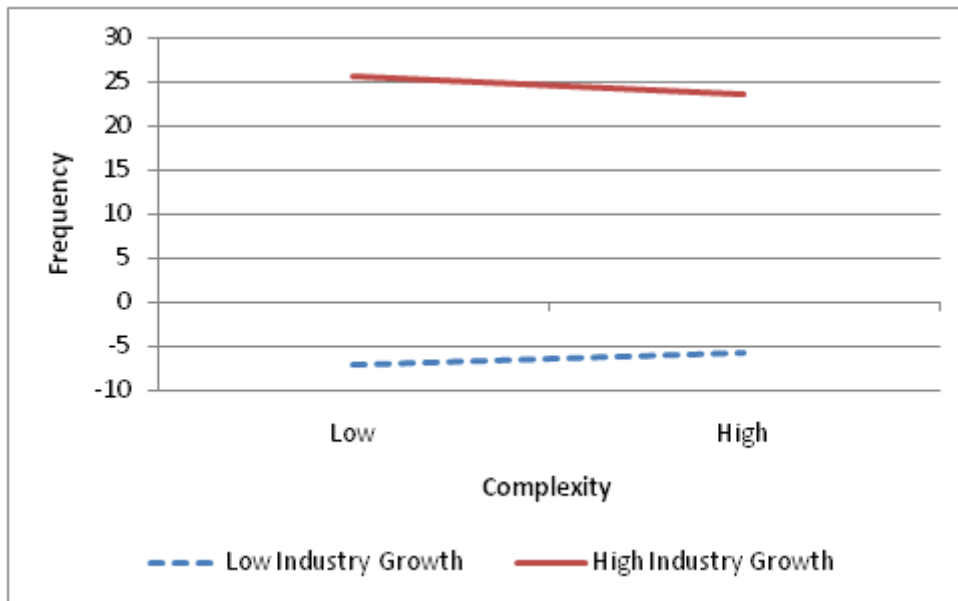


Figure 5: The effect of industry growth on the relationship between entrepreneurial schema complexity and frequency of organizational actions



⁴ Diversity, speed and social network heterogeneity are reversed coded which means that some of the line slopes are in the opposite direction.

Figure 6: The effect of industry growth on the relationship between entrepreneurial schema focus and frequency of organizational actions

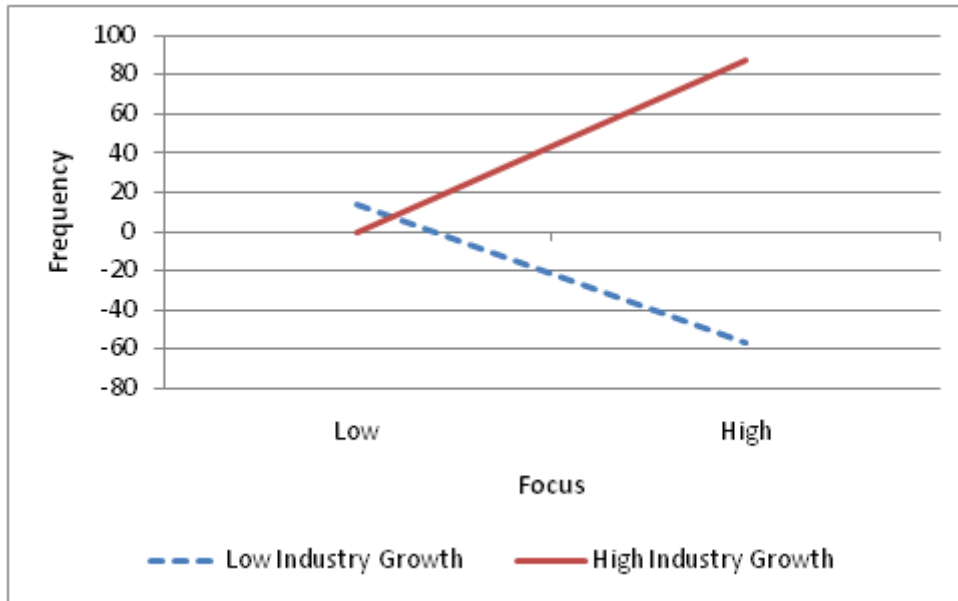


Figure 7: The effect of industry growth on the relationship between proactive causal logic and frequency of organizational actions

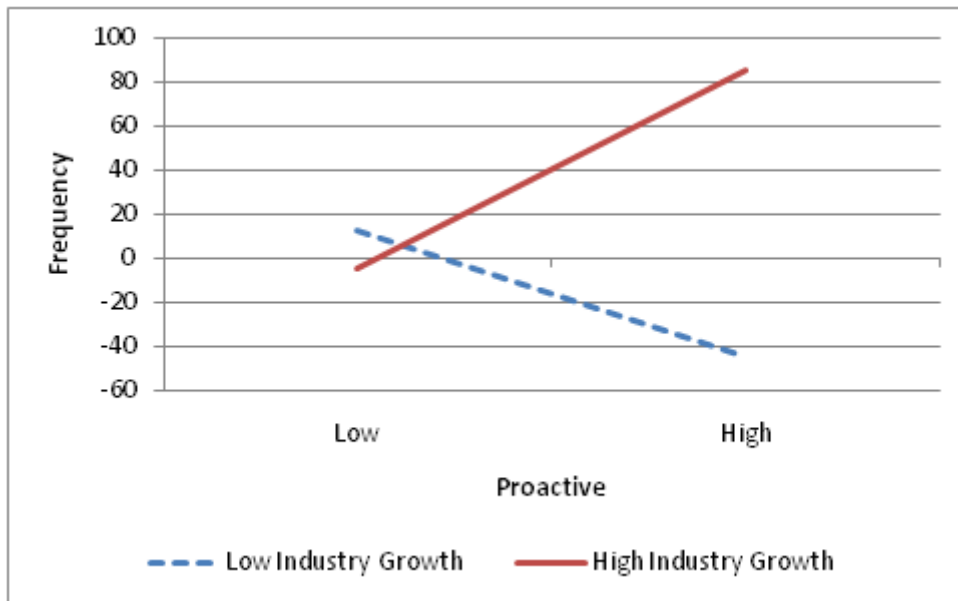


Figure 8: The effect of social network heterogeneity on the relationship between complexity of entrepreneurial schema and diversity of organizational actions

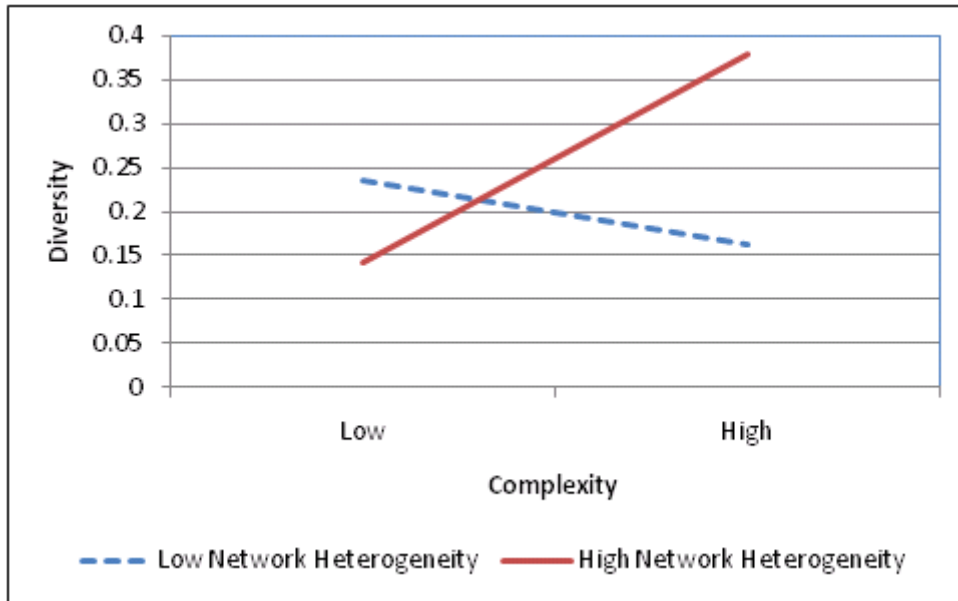


Figure 9: The effect of social network heterogeneity on the relationship between complexity of entrepreneurial schema and speed of organizational actions

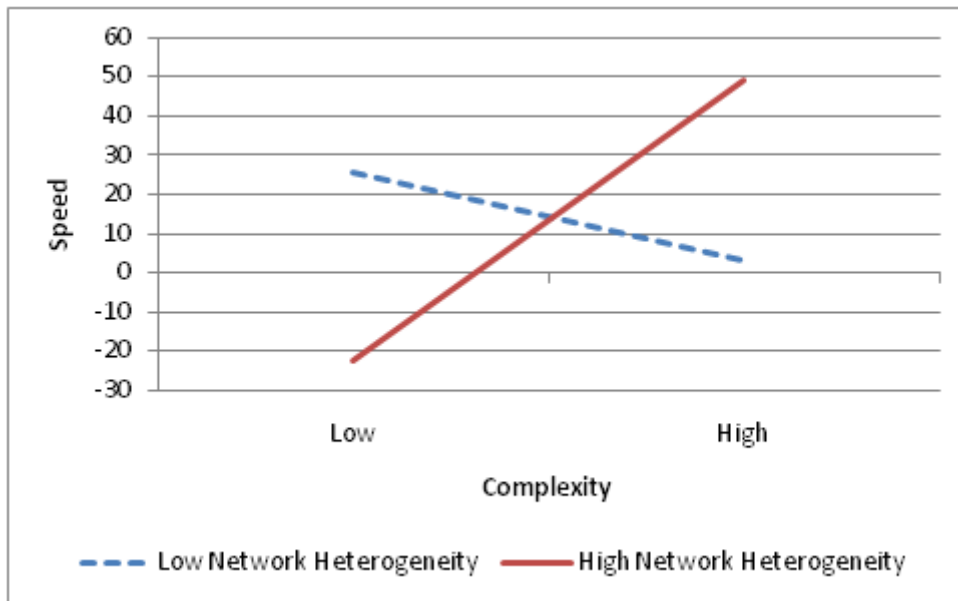


Figure 10: The effect of social network heterogeneity on the relationship between entrepreneurial schema focus and diversity of organizational actions

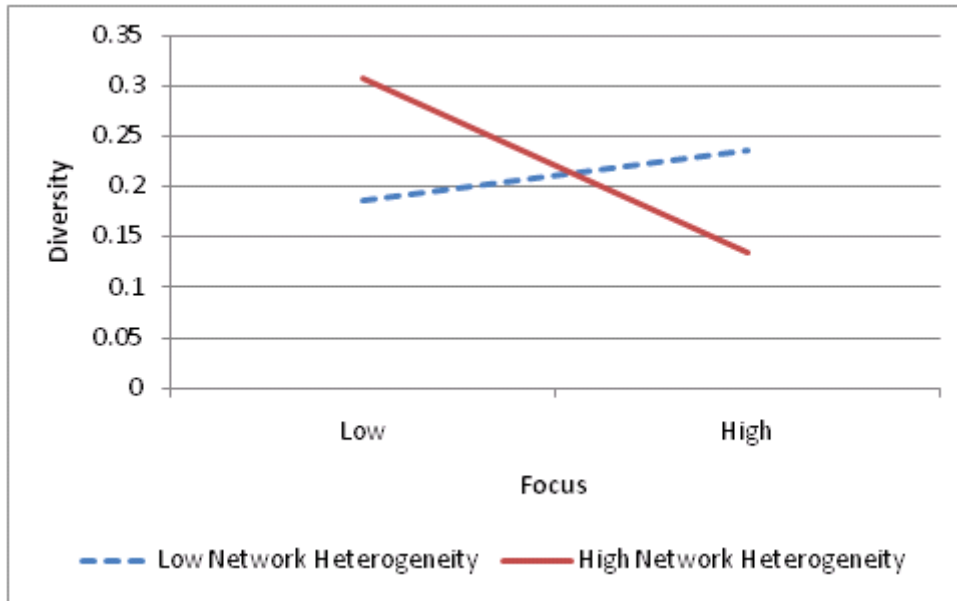


Figure 11: The effect of social network heterogeneity on the relationship between entrepreneurial schema focus on speed of organizational actions

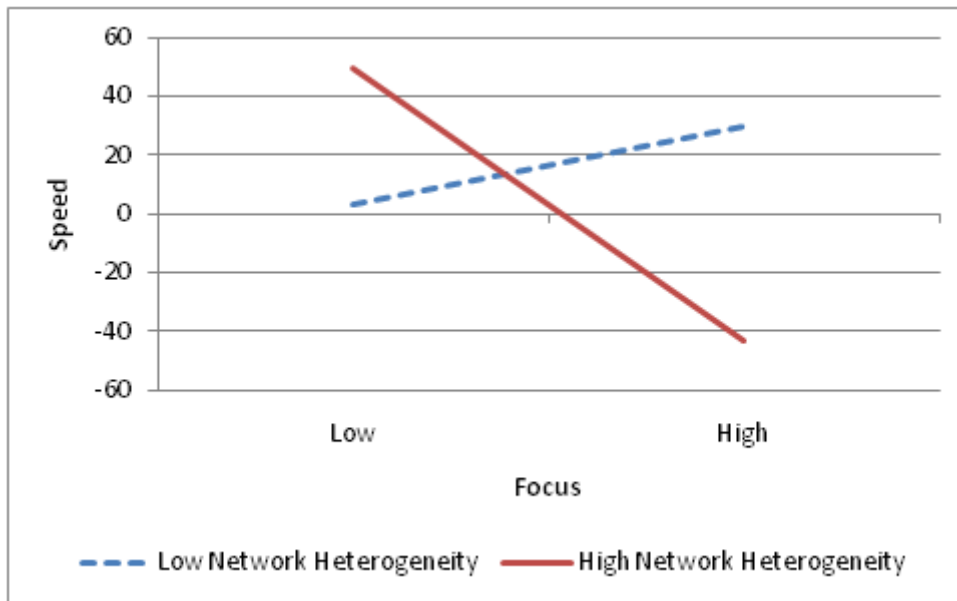


Figure 12: The effect of social network heterogeneity on the relationship between proactive causal logic and diversity of organizational actions

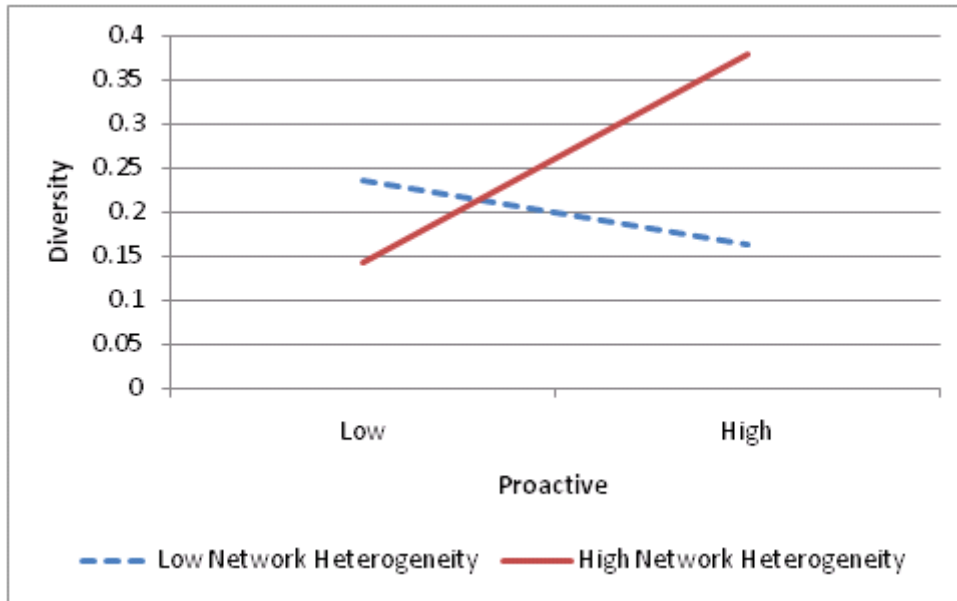


Figure 13: The effect of social network heterogeneity on the relationship between proactive causal logic and frequency of organizational actions

