IMPACT OF LIFECYCLE STAGE OF NEW TECHNOLOGY BASED FIRMS ON EXISTING MANAGEMENT AND INNOVATION THEORIES

A Dissertation
Submitted to
The Temple University Graduate Board

In Partial Fulfillment
Of the Requirements for the Degree
Doctorate of Business Administration
May, 2018

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May 2018

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ABSTRACT

This study investigates the concept of lifecycle stage and how, specifically in New Technology Base Firms (NTBFs), lifecycle stage can provide a more refined understanding of many of the relationships people have investigated, and would like to investigate, around NTBFs. This paper is broken up into a series of studies looking at specific areas of existing research of NTBFs, namely the attributes of a CEO and their relationship with firm success as well as previously discovered determinants of innovation within NTBFs, and provides an understanding of how the lifecycle phase of a firm impacts the conclusions within this existing research. The objective of this research is to demonstrate the importance of lifecycle stage as a key variable to be considered when studying NTBFs, and to help increase the predictiveness and generalizability of existing research to enable it to be more effectively translated into best practices used by practitioners.

ACKNOWLEDGEMENTS

This work would not have been possible without the assistance of so many people at Temple University and the Fox School of Business. The guidance and input of each professor within the Doctorate of Business program played an enormous role in the research, analysis and understanding that enabled this work. I am especially appreciative and grateful for the assistance of the program's administrative staff, namely Deborah Haak and Lindsay Clark, who provided support, guidance, and organization along this journey. I cannot thank them enough for everything they have done to help me get to this point.

This work has also been shaped so much by support and guidance from my advisor, Prof. Anthony Di Benedetto, and my dissertation committee, Prof. Detmar Straub and Prof. David Schuff. The relentless support, insight and guidance provided by each of you is the only reason I was able to take this concept and build it into what outlined in this paper.

Lastly, I'd like to thank my fellow D.B.A classmates and my family. The time and focus required in this program was made so much easier through the support and communal discussions with my classmates. I have learned an immense amount from all of you and have truly enjoyed your company in this process. The consummate support and understanding of my family throughout this process truly enabled all of this to happen. I could not have done this without the understanding and efforts of my wife and kids.

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INTRODUCTION: NEW TECHNOLOGY BASED FIRMS AND LIFECYCLE MODELS

Introduction

The core of most business research is focused on how differences between organizations impact their ability to be successful. Whether looking at structure, environment, execution, or investigating it through other lenses, researchers have looked for patterns to help predict a firm's success. Through that research a variety of trends and relationships have been identified which can influence firm success. Most researchers hope that driving a better understanding of these relationships will enable firms, and their management, to drive better business practices to help organizations become more successful. But, while there have been great strides, and in some cases broad agreement, around the impact of specific variables on firm success, in many cases those theoretical principles have struggled to turn into adopted best practices. This is especially true in the world of New Technology Based Firms (NTBFs), where high growth potential and rapid pace of change has driven huge investment to build high growth companies, but in many cases these firms become victims of the same mistakes as their predecessors. The lack of documented recommendations to avoid these past mistakes is not because researchers have not captured these connections, in fact to contrary, these are heavily researched areas, but a gap has developed between theory and practice. While there are many factors that contribute to how and why theoretical research

does not permeate into best practices, one key attribute of NTBFs that is commonly overlooked is the fact that they are rapidly changing organizations with varying needs throughout their lifecycle. Lifecycle research has been developed and focuses on a fundamental assumption that organizations transform, and with each transformation they deal with a new and unique set of challenges that require unique organizational and strategic configurations to overcome (Kazanjian, 1988). But most NTBF research does not account for this reality. This limits the applicability of those theories in practice. In this paper, we look at two specific, and heavily researched, areas of research around NTBFs: CEO characteristics and their relationship to firm success, as well as the determinants and moderators of innovation in NTBFs. This paper looks at the research that has been done in each of these domains and investigates how the NTBF lifecycle stage can impact the relationships found in prior research. Understanding this will provide a more accurate and applicable view of these theories.

By demonstrating the impact NTBF lifecycle stage has on other areas of research this paper helps develop a more accurate and thorough representation of the existing research around CEO characteristics and determinants and moderators of innovation. This refined view makes these theories more applicable and predictive for firms, increasing its relevance in practical situations. Also, by demonstrating the impact lifecycle stage has on this research this paper will guide future research to consider lifecycle stage as a key variable.

NTBFs Background

The term New Technology Based Firm has roots from the late 1970s with Author D. Little Consulting Group's work analyzing NTBF's in the UK, Germany and US (Little, 1977). The usage of the term, and research around it, has grown exponentially since its introduction. This interest is not surprising based on the impact NTBFs have had over the past few decades in world economies. Technology based firms have changed the entire landscape of many industries and national economies. Currently the five largest companies in the world (by market cap) are technology firms, up from just one of the top five firms just five years ago. Research has also shown NTBFs have significant and positive impact on job creation, economic growth, and disruptive potential (Spencer & Kirchhoff, 2006; Ejermo & Xiao, 2014; Autio & Parhankangas 1998). It is not just the demonstrated importance of NTBFs that has driven a large amount of interest and focus in academic research, it is also the differences in processes and operating models that can make NTBFs unique when compared to other firms. Everyone has heard the stories about "garage founded" companies like Apple who were able to take limited initial resources and, in a relatively short time, create slews of innovations that changed the world. Research has shown NTBFs are able to innovate more quickly (Rothwell & Zegveld, 1982), drive more differentiation (Carter et al., 1994), and see more rapid growth (Almus & Nerlinger, 1999) than their more traditional, larger, or non-technology focused counterparts. These differences have resulted in a large focused area of research dedicated to NTBFs. Founder characteristics, firm lifecycle and impacts of strategic choices on firm success are all examples of domains where

research has been done specific to NTBFs resulting in differing drivers and relationships than traditional companies (Alums & Nerlinger, 1999; Kazanjian, 1988; Roure & Keeley, 1990). This paper limits its focus to NTBFs due to this uniqueness and the significant and disruptive potential they represent.

Firms' Process of Change

Over the life of any firm it faces a variety of different challenges and objectives. It is logical to believe, and has been demonstrated empirically, that, at different stages of maturity firms face different challenges and have different barriers to success and growth (Van de Ven, 1986; Galbraith, 1982; Tushman & Nadler, 1986). Looking at Apple as an example, the problems they faced as a small group in a garage in California, compared to the challenges they face today as one of the largest corporations in the world are noticeably different. Many researchers have investigated if there are patterns of how firms encounter these challenges as the firm matures. This research has demonstrated several different, and common, patterns that firms experience as they grow (Scott, 1970; Mitchell & Summer, 1985; Kazanjian, 1988; Phelps et al., 2007). With the understanding that firms evolve in a consistent and predictable manor (Hanks, 1993) scholars have built several models to try to provide a more predictive mapping to help firms understand this process and how to best respond to the challenges facing a firm based on each stage. This has produced several stage models for firms (Utterback & Abernathy, 1975; Scott & Bruce, 1987; Phelps & Adam, 2007; Kazanjian, 1988). These models focus on different topologies to try to describe these patterns in a predictable way. Most of these models focus on the patterns organizations demonstrate as they see growth

(Scott, 1970; Smith, Smith Mitchell & Summer, 1985; Kazanjian, 1988). The basis of these models can range. For example, some focus on the trajectory of a firm, and how growth morphs over time (Scott & Bruce, 1987) while others focus on opportunities for firm growth (Chandler, 1962).

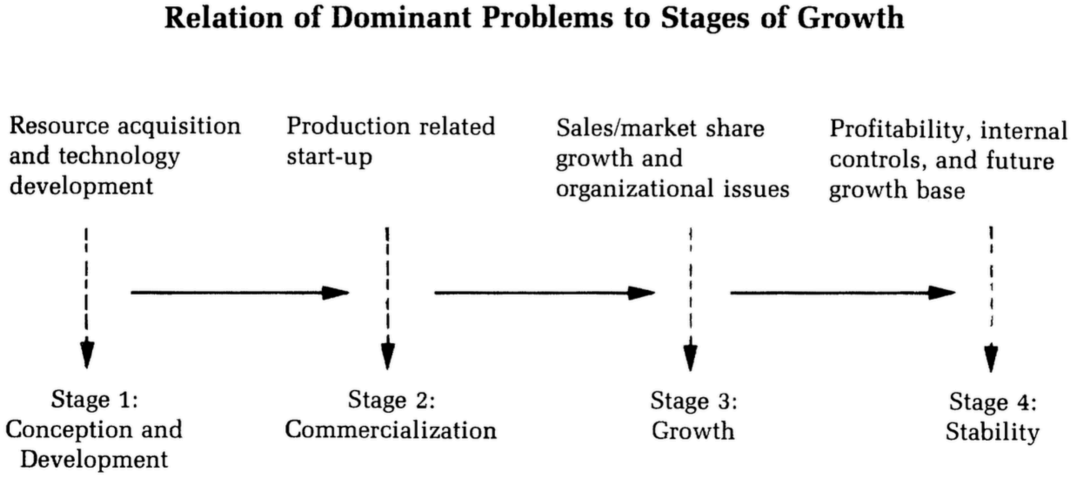
In his 2003 research Wasserman introduced a lifecycle stage model specific to NTBFs. This model focused on the expectations of the CEO and created two stages based on the challenges the CEO was facing at a given time: Founding vs Professional CEOs (Wasserman, 2003). This model was specific to NTBFs and clearly articulated the path of a firm, based on a common pattern of changing duties of a CEO.

The Wasserman model is interesting due to its focus on NTBFs but looking at firms through lenses such as the activities of the CEO relies heavily on internal aspects of the firm itself to determine the stage of that firm. This becomes a reactive view of the firm's stage because it determines the stage based on the firm's state which likely resulted from an external stimulus. A different school of thought is to focus on those external stimuli, namely the dominant problems a firm is facing at any given time and use that to identify the stage in the firm's lifecycle (Kazanjian, 1988). This is an especially interesting way of looking at corporate stages because the challenges facing a firm are outside the control of that firm which allows the lifecycle stage to be determined independent of any of the aspects of the firm. This enables a non-confounding investigation of many aspects of the firm itself and their relationship to lifecycle stage.

Stage model research based on the dominant problems of a firm has shown that the problems firms face are strongly associated with particular stages of growth (Block & McMillan, 1985, Galbraith, 1982). Kazanjian built on this concept to develop a stage model based on the dominant problems firms, specifically NTBFs, are undergoing while they grow (Kazanjian, 1988). Kazanjian developed a four-stage model (Figure 1) which categorized NTBFs based these dominant problems. These stages were supported through empirical testing based on longitudinal data from 71 NTBFs over an 18-month time period and showed that firms did travel through these four stages in a consistent manor (Kazanjian & Drazin, 1989). The stages in Kazanjian's model include: Conception & Development, Commercialization, Growth, and Stability.

Figure 1: Relation of Dominant Problems To Stages Of Growth

(Kazanjian, 1988)



Kazanjian's model, based on the dominant problems a firm is facing, as well as he and Drazin's work on impacts of this lifecycle on different aspects of the firm and their processes, begins to build in interesting foundation to understanding how lifecycle stage impacts different theories for NTBFs. The premise behind this concept is a logical one; as organizations form, different challenges are overcome by introducing appropriate organizational forms at which point another set of challenges become dominant requiring a new set of organizational forms to overcome (Greiner, 1997; Normann, 1977). As firms transition between these organizational forms it can impact the firm's operations, structure, decision making capabilities, and many other fundamental characteristics. There drive dramatic differences in how firms respond to problems, and those responses have different levels of success. While many attributes and relationships within a firm have been investigated to understand how they impact the growth of a firm, most of this research has ignored the concept of lifecycle stage.

Each of the stages outlined in Kazanjian's stage model are reflective on new sets of problems and challenges an organization is encountering at that time, and each of these stages may require different leadership, structures, skills and processes to effectively deal with those challenges (Kazanjian, 1988). Kazanjian and Drazin investigated the relationships between lifecycle stage and firm growth (Kazanjian & Drazin, 1990). Specifically, Kazanjian and Drazin showed that firm growth was contingent upon a fit between both decision-making centralization and specialization of resources and the lifecycle stage of a firm. This research, while

only limited to two areas, points to the impact of lifecycle stage on best practices. This provides a completely new view on research done in the areas of decision-making centralization and specialization of resources. It shows how best practices in real world situations, derived from research in these areas, would change based on the lifecycle stage of the firm. It shows how including lifecycle stage in this research makes it more generalizable and allows for useful best practices to be derived from the research. The goal of this paper is to extend this research to additional areas to show that lifecycle stage is a critical variable that needs to be considered in all NTBF research to effectively provide generalizable theories that can be adopted in practice.

This introduction is part of a series of papers. This series is broken into three parts which build on existing research to demonstrate how the lifecycle stage of a firm provides key insight into the applicability of broadly accepted theories. These papers focus on two areas of existing NTBF research: CEO Characteristics and firm success and Determinants of innovation. This series looks at how a firm's lifecycle stage impacts the previously demonstrated theories in these two areas.

Leveraging Kazanjian's 4 stage model, as well as Wasserman's two stage model, these papers attempt to provide a more accurate and detailed view of theories in these domains. The three sections of this series include:

- Pilot Study: The Right CEO for the Right Job: An Investigation on the Impact of Life Cycle Stage on CEO Fit a New Technology Based Venture
- Study 2: The Evolving Role of the CEO: How Lifecycle Stage Impacts the Relationships Between CEO Characteristics and NTBF Success

- Study 3: Innovating Based on Stage: Aligning Innovation Practices with Lifecycle Stage

A summary of the objectives of these studies is shown in Table 1.

Table 1: Summary of Three Studies

Study	Objective	Lifecycle Model	Sample Source
Pilot	Evaluate Possible Impact of Firm Lifecycle on the Relationships of CEO Background And Firm Success in NTBFs	2 Stage Model Based on CEO Type (Wasserman, 2003)	Analysis of Public Information of 12 Firms
Study 2	Demonstrate Quantifiable Impact of Firm Lifecycle on the Relationships of CEO Background And Firm Success in NTBFs	4 Stage Model Based on Determinant Problems of Firm (Kazanjian, 1988)	Field Study of 35 Firms
Study 3	Demonstrate Quantifiable Impact of Firm Lifecycle on the Determinants of Innovation and Firm Innovativeness in NTBFs	4 Stage Model Based on Determinant Problems of Firm (Kazanjian, 1988)	Field Study of 35 Firms

CHAPTER 2

PILOT STUDY- THE RIGHT CEO FOR THE RIGHT JOB: AN INVESTIGATION ON THE IMPACT OF LIFE CYCLE STAGE ON CEO FIT IN A NEW TECHNOLOGY BASED VENTURE

Abstract

Much of the literature in business and innovation explores aspects of the age-old question: what attributes lead some companies to succeed vs. fail. As researchers have pondered different variations of this question, and investigated possible drivers, one heavily investigated area has been the capabilities and compensation of the top management team (TMT) and specially the CEO. There have been several patterns and correlations between the composition and attributes of the TMT/CEO and firm performance (Child, 1972). The research shows the impact of TMT and CEO capabilities on the outcomes of firms is even more pronounced in early stage companies (Gilbert et al., 2006) as well as in new technology based firms (NTBF) (Roure & Keeley, 1990).

Most of research in this space highlights the importance of the having the right CEO and analyzes the different contributing attributes that help define "right". Based on the current research there continues to be many aspects of this relationship that continue to be unexplored. The research goal of this paper is to provide a pilot study to identify areas to potentially expand on the existing research around CEO skills in NTBFs, specifically by leveraging stage model research of NTBFs to understand how the importance of different CEO attributes change

through the early stages of a NTBF's life. This paper will look at the mixture of CEO Technical & Industry depth vs Business & Startup breadth, and how the relationship of these and firm success changes through the stages of a NTBF. This paper leverages Wasserman's two stage model for NTBFs which focuses on defining the firms stage by type of CEO, specifically a Founding CEO and then Professional CEO (Wasserman, 2003). This paper will look at the different roles a CEO plays in those stages and how a CEO must demonstrate different capabilities to fit those different stages.

Introduction

The CEO role is a critical role for any company. As the leader of a company CEO's have responsibilities to make strategic choices that directly impact financial results of a firm (Wasserman, 2003). Firms put enormous amounts of resources and thoughts into CEO selection, succession planning, compensation, etc. to ensure they have the right leader in their firm at all times. In small early stage firms individual resources can have an even more material impact on a firm, making human capitol more critical for success, and the CEO is no exception. Gilbert, McDougall and Audretsch commented that in small firms the CEO has the greatest impact within the firm on strategy and direction (Gilbert, McDougall, & Audretsch, 2006). Shrader and Siegel looked at this dynamic within NTBFs, investigating the importance of the CEO along with the rest of the TMT, and found that not only were these resources key to the firm but that they also were a major driver in the value of these early stage firms (Shrader & Siegel, 2007). The strength of the executive team

has also been identified by Roure and Keeley as one of the four items that impacted the majority of the variance in performance of NTBFs (Roure & Keeley, 1990).

Given this strong support for the importance of the CEO within a NTBF it is not surprising that there has been a significant amount of time and effort spent trying to understand the role and what attributes help drive more success for a CEO in a firm. Much of the research in this area is focused on how different attributes of a CEO can drive different outcomes that may or may not be desirable for a firm. These different attributes can range from age, to educational experience, to socioeconomic factors, etc. and correlations have been seen between each of these attributes and firms' predisposition for risk taking, their focus on innovation, and overall firm performance (Gupta & Govindarajan, 1984, Hambrick & Mason, 1994). This means that different characteristics of the CEO are going to potentially drive different end states, not necessarily good or bad, that judgment is really the combination of those end states overlaid with the needs of the firm at that time. For example, a CEO with a higher predisposition to risk taking is not necessarily good or bad for a firm, it really depends on the needs and make-up of the firm at the time the CEO is managing the firm. This is aligned with match theory thinking, where the question is less about good or bad resources; it is more about finding the right resources who "fits" into the role you are trying to fill (Jovanovic, 1979). So, while current research can assist in understanding how an individual aspect of a CEO might be correlated to one generic outcome, it makes it difficult to generalize what types of resources would be best for a more specific set of CEO responsibilities.

To make establishing correct fit even more difficult, the responsibilities of a CEO can vary wildly and change on a day-to-day basis. While these variations are unique from company to company, there are common trends that can be seen in a NTBF. Research has shown one key shift in CEO responsibilities is at the time where the firm transitions from a Founding CEO to a Professional CEO. This is a common occurrence in a NTBF where the firm will begin with a "Founding CEO" and over time, as the firm grows and matures, the role of CEO hits an inflection point where the CEO's duties dramatically change (Wasserman, 2003) at which point the CEO becomes, or is in many cases replaced by, a "Professional CEO" (Hellman & Puri, 2002). This research highlights the evolving demands on a CEO in a NTBF, and the changing capabilities a CEO must have to be successful in meeting the firm's needs. While all CEO shifts are extremely sensitive, as they have the potential impact firm performance, this shift is especially unique because it not a shift due to the performance of the CEO or a lack of fit with the company, it is because the CEO role has materially changed in what it needs to contribute to the company. This dynamic change alters the outcomes the CEO is trying to drive and the CEO's immediate responsibilities. With this shift in responsibilities the best fit for that CEO role might be a different resource, with a different set of attributes, that will fit these updated responsibilities. Even biologically the we see a separation between natural planners and designers, somewhat akin to founders and natural managers, where each relies more predominantly on skills derived from opposing hemispheres of the brain (Mintzberg, 1990). Wasserman also noticed how the characteristics of Founding and Professional CEOs differed the in his analysis of each, where he noted

Professional CEO's typically differed from Founding CEOs in many ways such as age and level of experience than their professional counterparts (Wasserman, 2003).

This paper looks at these Founding vs Professional CEO stages and attempts to understand how the attributes of the CEO that are most correlated to success shift as the company traverses through these stages. This paper focuses on two major categories of attributes of CEOs: First technical and industry depth, and second business and startup breadth, and investigates how CEOs with deeper experience in these categories impact firm performance differently in the Professional vs Founding CEO stages. This paper is meant to serve as a pilot study to outline how there is a potentially differing relationship between each of these attributes for Professional and Founding CEOs. Better understanding this relationship builds on the existing data around attributes impacting CEO performance and further generalizes it to help build a profile of the best resource for each of these unique stages of in a NTBF and highlight areas for additional research.

Attributes Impacting CEO Performance

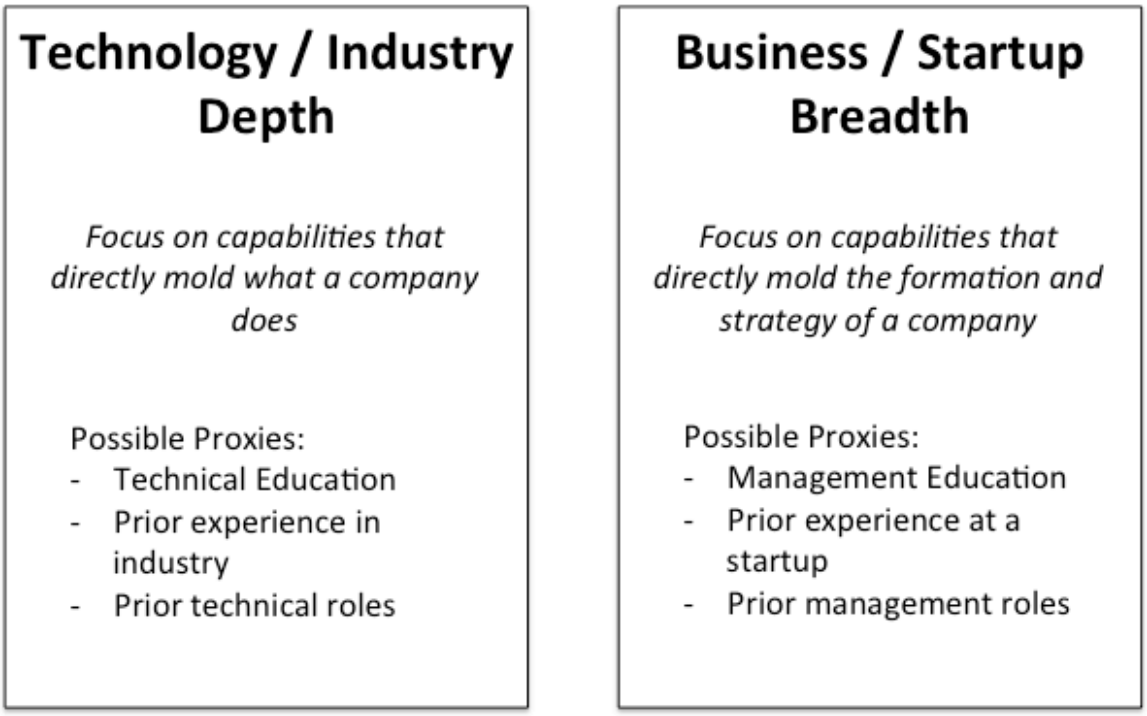
Much of the research around CEO fit begins with TMT homogeneity and insider vs outsider fit for CEOs (Guthrie & Deepak, 1997; Ensley & Hmieleski, 2005). While this type of research around fit can be immensely valuable in some situations, when investigating NTBFs, and specifically the transition from Founding to Professional CEO, these aspects lose much of their value. NTBFs TMTs typically consist of the founding partners. The founding partners are typically very closely aligned and most commonly have worked together in previous roles and for the same companies (Audia & Rider, 2005). This naturally makes the TMT homogenous

in almost all early stage NTBFs. Also, as companies make the transition from Founding CEO to Professional CEO, the Founding CEO is most commonly replaced, and in those replacement situations they are almost always replaced by an outsider (Hellman & Puri, 2002). These dynamics water down the usefulness of the significant research that has been done around heterogeneity of the TMT and insider vs outsider CEO succession when looked specifically looking at early stage NTBFs.

Looking deeper at indicators to help understand CEO fit in a NTBF, Hambrick and Mason provide and interesting summary of many of the different CEO attributes that have been studied and the specific outcomes they are correlated to. For example, CEO age is shown to have a negative correlation with willingness to take risks (Hambrick & Mason, 1994). Wiklund and Shepard build on this framework identifying knowledge about: the industry, type of business and startup experience as the key areas of knowledge a CEO must possess in a NTBF (Wiklund, Shepherd, 2003). This is similar to West and Noel who point to: Industry, strategic and business knowledge, and experience and knowledge of new ventures as the attributes that are key to CEO success in a NTBF. West and Noel identify the balance between managerial and technical knowledge as the key requirements for CEO success (West & Noel, 2009). In looking at these descriptions, in an attempt to synthesize these different concepts, two categories present themselves. Wiklund and Shepard as well as West and Noel talk about attributes that are specific to a domain. They talk about understanding what the business is trying do, for example understanding technologies and the industry itself, for simplicity this paper

summarizes these attributes as technical and industry depth. Technical and Industry depth is meant to capture the set of attributes that focus on what a NTBF is trying to accomplish, including: prior experience in the industry, technical or engineering education, and previous roles in technology. Examples of CEO's fitting this mold could be Bill Gates or Mark Zuckerberg in the early stages of Microsoft and Facebook. Complementing technical and industry depth, the other attributes are less focused on what the company does and more on the company itself. These are attributes like managerial experience, business experience and start up experience. This paper refers to these as business and startup breadth. This is a much broader set of skills that can be represented by factors such as: formal business education, previous small company experience, previous founder experience, and previous roles in management functions. These attributes have little to do with what the company builds or does, but more about how the company and the resources within it function. Figure 2 shows a summary of these two concepts.

Figure 2: Technology/Industry Depth Vs Business/Startup Breadth

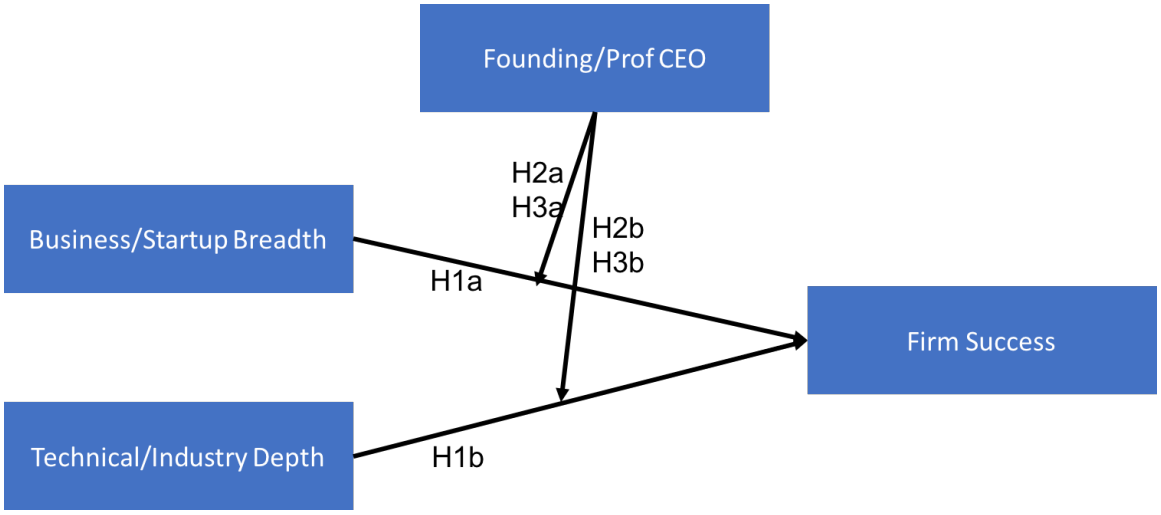


Both Wiklund and Shepard as well as West and Noel identify that both sides of this coin, technical and industry depth as well business and startup breadth, are critical for CEO success, but it is intuitive to believe that the comparative blend of these skills could differ between different resources. The relative weighting of these capabilities is an area that has not been explored. This introduces the first hypothesis of this paper (Figure 3):

H1a: Prior CEO experience that has led to broad business/startup knowledge has a positive influence on Firm Success.

H1b: Prior CEO experience that has led to deep technical/industry knowledge has a positive influence on Firm Success.

Figure 3: Pilot Hypotheses



Founder CEOs in NTBFs

As most NTBFs start, the initial leader of the firm is one of the founders, hence the term "Founding CEO". The Founding CEO, as well as the overall makeup of the founding team, has a huge impact on the overall direction of a firm. The Founding CEO in a way shapes the firm. In these early stages of the firm, the skills of these founders have a major impact on the direction of the NTBF itself, including the development of the firm's distinctive capabilities, which have been shown to be closely related to the skills and knowledge of the founder (Hodgson, 1998). This is in many ways because in the early stages of the firm, a NTBF must rely on founder knowledge as their core asset (Brush et al., 2001).

During the stage that a Founding CEO is in place the company is focused on a set of specific functions, including: the development of the initial product, search for funding, and formation of the initial team (Wasserman, 2003). These activities the firm is going through dictate many of the attributes that will enable a founding CEO

to help the NTBF to be successful. It is not surprising to learn that a blend of skills is critical, as entrepreneurs need to wear many hats and are in most cases generalists (Lazear, 2004). Looking deeper at founders' skills and attributes, research has shown several attributes, including: specific industry experience, technical experience, as well as graduate education and prior entrepreneurial experience, are positively correlated with success, but on the contrary, generic industry experience and management experience of the founders was not correlated with success (Colombo & Grilli, 2005). Shrader and Siegel investigated the impact of technical experience of a CEO and learned it was negatively related to generic low-cost business models, but positively related to strategies focused on differentiation (Shrader & Siegel, 2007). This dichotomy of technical experience helping drive differentiation strategies but hurting low cost models is very interesting with respect to NTBFs. In the early stages NTBFs are typically drivers of innovation and disruption, because of this the lion's share of NTBFs are pursuing a differentiation strategy which would lead one to believe that for early stage NTBFs technical capabilities are going to be correlated success.

This research, as well as the activities a company is working through at the time of the Founder CEO, suggests it would be logical to believe that for Founder CEOs in NTBFs, technical and specific industry knowledge are critical skills for a NTBF leading to a higher likelihood of success. This introduces hypothesis two (Figure 3):

> *H2a: The association between technical/industry depth and firm success is stronger for Founding CEOs than Professional CEOs.*

H2b: The association between business/startup breadth and firm success is weaker for Founding CEOs than Professional CEOs.

The Transition from Founding CEO to Professional CEO

As a NTBF matures, the needs of the firm change. One of the most core changes is as they move from a firm that has an idea or concept to a business that is executing on a strategy to bring that concept to market. As a NTBF goes through this transition they see an enormous amount of change. Their goals change, they begin to look at marketing and sales strategies, supply chain can become an area of concern, and they commonly are looking to accelerate growth through additional funding. As a firm encounters these new challenges, the CEO job broadens and gets more complete. The role now entails all aspects of building, selling, marketing and resource management. This change can create a mismatch in CEO skill sets especially for firms with a technical oriented CEO (Wasserman, 2003). It is this conversion that can drive NTBFs to make the shift to a Professional CEO.

Wasserman showed that two major catalysts typically align with the shift from Founding CEO to Professional CEO. These are: the firm getting a new round of financing and completion of product development (Wasserman, 2003). Both represent critical points for a NTBF. A new round of financing gives the firm the capitol to invest in the next stage of their business case. As the firm invests in these new activities the existing CEO may not have the capabilities required to help the firm achieve those goals. Also new financing commonly comes a new voice in the TMT. Whether it is new board members, advisors, etc., that new voice may have ideas about the current management, or the potential for new management.

Similarly, the completion of product development can be a major shift for a NTBF. It is at this point that the company shifts from transitioning a concept to a product to transitioning a product into a customer solution that drives revenue for the firm. This shift can change the focus of the firm creating a natural catalyst few the emergence of new CEO responsibilities and potential succession. It's important to point out the conversion that occurs at this time is less about the current CEO being an inadequate resource, but more of them not being a "fit" for the CEO role. This is supported by the fact that 40% founding CEOs who are replaced at this time continue with the company in a different capacity (Hellman & Puri, 2002).

As this transition happens and the capabilities change, the need for a strong technical background diminishes (Wasserman, 2003), but the increasing breadth of CEO responsibilities points to a need to have an executive with a much broader skill set and compliment of capabilities. This introduces the third hypothesis (Figure 3):

H3a: The association between business/startup breadth and firm success is stronger for Professional CEOs than Founding CEOs.

H3b: The association between technical/industry depth and firm success is weaker for Professional CEOs than Founding CEOs.

Methods for Pilot Study

In this pilot study we look at a sample of NTBFs in the San Francisco/Bay Area to explore the CEO background at different corporate stages. In this sample we assess the level of business/startup breadth and technical/industry depth they displayed at a given time and compare that to the overall success of the firm during

the timeframe to identify trends in this sample to understand if a broader study may be warranted.

Sample Identification

To control the size of the sample and limit outliers in this small sample we have focused only on venture funded NTBFs in the San Francisco/Bay Area. We have leveraged CrunchBase and limited the selection to:

- Firms focused on hardware, software, internet or mobile technology as identified through their category of business via Crunch Base
- Firms who were founded after 1/1/2007 and have received their most recent round of funding after 1/1/2014
- Firms with between $10M and $400B in venture funding
- Firms that have either IPO'd or closed

This provided us with a list of 12 firms outlined in Table 2.

Table 2: Pilot Companies

Company	Status	Founded
Company 1	IPO	1/1/2007
Company 2	IPO	1/2/2007
Company 3	IPO	6/30/2008
Company 4	Closed	1/1/2014
Company 5	IPO	1/1/2009
Company 6	Closed	1/26/2011
Company 7	IPO	2/1/2012
Company 8	IPO	1/1/2012
Company 9	Closed	2/1/2012
Company 10	IPO	6/1/2011
Company 11	Closed	1/1/2011
Company 12	Closed	10/1/2013

Stage Identification

To identify firms in Professional or Founding CEO stages we focused on the activities that a firm undergoes within that stage. Wasserman describes the duties of a founding CEO as, "the development of the initial product and search for funding" while a professional CEOs focus on "aspects of building, selling, organization and marketing" (Wasserman, 2003). While many of these are hard to quantify without an intimate knowledge of the firm, for this study we leveraged the timing of funding. Leveraging Crunchbase data we categorized the time period prior to firm's non-seed funding round as their Founding CEO stage and the time period after this round of funding as their Professional CEO stage.

CEO Background

To understand the CEO background we did an extensive internet search, looking at company websites, press releases and media articles to identify the CEO history of each of these firms (see Table 3). We leverage LinkedIn to capture the background of each of these CEOs and provide a rating between 0-4 of both Industry/technical depth and business/startup breadth. The rating was based on their scholastic and work history. To measure these eight categories were assessed for each CEO, if the CEO had a background that demonstrated that category they received 1 point towards their rating. Those categories were:

Technical/Industry Depth: Technical undergraduate degree, Technical Masters degree, Previous role as an engineer, architect, CTO, or VP of R&D, previous industry experience.

Business/Startup Breadth: Business undergraduate degree, MBA, Previous role as CEO, COO, SVP or General Manager, Previous experience with startup business

A score for each skill set was provided for each CEO as well as a calculation of the difference that represented a relative weighting for each CEO. A positive difference represents a heavier weighting towards to business/startup breadth and a negative difference demonstrates a heavier weighting towards technical/industry breadth. A difference of zero represented a balanced CEO with even scores in each skill set. Table 3 shows the CEO scores for each company.

Table 3: CEO Analysis

Company	Company Closed (Y/N)	Most Recent CEO	Biz/Startup Rating	Tech/Industry Rating	Difference	Former CEO (if applicable)	Biz/Startup Rating	Tech/Industry Rating	Difference
Company 1	N	CEO1	1	0	1	CEO1a	2	1	1
Company 2	N	CEO2	3	1	2	NA	NA	NA	NA
Company 3	N	CEO3	2	3	-1	NA	NA	NA	NA
Company 4	Y	CEO4	3	0	3	CEO4a	4	1	3
Company 5	N	CEO5	2	2	0	CEO5a	3	0	3
Company 6	Y	CEO6	2	0	2	CEO6a	2	0	2
Company 7	N	CEO7	2	1	1	CEO7a	NA	NA	NA
Company 8	N	CEO8	4	0	4	NA	NA	NA	NA
Company 9	Y	CEO9	2	2	0	NA	NA	NA	NA
Company 10	N	CEO10	3	0	3	CEO10a	1	4	-3
Company 11	Y	CEO11	1	1	0	NA	NA	NA	NA
Company 12	Y	CEO12	0	2	-2	NA	NA	NA	NA

Overall Success

The sample data was chosen to provide a binary view of overall firm success. Since all of these firms were venture funded we looked at success as providing a return to the investors. All of the firms in this pilot were either closed – therefore not providing a return to investors, or IPO'd – therefore providing a return to investors. This allowed the study to have a clear-cut rating where close = fail and IPO = success.

Results of Pilot Testing

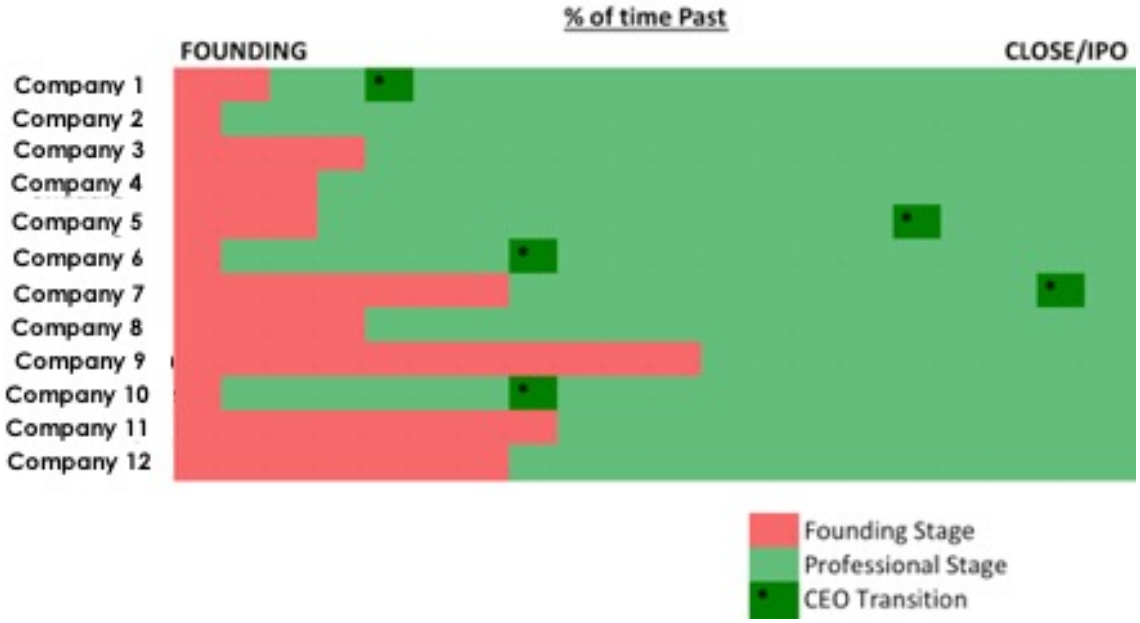
Given the small sample size the objective of this pilot was not to provide statistically compelling data to confirm these hypotheses, but instead to understand if a relationship appeared likely enough to warrant deeper investigation.

By looking at the basic relationships of CEO background and firm success, out of the 17 CEOs that were involved in these firms, all except for one of the CEO's had some level of Business/Startup breadth (Table 3). The one CEO that did not have any Business or Startup background was one of the seven CEO's involved in a failed firm. This supports the potential association between firm success and prior CEO business/startup experience in NTBFs as outlined in hypothesis 1a. Looking at CEO's prior technical/industry experience the results are less clear. Seven of the 17 CEOs studied were deemed to have no previous technical or industry experience. Out of those seven, just over half (4 CEOs) were members of firms that were successful. While these results are not as clearly correlated, it does not rule out the relationship between technical/industry depth and firm performance. This would be interesting to study in a larger sample to understand if this association does exist in any significant way, making hypothesis 1b inconclusive but worthy of further investigation.

As we look at how firm stage-impacted success, the first thing that stands out is the timing of the CEO transitions. As can be seen in Figure 4, just under half the firms in this sample experienced a CEO transition, and for those firms where a transition did occur it occurred well after the firm's transition to the Professional CEO stage. This was surprising as it was not in line with much of previous research

which demonstrated more frequent CEO turnover in NTBFs and a stronger correlation to that turnover and the transition from Founding to Professional CEO stages (Wasserman, 2003; Hellmann & Puri, 2002). This could be due to the small and focused sample in this pilot study. A larger sample which included NTBFs outside of the Bay Area could product different results. This also may have been impacted by the narrow measurement of professional and founding stage, by timing of financing, used in this pilot study. This is a phenomenon does warrant additional research to better understand and test.

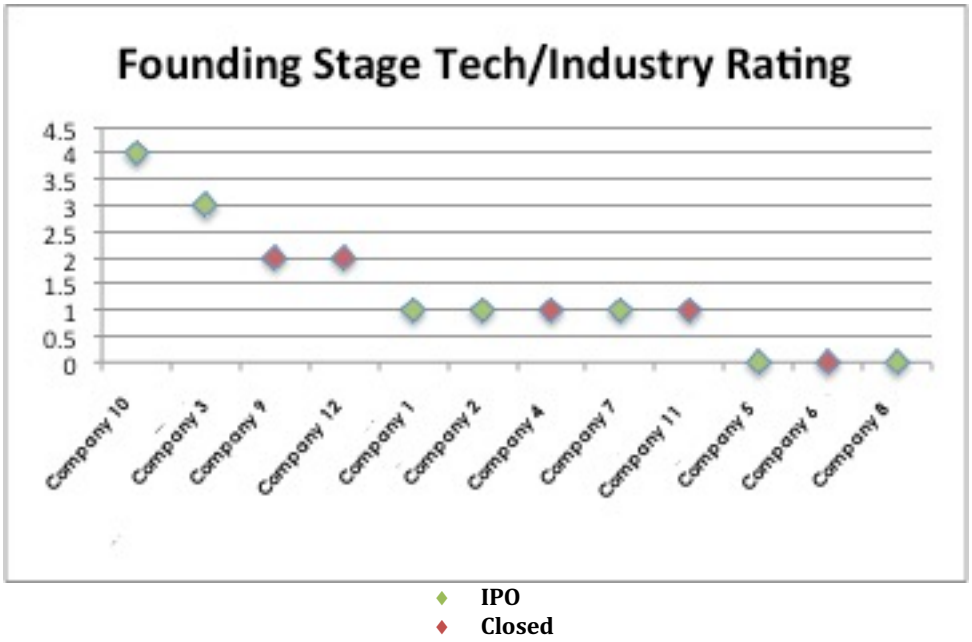
Figure 4: Pilot Founding vs Professional



Beyond the timing of the CEO turnover and transition the results were very mixed on the relationship between CEO characteristics and firm success. There were some firms, such as Company 10, which followed the trend as expected. Company 10 began with a CEO who much more technical/industry weighted which then transitioned to CEO who was more Business weighted leading to an eventual success, but the overall

results were less conclusive. Looking at the Founding CEO stage, the level of technical/industry depth ran the full spectrum, and results were dispersed in how that rating resulted in success of the firm (see Figure 5). The sample set in this pilot resulted in successes and failures with CEOs at the Founding stage with almost all levels of technical/industry depth. The one visible trend was the firms with CEOs with the highest levels of technical/industry depth, ratings above 2.5, all were members of successful firms which would provide potential support for Hypothesis 2a but the CEO's that fit these criteria was extremely small, only 2 firms falling in that category, so it is very difficult to draw any conclusions. Along with the small sample size of the pilot, and N of only 17, there may be some distortion in these metrics as we are measuring firm success/failure as the end success/failure of the firm. This could make a CEO who helped a firm be very successful in the founding stage be deemed as unsuccessful because of a later result of the firm. A different measure of firm success more specific to the founding stage may alter these results and provide a more accurate view. While the data does suggest there could be a trend, it is difficult to understand if an association between founding stage CEOs and technical/industry depth does in fact exist. Based on this sample, and without understanding if that basic association exists, it is not possible to understand if the relationship is stronger for Founding opposed to Professional CEOs. This makes us unable to support or deny hypothesis 2a based on this sample, but it does feel there is value in a deeper investigation.

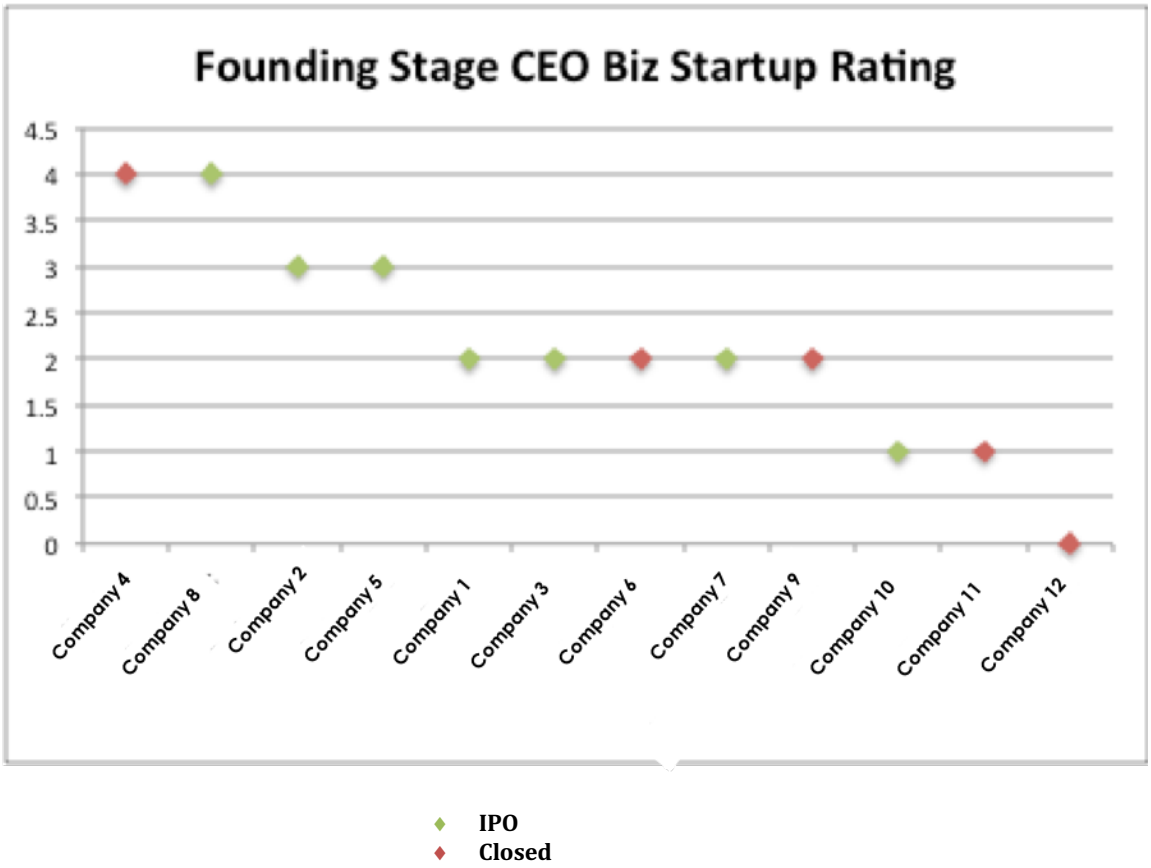
Figure 5: Pilot Founding Stage Tech/Industry Rating



Looking at the professional CEO stage and CEO business/startup breadth skills, we see a much stronger relationship. Even in this small sample, a strong relationship is evident between Business/Startup breadth and firm success in the Professional CEO stage as seen in Figure 6. With very few outliers, firms with CEOs without business/startup breadth in the Professional CEO stage were not successful whereas firms with CEOs with business/startup breadth in the Professional CEO stage were successful. This influence was also evident in the Founding stage CEO's as well (Figure 6), although the relationship appears to be slightly weaker. Looking at the relationship for each as outlined in Figure 6 the differences are very subtle and while the data in this sample points a very strong influence between business and startup breadth for both Professional stage and Founding stage CEOs it is very difficult to conclude if the influence is stronger in a meaningful way for Professional Stage CEOs. Given the size of this sample and the number of firms who did not

change CEO's between the Founding and Professional stages it makes it difficult to make any conclusions for Hypothesis 2b, but it definitely appears to warrant more investigation.

Figure 6: CEO Biz/Startup Rating



Conclusions and Areas for Additional Research Based on the Pilot

The objective of this paper was to provide a pilot study to understand if more research was warranted around CEO capabilities based on stage of NTBFs, specifically looking at how CEO business/startup breadth and technical/industry depth was correlated with firm success for firms in the Professional vs Founding CEO stages. Based on the small sample size for this pilot study the results were not conclusive, but they did point to several apparent relationships between these CEO

capabilities and firm success that warrant further and deeper investigation. The link between business/startup breadth and NTBF's success appeared very strong, but it was difficult to see how that changed between the Founding and Professional CEO stages of the firm. The link between technical/industry depth was less clear for these NTBFs, but was apparent in some individual situations. This linkage needs to be better understood before understanding how this changes across the stages of the firm.

As this study was only a pilot there were several limitations of the study that could be expanded to provide a more comprehensive and conclusive understanding of these topics. Key limitations that should be mitigated in a more comprehensive investigation include:

- Sample size: This was a well-understood and expected limitation of this study. A larger sample is required to reduce outlier impact and make results more statistically significant.
- Identification of Founding vs Professional CEO stage: This study took a simplistic view of defining these stages based on timing of funding. The results did not show a clear relationship between CEO turnover with these stages as suggested in previous research. It would be beneficial to take a more holistic view of these stages using multiple indicators beyond just funding (initial product release, initial customer acquisition, etc.) to better understand this relationship and how it aligns to prior research.
- Firm Success Metrics: The view of success of firms in this study was limited to the firms eventual IPO or shutting of the doors. This metric limited any

understanding of how successful a firm was within each individual stage and instead only pointed to eventual success. Also, the binary nature of this measure caused it to lose relative weighting across successful companies, which made it more difficult to notice influences. Additional metrics identifying firm success would allow for a more thorough investigation of these relationships.

These limitations are items that should be thought through in a more comprehensive study.

CHAPTER 3

STUDY 2: THE EVOLVING ROLE OF THE CEO: HOW LIFECYCLE STAGE IMPACTS THE RELATIONSHIPS BETWEEN CEO CHARACTERISTICS AND NTBF SUCCESS

Abstract

When trying to understand what helps NTBFs succeed, one heavily investigated area has been the capabilities and compensation of the top management team (TMT) and specially the CEO. There have been several patterns between the composition and attributes of the TMT/CEO and firm performance (Child, 1972). The research on TMT/CEO capabilities and their impact on firm performance is even more pronounced in early stage companies (Gilbert et al., 1996) and NTBFs (Roure & Keeley, 1990).

Most of research in this space highlights the importance of the having the right TMT and CEO in a NTBF and provides analysis of the different contributing attributes that help define "right". Based on the current research there continues to be many aspects of this relationship that are unexplored. The research goal of this paper is to identify areas to potentially expand on the existing research around CEO skills in NTBFs, specifically by leveraging Kazanjian's 4 stage lifecycle model to understand how the importance of different CEO attributes change through the early stages of a NTBF's life. This paper will look at the different roles a CEO plays in each lifecycle stage and how a CEO must demonstrate different capabilities to fit those different stages.

Introduction

The CEO role is a critical role for any company. As the leader of a company CEO's have responsibilities to make strategic choices that directly impact financial results of a firm (Wasserman, 2003). Firms put enormous amounts of resources and thoughts into CEO selection, succession planning, compensation, etc. to ensure they have the right leader in the firm at all times. In small early stage firms, individual resources can have an even more material impact on a firm, making human capitol more critical for success, and the CEO is no exception. Gilbert, McDougall and Audretsch commented that in small firms the CEO has the greatest impact within the firm on strategy and direction (Gilbert, McDougall, & Audretsch, 2006). Shrader and Siegel looked at this dynamic within NTBFs, investigating the importance of the CEO along with the rest of the TMT and found that not only were these resources key to the firm but that they were a major driver in the value of these early stage firms (Shrader & Siegel, 2007). The strength of the executive team has also been identified by Roure and Keeley as one of the four items that impacted most of the variance in performance in NTBFs (Roure, Keeley, 1990).

Given this strong support for the importance of the CEO within a NTBF it is not surprising that there has been a significant amount of time and effort spent trying to understand the role as well as what attributes help drive more success for a CEO in a firm. Much of the research in this area is focused on how different attributes of a CEO can drive different outcomes that may or may not be desirable for a firm. These different attributes can range from: age to educational experience to socioeconomic factors etc., and correlations have been seen between each of

these attributes and the firms' predisposition for risk taking, focus on innovation, and overall firm performance (Gupta & Govindarajan, 1984; Hambrick & Mason, 1994). This means that different characteristics of the CEO are going to potentially drive different end states, not necessarily good or bad end states, that judgment is really the combination of those end states overlaid with the needs of the firm at that time. For example, a CEO with a higher predisposition to risk taking is not a good or bad thing, it really depends on the needs of the firm at the point where that CEO is managing the firm. This is aligned with match theory thinking, where the question is less about good and bad resources; it is more about finding the right resources who "fits" into the role you are trying to fill (Jovanovic, 1979). While current research can assist in understanding how an individual aspect of a CEO might be correlated to one generic outcome, it is difficult to generalize what types of resources would be best for a more specific set of CEO responsibilities.

To make establishing correct fit even more difficult, the responsibilities of a CEO can vary wildly and change on a day-to-day basis. While these variations are unique from company to company, there are common trends that can be seen in a NTBF. Research has shown one key shift in CEO responsibilities is the transition from a Founding CEO to a Professional CEO. This is a common occurrence in a NTBF where the firm will start out with a "Founding CEO" and as the firm grows and matures the role of CEO hits an inflection point where the CEO's duties dramatically change (Wasserman, 2003) at which point the CEO becomes, or is in many cases replaced by, a "Professional CEO" (Hellman & Puri, 2002). This research highlights the evolving demands on a CEO in a NTBF, and the changing capabilities a CEO must

have to be successful in meeting the firm's needs. Wasserman also noticed how the characteristics of Founding and Professional CEOs differed the in his analysis of each, he noted Professional CEO's typically differed from Founding CEOs in many ways such as age and level of experience than their professional counterparts (Wasserman, 2003). This transition from professional to founding CEOs represents a growth pattern akin to life cycle stages.

This paper looks at the attributes of the CEOs that have been shown to be beneficial to NTBF growth and attempts to show how looking at these through the lens of the NTBF lifecycle helps understand how the impact of these attributes change as the firm grows. We look specifically at the firm's growth through the stages of growth identified by Kazanjian in his four-stage model. This paper focuses on two major categories of attributes of CEOs: First: technical and industry depth, and second: business and startup breadth. We investigate how CEOs with deeper experience in these categories impact firm performance differently in each of Kazanjian's four identified stages. Better understanding this relationship builds on the existing research around CEO fit and extends it to help build a profile of the best resource for each of these unique stages of in a NTBF.

Attributes Impacting CEO Performance

Much of the research around CEO fit begins with TMT homogeneity and insider vs outsider fit for CEOs (Guthrie Datta & Deepak, 1997; Ensley & Hmieleski, 2005). While this research around fit can be immensely valuable in some situations, when investigating NTBFs these aspects lose some of their value. NTBFs TMTs typically consist of the founding partners. The founding partners are typically very

closely aligned and most commonly have worked together in previous roles and for the same companies (Audia & Rider, 2005). This makes the TMT homogenous in almost all early stage NTBFs. Also, as NTBFs make CEO transitions in their early stages it is rare they leverage insiders for CEO succession, for instance during the common transition from Founding CEO to Professional CEO, the Founding CEO is almost always replaced by an outsider (Hellman & Puri, 2002). These dynamics water down the usefulness of the significant research that has been done around heterogeneity of the TMT and insider vs outsider CEO succession when specifically looking at NTBFs.

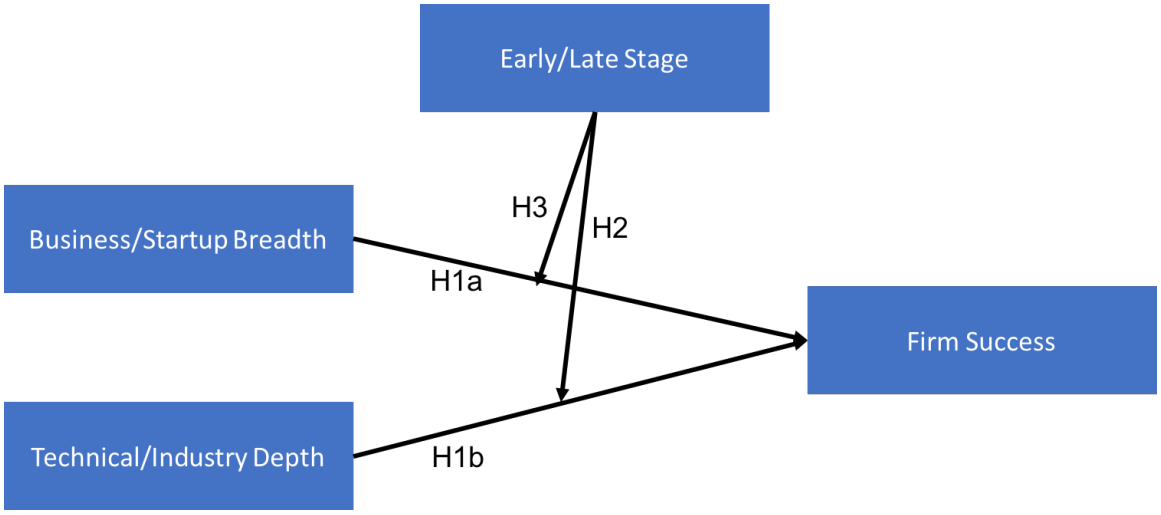
Looking deeper at indicators to help understand CEO fit in a NTBF, Hambrick and Mason provided an interesting summary of many of the different CEO attributes that have been studied as well as the specific outcomes they are correlated to. For example, CEO age is shown to have a negative correlation with willingness to take risks (Hambrick & Mason, 1994). Wiklund and Shepherd build on this framework identifying knowledge about: the industry, type of business and startups as the key areas of knowledge a CEO must possess in a NTBF (Wiklund & Shepherd, 2003). This is like West and Noel who point to: Industry, strategic and business knowledge, and experience and knowledge of new ventures as the attributes that are key to CEO success in a NTBF. West and Noel identify the balance between managerial and technical knowledge as a requirement for CEO success (West & Noel, 2009). In looking at these descriptions, in an attempt to synthesize these different concepts, two categories present themselves. Wiklund and Shepherd as well as West and Noel talk about attributes that are specific to a domain. They talk about understanding

what the business is trying do, for example understanding technologies and the industry itself, for simplicity this paper summarizes these attributes as technical and industry depth. Technical and Industry depth is meant to capture the set of attributes that focus on what a NTBF is trying to accomplish, including: prior experience in the industry, technical or engineering education, and previous roles in technology. Examples of CEO's fitting this mold could be Bill Gates or Mark Zuckerberg in the early stages of Microsoft and Facebook. Complementing technical and industry depth, the other attributes are less focused on what the company does and more on the company itself. These are attributes like managerial experience, business and start up experience. This paper refers to these as business and startup breadth. This is a much broader set of skills that can be represented by factors such as: formal business education, previous small company experience, previous founder experience, and previous roles in management functions. These attributes have little to do with what the company builds or does, but more about how the company and the resources within it function. Figure 2 shows a summary of these two concepts. Both Wiklund and Shepard as well as West and Noel identify that both sides of this coin, technical and industry depth as well business and startup breadth, are critical for CEO success, but it is intuitive to believe that the comparative blend of these skills could differ between different resources. The relative weighting of these capabilities is an area that has not been explored. This introduces the first hypothesis of this paper (Figure 7):

1a: CEO prior experience that has led to broad business/startup experience has a positive association with Firm Success

1b: CEO prior experience that has led to deep technical/industry experience has a positive association with Firm Success

Figure 7: CEO Background Hypothesis:



Changing Role of CEO Through Company Stages

As a NTBF grows the needs of the firm change, meaning the role the CEO needs to play changes. Looking at the stages and dominant problems identified by Kazanjian (Figure 1) it is easy to see the needs of the firm shift as they transition from:

- Conception and Development – In this stage the firm is focused on developing the concept that initially defines the firm. This stage is focused on development of the initial prototype or solution, securing funding and validating the market opportunity for the solution. In this stage, the firm is essentially building and materializing the initial business plan by ensuring technical feasibility, commercial potential and financial means for the firm.
- Commercialization – Here the firm shifts from proving the concept to selling a product. The firm's focus goes beyond development and begins to focus on

the full value chain required to bring a solution to market. This includes facilities, vendor networks, product support, and scale production. At this point a firm begins to have the beginnings of a formal structure and begins producing sales.

- Growth – At this point the firm begins to focus on volume and profitability. The firm begins to need to understand how to be able to produce more efficiently at scale and ensure that it is balancing immediate financial concerns with long term growth. At this point a firm develops a level of formality with a shift to more hierarchical management, professional management and functional specialization.
- Stability – At this point the market and firm growth rates begin to align. The firm's major focus is around protecting their growth and position in the market. At this point the firm begins to look for new opportunities for growth, whether from market expansion or second-generation innovations. At this point the firm is functioning as a mature firm, with increased bureaucracy, financial and operational governance models and in most cases a replacement of the initial management and founders with a professional management team.

As most NTBFs start, the initial leader of the firm is one of the founders, hence the term "Founding CEO". The Founding CEO, as well as the overall makeup of the founding team, has a huge impact on the overall direction of a firm. The Founding CEO in a way shapes the firm. In these early stages of the firm, the skills of these founders have a major impact on the direction of the NTBF itself including the

development of the firm's distinctive capabilities, which have been shown to be closely related to the skills and knowledge of the founder (Hodgson, 1998). This is because in the early stages of the firm, a NTBF must rely on founder knowledge as their core assets (Brush et al., 2001).

During these early stages a firm is focused on a set of specific functions, including the development of the initial product, search for funding for the NTBF and formation of the initial team (Wasserman, 2003). These activities the firm is going through dictate many of the attributes that enable a CEO to help the NTBF to be successful at this stage. It is not surprising to learn that a blend of skills is critical, as entrepreneurs need to wear many hats and are in most cases generalists (Lazear, 2004). Looking deeper at founders' skills and attributes, research has shown several attributes, including: specific industry experience, technical experience, as well as graduate education and prior entrepreneurial experience positively correlated with success, but on the contrary, generic industry experience and management experience of the founders was not correlated with success (Colombo & Grilli, 2005). Shrader and Siegel investigated the impact of technical experience of a CEO and learned it was negatively related to generic low-cost business models, but positively related to strategies focused on differentiation (Shrader & Siegel 2007). This dichotomy of technical experience helping drive differentiation strategies but hurting low cost models is very interesting with respect to NTBFs. In the early stages NTBFs are typically drivers of innovation and disruption, because of this the lion's share of NTBFs are pursuing a differentiation

strategy which would lead one to believe that for early stage NTBFs technical capabilities are going to be correlated success in these early stages.

All this research, as well as the activities a company is working through in the early stages of the firm, suggests it would be logical to believe that for CEOs in these early stages of an NTBF, technical and specific industry knowledge are critical skills for a NTBF leading to a higher likelihood of success. This introduces hypothesis two (Figure 7):

> *H2: The association between technical/industry depth and firm success is stronger when firms are in the earlier stages of a NTBF's lifecycle and weaker in later stages of the lifecycle.*

As the firm continues to grow it encounters new challenges, and the CEO job broadens and gets more complete as it entails all the aspects of building, selling, organization and marketing. This change can create a mismatch in CEO skill sets especially for firms with a technical oriented CEOs (Wasserman, 2003). This can create CEO turnover where the changing needs of the firm cause a changing need on CEO skills. CEO transitions, especially at the early stages of a firm can be an interesting window into the changing needs of a firm.

Trends can be seen in the timing of CEO turnover in NTBFs. Key events such as: the firm getting a new round of financing, and completion of product development can become key catalysts accounting for CEO turnover (Wasserman, 2003). Both of these represent critical points for a NTBF. A new round of financing gives the firm the capitol in many cases to invest in the next stage of their business

case. As the firm invests in these new activities the existing CEO may not have the capabilities required to help the firm achieve those goals. Also, with new financing comes a new voice in the TMT in many situations. Whether it is new board members, advisors, etc., those new voices may have ideas about the current management, or the potential for new management. Similarly, the completion of product development can be a major shift for a NTBF. It is at this point that the company shifts from building a product to delivering a customer solution that drives revenue. This shift can change the focus of the firm creating a natural catalyst for new CEO responsibilities. It's important to point out the conversion that occurs at this time is less about the current CEO being an inadequate resource, but more of them not being a "fit" for the CEO role. This is supported by the fact that 40% founding CEOs continue with the company beyond this point, just in a different capacity (Hellman & Puri, 2002).

As initial CEO transition occurs, and the capabilities change, the need for a strong technical background diminishes (Wasserman, 2003), but the increasing breadth of the role the CEO is asked to play points to a need to have an executive with a much broader skill set and compliment of capabilities. This shift shows a natural transition occurring in the needs of the firm and the attributes a CEO must have to drive firm growth. This points to shift where there is a reduced need for specific domain or technical skills and broad business skills become key for CEOs to drive continued growth for the firm. This leads to our third hypothesis (Figure 7):

H3: The association between business/startup breadth and firm success is stronger when firms are in the later stages of a NTBF's lifecycle and weaker in earlier stages of the lifecycle.

Methods for Study 2

To understand the differences in how firms' lifecycles impact the importance of CEO attributes, a field study was conducted, providing visibility into different points of time within 35 organizations using a survey for data collection (Appendix A). The use of a field study enabled this study to provide very rich data with strong internal validity, but, as is the risk in most qualitative research, this does provide the potential for lower generalizability (external validity) when compared to quantitative based methods (Trochim, 2006). These 35 organizations were either stand-alone technology firms or autonomous business units within larger technology firms, and all focused on computer hardware, web technologies, technical services or software. These were organizations where personal relationships previously existed, which provided access to executive management and CEOs. The information was provided by an executive, or former executive, as top managers have been shown to be able to provide reliable information about the functional, organizational and strategic attributes of a firm (Hrebiniak, Snow 1980; Mintzberg 1985). Each of these executives provided their point of view of the firm at two different points in time: when they started with the firm, and when they left the firm (or the current state if they were still with the firm). The survey questions covered information about the firm, about the objectives of the firm, success of the firm and leadership of the firm at each of these points in time. This information,

along with information correlated via LinkedIn, allowed for a data set that could be mapped to the variables in the model. An anonymized view of relevant parts of this information can be seen in Table 4.

Table 4: CEO Background Survey Results

Respondant Role	Type of Organization	Main Business	At Time of Starting with Org				Currently or at Time of Departure			
			Lifecycle Stage	CEO Business Startup Breath	CEO Tech/Industry Depth	Rating of Success (1-5, 5=most succesful)	Lifecycle Stage	CEO Business Startup Breath	CEO Tech/Industry Depth	Rating of Success (1-5, 5=most succesful)
Product Executive	Stand Alone	Software	1	1	2	2	2	3	0	5
CTO and Co-founder	Stand Alone	Software	1	1	2	1	3	3	0	4
Early Advisor	New Line of business	Software	1	3	3	1	3	3	1	3
R&D Executive	Stand Alone	Web Technologies	2	3	1	5	3	3	1	4
Co-founder	Stand Alone	Software	2	2	2	4	3	2	2	5
R&D Executive	Stand Alone	Software	2	2	2	5	3	2	2	4
Sales Executive	Stand Alone	Software	2	2	2	4	4	2	2	2
Sales Executive	Stand Alone	Software	2	3	0	3	4	3	0	4
Product Executive	Stand Alone	Software	3	3	0	5	4	3	0	4
Product Executive	Stand Alone	Other (HW+SW)	1	0	0	3	2	0	0	4
CEO/President	Stand Alone	Software	1	2	1	2	3	3	0	5
CIO	Stand Alone	Software	2	3	1	5	4	3	1	4
Senior Director - Consulting Services	Stand Alone	Software	2	1	4	2	1	1	4	1
Product Executive	Stand Alone	Software	2	NA	NA	4	4	NA	NA	4
Finance/Operations Exectutive	Stand Alone	Software	3	4	0	5	NA	4	0	
Product Executive	Stand Alone	Software	2	3	1	3	4	4	2	4
Marketing Executive	Stand Alone	Software	2	3	2	3	3	3	2	5
Marketing Executive	Stand Alone	Hardware	1	2	2	5	3	2	3	5
CTO	Stand Alone	Software	3	4	0	4	NA	4	0	
R&D Executive	Stand Alone	Software	1	2	3	2	3	2	3	4
Product Executive	Stand Alone	Software	2	1	2	3	4	4	0	4
Head of Global Talent Acquisition	Stand Alone	Software	1	2	0	3	3	2	0	5
CEO/President	Stand Alone	Web Technologies	3	3	0	2		3	0	3
CEO/President	Stand Alone	Software	3	NA	NA	2	4	4	0	4
Finance/Operations Executive	Stand Alone	Software	2	3	0	3	4	3	0	4
Sales Executive	Stand Alone	Software	1	4	1	2		4	1	
Product Executive	Stand Alone	Software	1	2	2	5	4	3	2	2
Product Executive	Stand Alone	Web Technologies	2	3	2	1	2	NA	NA	4
CEO/President	Stand Alone	Web Technologies	2	3	1	3	4	3	3	4
CEO/President	Stand Alone	Software	3	3	0	5	3	3	0	5
Product Executive	New Line of business	Software	3	4	0	3	3	2	1	3
Marketing Executive	Stand Alone	Software	1	3	3	3	3	1	2	1
Product Executive	Stand Alone	Software	1	4	0	4	3	4	0	4
R&D Executive	Stand Alone	Software	2	NA	NA	3	3	2	1	5
CEO/President	Stand Alone	Software	2	NA	NA	4	4	NA	NA	4

Lifecycle Stage Identification

Respondents to the survey were asked questions that allowed them to self-identify into a lifecycle stage for the firm at both the time they started with, as well as the when they departed from, the firm. This method of self-identification is supported via Kazanjian's model of identifying lifecycle stage through self-identification (Kazanjian, Drazin 1989) where managers are asked to select one of four categories with descriptions that are used to identify their stage. Given the

limited differences between Kazanjian's first two stages: Conception & Development and Commercialization, as well as the latter two stages: Growth and Stability, these were merged together creating just two lifecycle stages: Early and Late stage. This simplification as has also been done in previous studies (Kazanjian, Drazin 1989; Koberg 1996).

CEO Background

In the survey respondents were asked to provide the name of the CEO when they started with the firm as well as when they left the firm. Each CEO was researched via LinkedIn to capture their background and that information was used to evaluate CEO background. The LinkedIn information for each CEO was used to calculate a rating between 0-4 for both Industry/technical depth and business/startup breadth. The rating reflects their scholastic and work history. To calculate these scores, eight categories were assessed for each CEO, if the CEO had a background that demonstrated that category they received 1 point towards their rating. The categories were:

- Technical/Industry Depth: Technical undergraduate degree, Technical Masters degree, Previous role as an engineer, architect, CTO, or VP of R&D, previous experience at a company in the same industry.
- Business/Startup Breadth: Business undergraduate degree, MBA, Previous role as CEO, COO, SVP or General Manager, Previous experience with a small private firm

This resulted in scores for both Technical/Industry Depth as well as Business/Startup Breath for each CEO.

Measuring Firm Success

Firm success for the purposes of this study is success w/r/t the firms' internal objectives during that time period. As part of the survey, each executive was asked to rate overall firm/BU performance against the firm's objectives at the time they started with the firm and when they left the firm. Each respondent rated the firm's success against it's objectives on a 5 point scale ranging from Very Successful to Very Unsuccessful. This provide a relative point of view on how successful the firm was in each time period.

Analysis of Data

Each respondent providing two independent views from different times at the firm resulted in two unique data points from each survey for each firm. In most cases each data point represented a different lifecycle stage, different view of success and a different CEO with a unique background. Given the uniqueness of each of these responses, each response was treated as an individual sample, resulting in an N of 68 (two responses instances were not included due to lack of information).

The small sample size within this study (N = 68) provided some limitations to methods that would be applicable for analysis. Partial Least Squares (PLS) modeling has been shown to be effective in situations with smaller sample sizes, with as few as 10 cases per predictor having been shown to provide a sufficient sample for analysis (Barclay et al, 1995; Chin, 1998). With three predictors, an N of 30 would be acceptable under these conditions. Because of this, PLS analysis with bootstrapping was the analysis method chosen. It is important to mention that

there are some questions as to whether PLS can effectively provide analysis at these small sample sizes where other techniques such as regression are not applicable (Goodhue, et al, 2012). The results section notes some relationships that did not provide significant results which could have been impacted by this sample size, even with the use of PLS.

Four control variables were also included in the analysis, these were: the amount of sales at the time of the analysis, number of people working for the firm at that time, the industry they were involved, and funding source. These were all gathered directly from the survey, industry and funding source were simplified for purposes of this analysis to Software vs other industries, and Venture Capital funded vs other sources, respectively, due to the lack of variation in the survey responses.

Results of Study 2

The PLS analysis of the data (Figure 8) provided some, but fewer than expected, significant relationships between the independent variables, as well as the moderators, and the firms' success (Table 5). This lack of significance could be due, in a some part, to the small sample size, but it would require further research to confirm this.

When investigating the relationship between Business/Startup Experience and Technical/Industry Experience of the CEO and firm success, a significant relationship was demonstrated between Technical/Industry Experience and firm success (p-value = 0.019). In this study we used a p-value of .05 as the alpha protection level to determine significance, as is common in the social sciences; this result was well below the .05 significance level. But while this was demonstrated as

significant, the path coefficient of -0.305 shows this relationship, while significant, is the opposite of what was expected. This means that in this situation, as CEO's Technical/Industry experience grows, the chances of the CEO being successful decreases. To limit the chances of a mechanical issue causing this, a Spearman rank order correlation test was used which supported the inverse relationship that was seen in the PLS Analysis (Figure 9). This invalidates Hypothesis 1b.

Figure 8: PLS Path Model of CEO Background

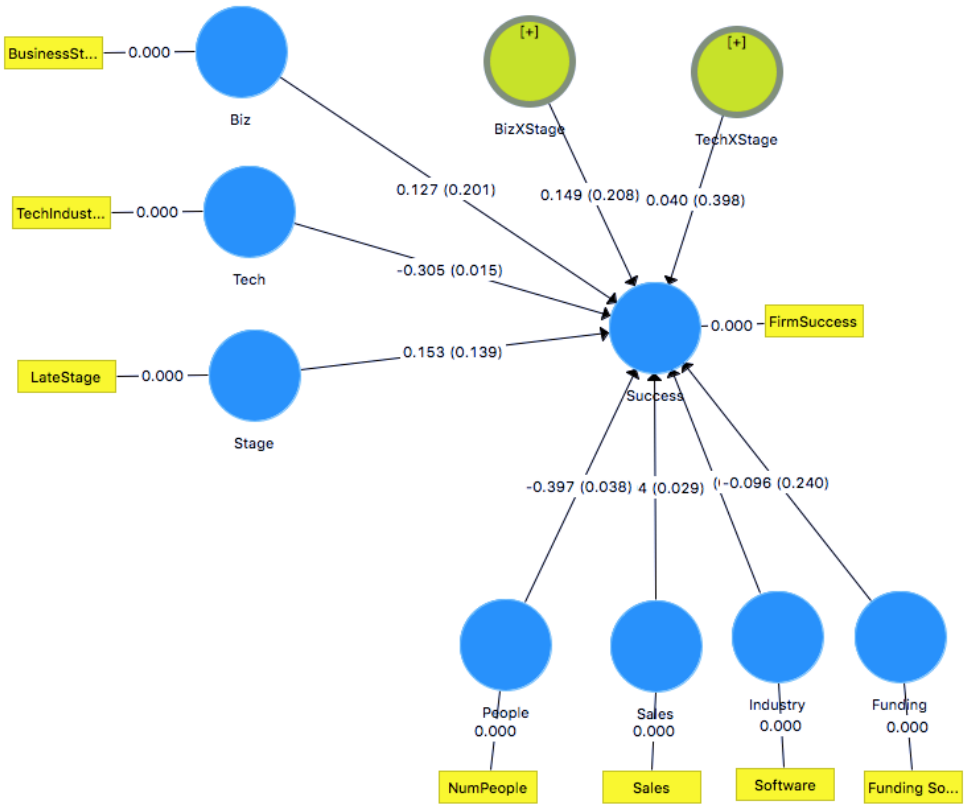


Table 5: PLS Analysis Of CEO Background

Variable	Path Coefficient	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Incremental R Squared
Relationship with Firm Success						
Biz	0.127	2.629	1.035	0.863	0.201	0.015
Tech	-0.305	1.129	1.157	2.081	0.015	0.072
Moderators						
BizXStage	0.149	NA	NA	0.829	0.208	NA
TechXStage	0.040	NA	NA	0.289	0.398	NA

Figure 9: Spearman Correlation Test of CEO Background

Correlations

			FirmSuccess	TechIndustry Depth
Spearman's rho	FirmSuccess	Correlation Coefficient	1.000	-.139
		Sig. (1-tailed)	.	.130
		N	68	68
	TechIndustryDepth	Correlation Coefficient	-.139	1.000
		Sig. (1-tailed)	.130	.
		N	68	68

When investigating the relationship between Business/Startup Experience and Technical/Industry Experience of the CEO and firm success, a significant relationship was demonstrated between Technical/Industry Experience and firm success (p-value = 0.019). In this study we used a p-value of .05 as the alpha protection level to determine significance, as is common in the social sciences; this result was well below the .05 significance level. But while this was demonstrated as significant, the path coefficient of -0.305 shows this relationship, while significant, is the opposite of what was expected. This means that in this situation, as CEO's Technical/Industry experience grows, the chances of the CEO being successful decreases. To limit the chances of a mechanical issue causing this, a Spearman rank

order correlation test was used which supported the inverse relationship that was seen in the PLS Analysis (Figure 8). This invalidates Hypothesis 1b.

Along with this major difference, when looking at relationship of business/startup breadth and success, with a p-value of 0.195 we failed to show a significant relationship, making it unable to confirm Hypothesis 1a. Leveraging sample size calculators via Daniel Soper (www.danielsoper.com) we expected this analysis to require 23 samples to achieve a power of .8 and an effect size of .5, as this has been shown sufficient in other research (Guo et. al., 2014). The resulting n of 68, and the observed R^2 in this analysis of .269 provided an observed statistical power of .96. This sufficiently high power, above .80, makes it unlikely that a Type II error is occurring (Cohen, 1998), assuming this data is representative of the general population. Given the single survey approach to this, correlation across variables was tested and the resulting VIF for all relationships was below 3.3 demonstrating sufficient independence across variables (Table 6). The effect size (F^2) of each of these relationships was also small (Table 7), but the effect of Technical/Industry Depth (F^2 = .098) was almost four times the effect of Business/Startup Breadth (F^2 = .021). This is an interesting result as it indicates that the level of technical/industry experience and training has significant influence on the ability for the firm to succeed at that time, but former business/startup experience of the CEO, did not show a significant relationship with success and explained very little of the variability in firm success.

Table 6: CEO Background Collinearity Test (VIF)

Independent Variable	Biz/Start	Tech/Ind	Stage	Success
Biz/Start	0.000	1.047	1.146	1.158
Tech/Ind	1.119	0.000	1.240	1.142
Stage	1.039	1.052	0.000	1.022
Success	1.153	1.064	1.124	0.000

Table 7: Effect Size of CEO Attributes Impact on Firm Success

Models Compared				Change in R Squared	Effect Size	
Full Model	Partial (Nested) Model	Full R Sq	Partial R2			
Biz, Tech -> Success	Biz-> Success	0.269	0.197	0.072	0.098	small
Biz, Tech -> Success	Tech -> Success	0.269	0.254	0.015	0.021	small

The results continue to become interesting when looking at the moderating effects of lifecycle stage. Analysis showed that stage did not have a significant moderating impact on the relationship between the success of the firm and the technical/industry experience of the CEO (p-value 0.386), lacking support for Hypothesis 2 which indicated the relationship between success and technical/industry experience of the CEO is stronger for early stage firms than late stage firms. In this data set, a positive t-value (T=.289) was also shown, representing that the variable Late Stage had an insignificant but positive moderating impact on the relationship between Technical/industry CEO experience and firm success meaning that technical/industry experience of the CEO is actually more important for late stage firms which is in direct conflict with Hypothesis 2 which thought this would be more important for early stage firms. Given these results, it is hard to envision that the same tests, even at larger sample sizes, would provide results supporting hypothesis 2.

When looking Hypothesis 3, where it was predicted that the relationship between Business/Startup experience of the CEO and firm success would be stronger in late stage companies, this again provided insignificant results (p-value 0.204) resulting in a lack of support for Hypothesis 3. Although there was significant power in this study, there is still questions if this sample was representative of the population. Given the limited number of firms involved in this research and the challenges around external validity of this type of study, this could warrant additional testing in a larger data set.

To help rule out mechanical issues that may skew results a nested approach as taken to add each variable one by one to see if any results significantly differed from one another, but in all tested provided similar results (Table 9) limiting the chance for any mechanical issue due to the variables. Sample size is a possible explanation for some of the lack of significance in these results, given this there is value in testing many of these relationship, especially Hypothesis 1a and 3, with a larger data set. Along with sample size there could be some impacts of the simplistic measurement leveraged in this study to capture CEO background. To investigate this further a quick analysis was done looking at the attributes that were captured to determine CEO background, breaking these down to a more granular level – specifically with the lens of experience vs education. To provide a more granular view, 4 scores were established for each CEO, one for: Business/Startup Experience (focusing on the professional experience of the CEO), Business/Startup Education (focusing on the undergraduate and graduate attributes), as well as Technical/Industry Experience and Education. A quick analysis (Figure 10, Table 8)

of this showed significant variation in the moderating impacts of Business Education (p-value = 0.095) and Business Experience (p-value 0.448). This helps demonstrate the different lenses that could be put on CEO background which may have a material impact on the significance of these moderating effects.

Table 8: PLS Analysis of CEO Background Experience Vs Education

Variables	Path Coefficients	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Relationship with Firm Success					
BizEd	-0.150	0.716	0.147	1.022	0.154
BizExp	0.274	0.616	0.227	1.203	0.115
TechEd	-0.116	1.157	0.207	0.560	0.288
TechExp	-0.221	0.782	0.223	0.991	0.161
Moderators					
BizEdXStage	0.219	NA	NA	1.315	0.095
BizExpXStage	-0.036	NA	NA	0.131	0.448
TechEdXStage	0.162	NA	NA	0.780	0.218
TechExpXStage	-0.017	NA	NA	0.086	0.466

Figure 10: PLS Path Model for CEO Experience Vs Education

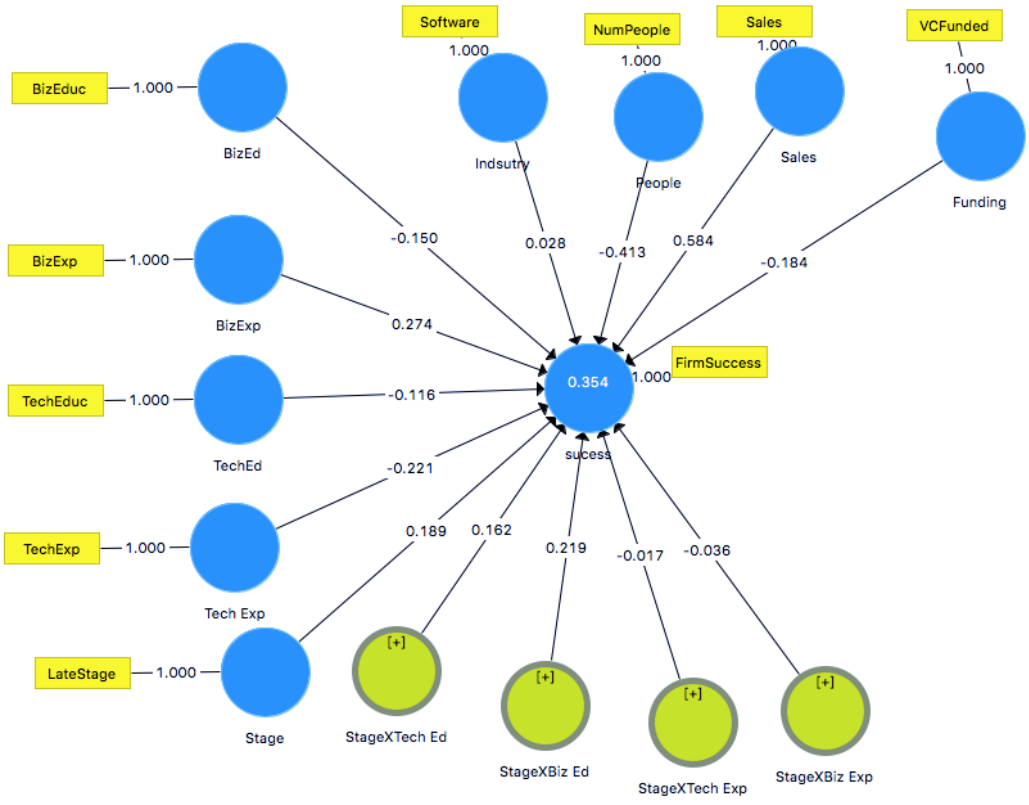


Table 9: Survey Data on Innovation And Determinants Of Innovation

	Single Independent Variable Alone		Both Independent Variables Together		Both Independent Variables and Stage Moderators	
	Path Coefficient	p value	Path Coefficient	p value	Path Coefficient	p value
Tech/Ind	-0.325	0.006	-0.299	0.009	-0.273	0.006
Biz/Startup	0.18	0.052	0.075	0.249	0.092	0.282

Conclusion and Areas for Additional Research Based on Study 2

The results of this analysis concluded a single significant relationship between technical/industry experience of CEOs and firm success but it was the opposite impact than had been expected, challenging Hypothesis 1B. We also failed to show a significant relationship between Business/Startup Experience and Firm Success (Hypothesis 1A) and the moderating impact of a firm's lifecycle stage on either of these relationships (Hypotheses 2 and 3). As discussed in the analysis section, for Hypothesis 1A and 2 there was some association demonstrated, but this association failed to be significant. These results lead to an indication that for technology firms looking at CEO candidates, they should expect an increased likelihood of success when the CEO has demonstrable technical or industry experience, but they should not expect significant differences in candidates who possess business or start up experience or education. This would hold true for technology firms of all stages.

While this was true in this study, it was understood at the start that the sample size would provide limitations on the analysis techniques and possible the quality of the analysis that could be done in this study. It would be interesting to

investigate this with a larger sample size to see if more of these relationships become significant. This would also open up the analysis to other types of statistical analysis which may provide different results than the PLS analysis conducted in this study.

Another potential area for additional research would be to test these hypotheses with different lenses on CEO background. The metrics covered here provided a simplistic view on the background of CEOs via what was available in LinkedIn. Doing direct research via surveys or interviews with CEOs could provide a much more comprehensive view of their background. A more thorough understanding of CEO background could provide more dexterity in the model and potentially show different relationships that may not have been evident in this study.

Continued research and a more comprehensive understanding of these relationships could continue to further the research of how different CEO backgrounds can drive improved firm performance for NTBFs.

CHAPTER 4

STUDY 3: INNOVATING BASED ON STAGE: ALIGNING INNOVATION PRACTICES WITH LIFECYCLE STAGE

Abstract

Innovation is the lifeblood of all organizations, but especially for NTBFs. NTBFs have been shown to innovate faster than their traditional counterparts and be more reliant on that innovation to drive differentiation (Rothwell, Zegveld 1982; Carter et al 1994). There has been research around many aspects of innovation ranging from adoption of innovation (Damanpour, Schneider 2006) to converting innovative ideas into currency for the business (Van de Ven, 1986) most of which has the end goal of finding ways to drive more consistency in firms' attempts to drive, sustain and utilize innovation in their organizations. While the research has been significant around innovation, the reality is while companies have invested heavily in innovation, the percentage of ideas that successfully emerge from the innovation pipeline is miniscule (Stevens, Burley, 1997). Similarly, while there has been a significant amount of research dedicated to innovation the results have led to some very critical reactions regarding the variations in the data and the lack of ability to make any firm conclusions or interpretations based on this research (Downs, Mohr, 1976). One area that could account for some of this variation is the lack of consideration of lifecycle stage in innovation research. Several researchers have articulated the likely impact of lifecycle stages on innovation practices (Van de Ven, 1986; Walsh and Dewar, 1987) but there has been very little research which

has taken this into account. Koberg leveraged Kazanjian's model to test several heavily researched areas of innovation to understand if the relationships between different variables and innovation changed for firms in different stages of the organizational lifecycles and concluded that the lifecycle stage of the firm had a demonstrable impact on these relationships (Koberg, 1996). Koberg concluded that "researchers that present results of studies without considering the life-cycle stage of the firm as a potential moderating variable hide important differences". This paper looks to expand on Koberg's research to apply the lens of lifecycle stage to a broader set of drivers of innovation. We will look at the thirteen specific drivers of innovation, as outlined by Damanpour in his meta-analysis of the determinants and moderators of innovation (Damanpour, 1991) to understand how the effect of each of these change across different stages of a NTBF's lifecycle leveraging Kazanjian's model.

Innovation in NTBFs

Innovation is a very broad topic with multiple definitions. Van de Ven defines innovation as "the development and implementation of new ideas by people who overtime engage in transactions with others within an institutional context" (Van de Ven 1986). This definition highlights four basic concepts in understanding innovation: ideas, people, transactions and context. Damanpour provides a slightly narrower definition, more focused on the required adoption of that idea and the result of a new product or service (Damanpour, 1991). While the definitions of innovation can differ slightly, there is no dispute on the necessity for firms to innovate as reflected in the common saying "Innovate or die". But innovation has

proven to be difficult. It has been shown to take 3,000 ideas to create one successful innovation and that "less than 1% of patent disclosures represent 'crown jewels' with major commercial significance" (Stevens, Burley 1997). This high importance combined with a low success rate has caused a major focus, both academically and in practice, to understand how to drive more effective innovation with fewer "failures".

As practitioners and theorists have dug into innovation the results have been mixed. Not only is innovation hard to define, it comes in different forms and it relies on diffusion to be adopted, making it hard to measure. This has caused a wide variety of research on the topic with mixed results that have in many cases contradicted one another creating a major problem of instability in innovation research (Downs, Mohr 1976). Downs and Mohr looked at this perceived instability and pointed to four main challenges driving that instability:

- Variation among primary attributes: Primary attributes are the attributes which are "essential to the object or substance and so are inherent in it". These attributes don't fluctuate based on size or market providing a more stable and consistent definition across firms. If all research did in fact leverage primary attributes any variation would a sign of instability, but if in many cases research has leveraged secondary attributes and treated them as primary attributes thus instability may be explainable.
- Interaction: As multiple secondary attributes are looked at for a single innovation these secondary attributes can be looked at as moderators for that innovation. In cases, like most, where it is not only one of these

attributes being evaluated but instead many, the interaction model must be understood between these difference attributes.

- Ecological Influences: The dependent variable in studies of innovation can also be a challenge. There can be significant variations of what "good" means for any specific independent variable across firms, industries, sizes of firms etc. For example, dependent variables such as number of patents or profitability can take on very different definitions across organizations, this can create an ecological bias that can result in perceived instability.
- Varying Operationalizations of Innovation: Lastly, most measurements of innovation success rely not only on a concept emerging, but that concept having some level of an impact. To have an impact, and especially to have a significant impact, relies on adoption of that innovation. This process of measuring innovation in a way that mixes the process of innovating and the adoption of innovation is another major source of instability.

When looking at these sources of instability it is interesting to evaluate how a firm lifecycle can potentially capture several of the sources of this instability. Lifecycle itself can represent a secondary attribute but also inherently impacts several others, such as impact of existing customer base, company size, and centralization of decision making. Ecological influences and the variation of operationalization could also be reduced by limiting scope to firms within a specific area of the lifecycle as they are dealing with the same dominant problems and therefore have more alignment in goals. This begins to point to the potential that lifecycle stage could

potential limit the instability and serve as an important moderator to innovation research.

Impact of Lifecycle on Drivers of Innovation

There has been substantial research on the different determinants and moderators of innovation. This research has some commonality and differences. To rationalize these different views Damanpour consolidated these determinants and moderators in his 1991 meta-analysis resulting in 13 determinants, 10 of which proved statistically significant through empirical testing, and 4 moderators to innovation, each of which were shown to be empirically significant strengthening the relationships between the determent and the impact on innovation (Damanpour, 1991). The results of Damanpour's study can be seen in Figure 11, but the determinants and moderators found to be statistically significant can be summarized as:

Determinants

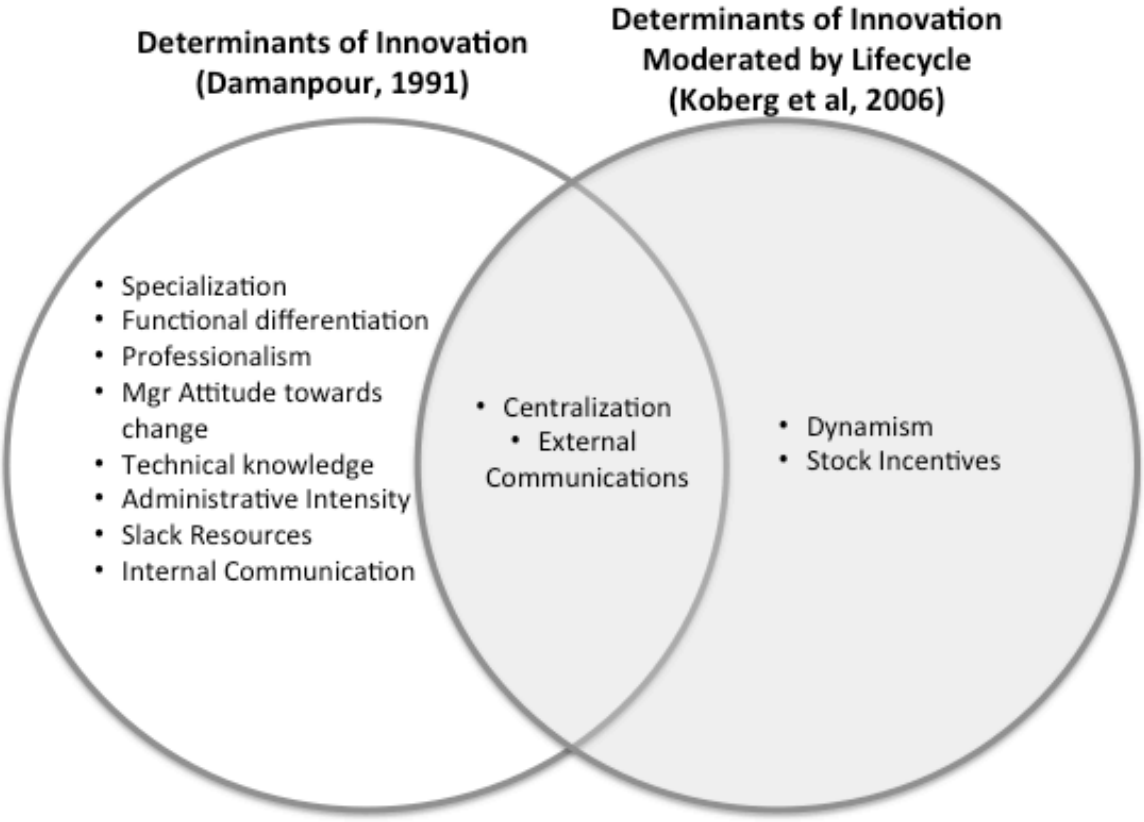
- Specialization – An increase in the amount of specialist resources has a positive correlation with innovativeness
- Functional Differentiation – Resources with functionally diverse backgrounds working as coalitions have a positive correlation with innovativeness
- Professionalism – The number of professional resources within a firm has a positive correlation with innovativeness
- Centralization – Centralization of decision making has a negative correlation with innovativeness

- Managerial attitude towards change – Managers more open to driving change have a positive correlation with innovativeness
- Technical knowledge of resources – Greater technical knowledge of resources has a positive correlation with innovativeness
- Administrative Intensity – Greater reliance on managers as organizational leaders has a positive correlation with innovativeness
- Slack resources – The amount of slack resources within a firm has a positive relationship with innovativeness
- External communication – The relationship the firm has with the larger external community has a positive relationship with innovativeness
- Internal communications - Increased abilities to disseminate information internally has a positive relationship with innovativeness

Moderators

- Organizational Type
- Type of Innovation
- Stage of Adoption
- Scope of innovation

Figure 11: Determinants of Innovation



Of these determinants and moderators, it is interesting to consider how a firm's lifecycle may be captured in this model. Firms within a specific stage of a lifecycle may have more commonality across these determinants. For example, based on Kazanjian's lifecycle model, companies in the commercialization stage have limited formality and will therefore have low administrative intensity by definition. Also, when looking at the moderators, Organization Type becomes interesting, as one could question if a single organization can represent a different type throughout its lifecycle? Several have theorized that the relationship between lifecycle stage and the determinants and moderators of innovation do exist and impacts on innovativeness are moderated by firm lifecycles (Ven de Van 1986; Walsh, Dewar

1987), but there has been very limited empirical evidence to support this. Koberg et. al. provided the first empirical support of this theory in 1996, but this was very limited to understanding lifecycle impact on 3 individual determinants of innovation: Environment (Resource & Dynamism), Information Processing (Scanning & Analysis), and Structure (Formalization, Centralization, and Stock Incentives) (Koberg et al 1996). While this is critical in demonstrating the relationship, it does not cover the full set of determinants demonstrated by Damanpour's meta-analysis (Figure 12) and without that analytic support you are unable to make the assumption that lifecycle stage does moderate these other determinants. This paper aims to extend the existing research by showing that (Figure 12):

H1: A NTBF's lifecycle stage has a moderating impact on the association between resource specialization and firm innovativeness

H2: A NTBF's lifecycle stage has a moderating impact on the association between functional differentiation and firm innovativeness

H3: A NTBF's lifecycle stage has a moderating impact on the association between professionalism and firm innovativeness

H4: A NTBF's lifecycle stage has a moderating impact on the association between Managerial Attitude towards Change and firm innovativeness

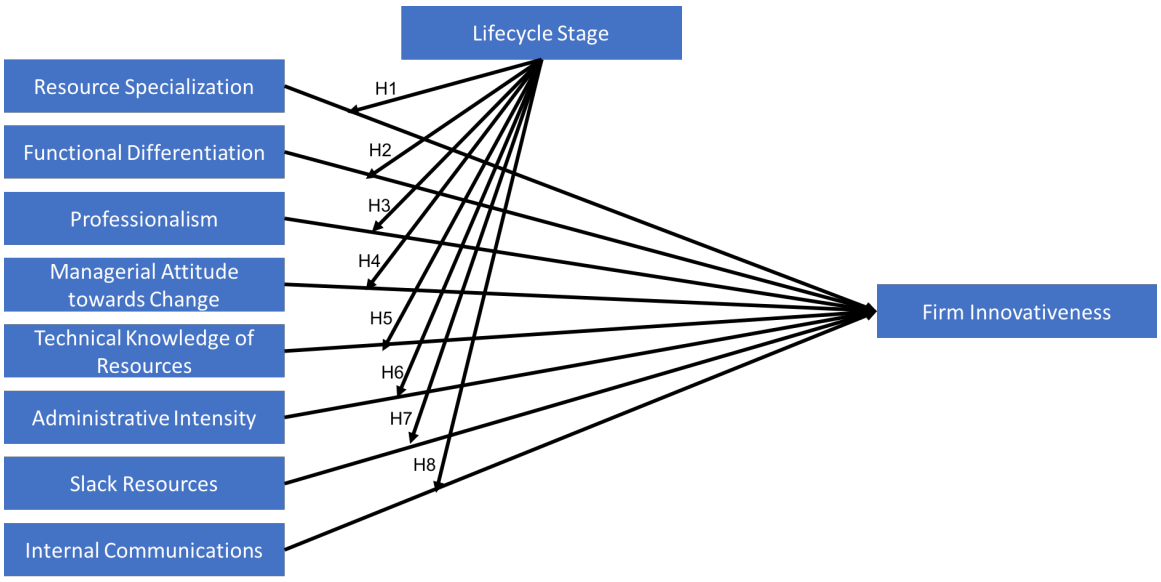
H5: A NTBF's lifecycle stage has a moderating impact on the association between technical knowledge of resources and firm innovativeness

H6: A NTBF's lifecycle stage has a moderating impact on the association between Administrative Intensity and firm innovativeness

H7: A NTBF's lifecycle stage has a moderating impact on the association between Slack Resources and firm innovativeness

H8: A NTBF's lifecycle stage has a moderating impact on the association between Internal communications and firm innovativeness

Figure 12: Determinants of Innovation Hypothesis



Methods for Study 3

To understand the differences in how firms' lifecycle impact the importance of determinants of innovation a field study was conducted looking at two different points of time within 35 organizations, data for which was collected via a survey (Appendix A). The use of a field study enabled very rich data with strong internal validity, but, as is the risk in most qualitative research, this does provide the potential for lower generalizability (external validity) when compared to quantitative based methods (Trochim, 1996). These 35 organizations were either

stand-alone technology firms or autonomous business units within larger technology firms, and all focused-on computer hardware or software. Personal relationships existed in each of these firms which provided access to executive management and CEOs. The information was provided by an executive, or former executive, as top managers have been shown to be able to provide reliable information about the functional, organizational and strategic attributes of a firm (Hrebiniak, Snow 1980; Mintzberg 1985). Each of these executives provided their point of view on the firm at two different points in time, when they started with the firm, and when they left the firm (or the current state if they have not left). The survey questions covered information about the firm, about the objectives of the firm, innovativeness of the firm and the individual determinants of innovation at the firm at each of these points in time. This information provided a view of each of the determinants of innovation, the lifecycle stage, and then innovativeness of the firm at each of these points in time (a summary of which can be seen in Table 10).

Lifecycle Stage Identification

Respondents to the survey were asked questions that allowed them to self-identify into a lifecycle stage of the firm at both the time they started as well as when they departed the firm. This method of self-identification is supported via Kazanjian's model of identifying lifecycle stage through self-identification (Kazanjian, Drazin 1989) where managers were asked to select one of four categories with descriptions that are used to identify their stage. Given the limited differences between Kazanjian's first two stages: Conception & Development and Commercialization as well as the latter two stages: Growth and Stability, these were

merged together creating just two lifecycle stages: Early and Late stage (Kazanjian, Drazin 1989; Koberg 1996).

Measuring Determinants of Innovation

To measure each of the 8 variables previously shown as determinants of innovation (Damanpour, 1991) a specific question was asked in the survey asking the respondent to provide a measurement of each variable for both the time they started with the firm and when they left the firm. For each variable the respondent was asked if they agreed with, or disagreed with, a statement regarding the presence of that determinant of innovation at that specific time. Respondents expressed their level of agreement/disagreement on a five-point scale providing a numeric rating for each of the determinants of innovation.

Table 10: Survey Data on Innovation And Determinants Of Innovation

Respondant Role	Type of Organization	Main Business	At Time of Starting with Org				Currently or at Time of Departure			
			Lifecycle Stage	CEO Business Startup Breath	CEO Tech/Industry Depth	Rating of Success (1-5, 5=most succesful)	Lifecycle Stage	CEO Business Startup Breath	CEO Tech/Industry Depth	Rating of Success (1-5, 5=most succesful)
Product Executive	Stand Alone	Software	1	1	2	2	2	3	0	5
CTO and Co-founder	Stand Alone	Software	1	1	2	1	3	3	0	4
Early Advisor	New Line of business	Software	1	3	3	1	3	3	1	3
R&D Executive	Stand Alone	Web Technologies	2	3	1	5	3	3	1	4
Co-founder	Stand Alone	Software	2	2	2	4	3	2	2	5
R&D Executive	Stand Alone	Software	2	2	2	5	3	2	2	4
Sales Executive	Stand Alone	Software	2	2	2	4	4	2	2	2
Sales Executive	Stand Alone	Software	2	3	0	3	4	3	0	4
Product Executive	Stand Alone	Software	3	3	0	5	4	3	0	4
Product Executive	Stand Alone	Other (HW+SW)	1	0	0	3	2	0	0	4
CEO/President	Stand Alone	Software	1	2	1	2	3	3	0	5
CIO	Stand Alone	Software	2	3	1	5	4	3	1	4
Senior Director - Consulting Services	Stand Alone	Software	2	1	4	2	1	1	4	1
Product Executive	Stand Alone	Software	2	NA	NA	4	4	NA	NA	4
Finance/Operations Exectutive	Stand Alone	Software	3	4	0	5	NA	4	0	
Product Executive	Stand Alone	Software	2	3	1	3	4	4	2	4
Marketing Executive	Stand Alone	Software	2	3	2	3	3	3	2	5
Marketing Executive	Stand Alone	Hardware	1	2	2	5	3	2	3	5
CTO	Stand Alone	Software	3	4	0	4	NA	4	0	
R&D Executive	Stand Alone	Software	1	2	3	2	3	2	3	4
Product Executive	Stand Alone	Software	2	1	2	3	4	4	0	4
Head of Global Talent Acquisition	Stand Alone	Software	1	2	0	3	3	2	0	5
CEO/President	Stand Alone	Web Technologies	3	3	0	2		3	0	3
CEO/President	Stand Alone	Software	3	NA	NA	2	4	4	0	4
Finance/Operations Executive	Stand Alone	Software	2	3	0	3	4	3	0	4
Sales Executive	Stand Alone	Software	1	4	1	2		4	1	
Product Executive	Stand Alone	Software	1	2	2	5	4	3	2	2
Product Executive	Stand Alone	Web Technologies	2	3	2	1	2	NA	NA	4
CEO/President	Stand Alone	Web Technologies	2	3	1	3	4	3	3	4
CEO/President	Stand Alone	Software	3	3	0	5	3	3	0	5
Product Executive	New Line of business	Software	3	4	0	3	3	2	1	3
Marketing Executive	Stand Alone	Software	1	3	3	3	3	1	2	1
Product Executive	Stand Alone	Software	1	4	0	4	3	4	0	4
R&D Executive	Stand Alone	Software	2	NA	NA	3	3	2	1	5
CEO/President	Stand Alone	Software	2	NA	NA	4	4	NA	NA	4

Measuring Firm Innovativeness

A series of three paired statements about firm innovativeness characteristics were provided for respondents to choose which best fit the firm at both the time they started with the firm and when they left the firm. Respondents assessed these statements on a 5-point scale, which was then used to provide visibility into firm innovativeness. This method is based on the work of Miller and Friesen (1982) and has also been leveraged and validated by several more other studies (Khan, Manopichetwattana 1989; Jennings, Young 1990; Koberg 1996). As was done in those studies, these three independent views were averaged providing a singular rating for each sample representing the innovativeness of the firm at each of the given times which the respondent was evaluating.

Analysis of Data

With each respondent providing two separate views from independent times with the firm the sample resulted in two unique views of the firm, which, in most cases, represented different levels of innovativeness, different lifecycle phases and different views the determinants of innovation. Given the uniqueness of each of these responses, each response was treated as an independent sample resulting in an N of 68 (two responses instances were not included due to lack of information).

The small sample size within this study (N=68) provided some limitations to methods that would be applicable for analysis. Partial Least Squares (PLS) modeling has been shown to be effective in solutions with smaller data sets, with as

few as 10 cases per predictor having been shown to provide a sufficient sample for analysis (Barclay et al, 1995; Chin, 1998). Which would imply and N of 80 would be sufficient given the 8 predictors in this model, this is larger than the N of 68, possibly pushing the limits of PLS analysis. Due to this, PLS analysis with bootstrapping was the analysis method chosen. It is important to mention that there is some question in the research community if PLS can effectively provide analysis at these small sample sizes when other techniques such as regression are not applicable (Goodhue, et al, 2012). In the results section we will talk about some relationships that did not provide significant results which could have been impacted by this sample size, even with the use of PLS.

Results of Study 3

There was a wide variation across many of the expected and hypothesized relationships investigated in this study. Several of the relationships seen in this study challenged previous research, providing results possibly questioning previous research or possibly highlighting the deficiencies of the sample set used in this analysis.

The PLS analysis (Figure 13) indicated the moderating impact of stage did show a significant impact on the relationship between Internal Communications and firm innovativeness, with a p-value of 0.028, confirming Hypothesis 8 (Table 11). This indicates that the impact of internal communication on firm innovativeness is stronger for late stage firms than it is for early stage firms. This is logical as early stage firms will typically be smaller, and have informal commination processes, but

as a company grows, if it fails to establish solid internal communication processes it can be an inhibitor to firm innovativeness.

Figure 13: PLS Model for Determinants Of Innovation And Moderations Of Stage

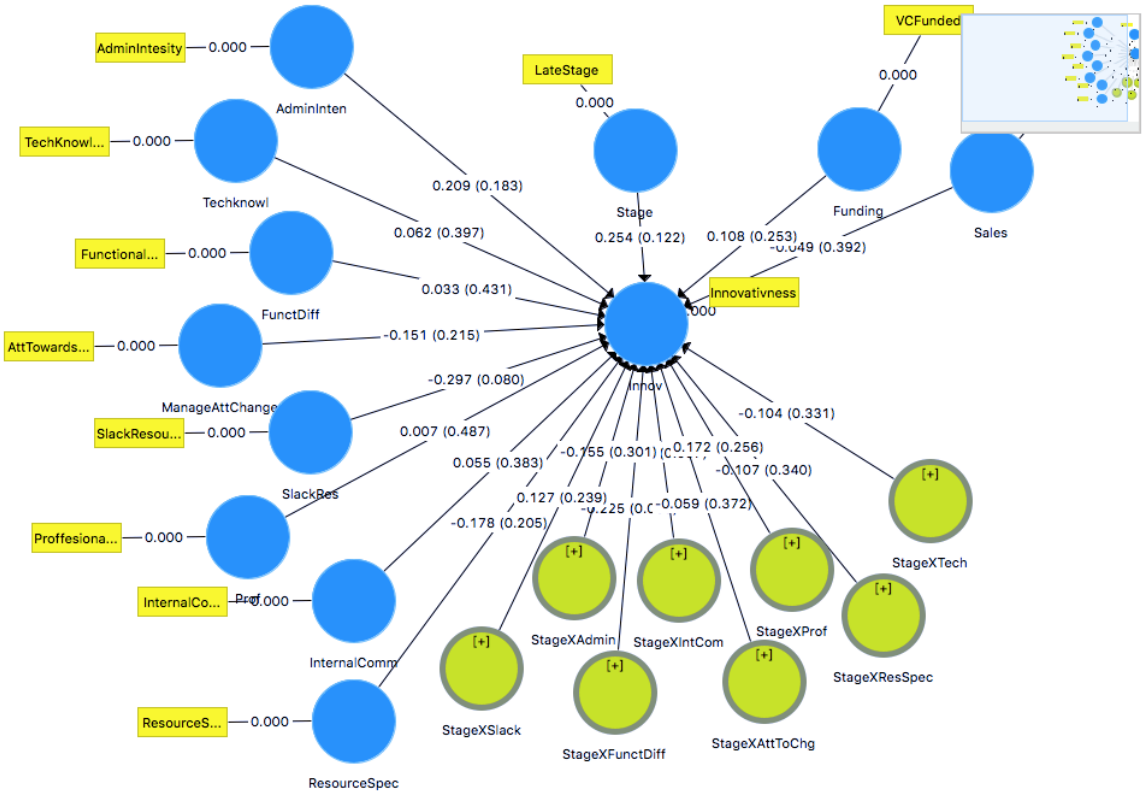


Table 11: PLS Analysis Determinants Of Innovation And Stage Moderators

Variable	Path Coefficients	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Incremental R Squared
Determinants of Innovation						
Admin Inten	0.197	2.463	1.201	0.841	0.201	0.021
Funct Diff	0.037	2.985	1.064	0.212	0.416	0.035
Internal Comm	0.098	3.324	1.181	0.609	0.272	0.035
Managerial Att Change	-0.195	3.118	1.289	1.081	0.140	0.011
Prof	0.022	2.456	1.169	0.089	0.465	0.012
Resource Spec	-0.211	3.265	1.106	1.027	0.153	0.013
Slack Res	-0.324	2.382	1.058	1.916	0.028	0.073
Tech Knowl	0.049	3.603	1.059	0.256	0.396	0.012
Stage Moderation						
Stage X Admin	-0.177	NA	NA	0.729	0.233	NA
Stage X Att To Change	-0.067	NA	NA	0.363	0.359	NA
Stage X Funct Diff	-0.224	NA	NA	1.264	0.104	NA
Stage X Int Com	0.310	NA	NA	1.923	0.028	NA
Stage X Prof	0.167	NA	NA	0.736	0.231	NA
Stage X Res Spec	-0.103	NA	NA	0.443	0.329	NA
Stage X Slack	0.108	NA	NA	0.657	0.256	NA
Stage X Tech	-0.166	NA	NA	0.817	0.207	NA

Given the single survey approach to this, we tested for correlation across variables and the resulting VIF for all relationships was below 3.3 demonstrating sufficient independence across variables (Table 12). Also to validate sample size, calculators via Daniel Soper were used (www.danielsoper.com) prior to the study informing us that we would require 23 samples to achieve a power of .8 and an effect size of .5 as has been show sufficient in other research (Guo et. al., 2014). The resulting sample size of 68 and the observed R^2 in this analysis of .334 provided an observed statistical power of .98. This sufficiently high power, above .80 (Cohen, 1998), makes it unlikely that a type II error is occurring, assuming this data is representative of the general population. Given the limited number of firms involved in this research and the challenges around external validity of this type of study, this could warrant additional testing in a larger data set.

Table 12: CEO Background Collinearity Test (VIF)

Indpendent Variable	Admin Inten	Funct Diff	Internal Comm	Managerial Att Change	Prof	Resource Spec	Slack Res	Tech Knowl	Stage	Innovativeness
Admin Inten	0.000	3.115	3.120	2.921	2.448	3.107	2.999	3.144	2.494	3.073
Funct Diff	1.124	0.000	1.115	1.114	1.099	1.109	1.101	1.128	1.098	1.094
Internal Comm	1.317	1.303	0.000	1.195	1.296	1.311	1.318	1.238	1.298	1.311
Managerial Att Change	1.588	1.678	1.540	0.000	1.541	1.685	1.625	1.696	1.693	1.645
Prof	1.899	2.362	2.381	2.198	0.000	2.292	2.291	2.387	2.378	2.289
Resource Spec	1.327	1.311	1.327	1.393	1.262	0.000	1.320	1.292	1.280	1.325
Slack Res	1.387	1.410	1.444	1.382	1.366	1.429	0.000	1.413	1.444	1.229
Tech Knowl	1.240	1.244	1.168	1.242	1.255	1.204	1.216	0.000	1.240	1.191
Stage	1.479	1.803	1.823	1.846	1.818	1.777	1.851	1.847	0.000	1.701
Innovativeness	1.277	1.273	1.292	1.259	1.289	1.284	1.106	1.275	1.230	0.000

Looking at the other relationships expected, the analysis showed that several of the moderating impacts investigated resulted in p-values above .05, but relatively low (Table 11). Given the samples sizes and the number of variables tested in this model, the lack of significance in these instances may not point to a lack of a statistically significant relationship, but it may point to limitations of this study due to the size and representativeness of the data set used. The moderation of lifecycle stage on: Functional Differentiation (p-value .104), Technical Knowledge (p-value .207), Professionalism (p-value .231) and Administrative Intensity (p-value .233) would be especially interesting to test in a large data set to see if the p-values reduce demonstrating a significant impact. Thus, while this data set does not provide conclusive support for Hypotheses 2, 3, 5, or 6, the limitations of this study would leave these relationships worthy of further investigation and therefore should be considered inconclusive at this time.

The moderating impacts of lifecycle stage on the relationships between firm innovativeness and the final three determinants of innovations tested in this analysis: Availability of Slack Resources, Resource Specialization, and Managerial Attitude towards change, were weak in this analysis (p-values of .256, .329, and .359 respectively). While it is challenging to determine any final conclusions given the

small data set in this study, it's difficult to envision a significant effect of these relationships, even with a larger data set. While there is enough uncertainty due to the data set size in this test that it is not possible to say significant relationships could not emerge, this data does not provide support Hypotheses 1, 4, and 7, and it appears unlikely that even in a larger dataset the moderating impact on these relationships would become significant.

This study was not intended to focus specifically on each of the assumed determinants of innovation, and if they had a significant relationship with innovativeness of the firm, as those relationships have been demonstrated in Damanpour's previous research (Damanpour, 1991). But this analysis did provide interesting results, some of which does conflict with the results demonstrated by Damanpour. This analysis showed only one of the eight expected determinants of innovation, Slack Resources, showed a statistically significant relationship with the innovativeness of the firm (Table 11). Three other independent variables: Functional Differentiation, Resource Specialization and Administrative Intensity, had p-values essentially at, or below, 0.20 while the other four previously demonstrated determinants of innovation showed p-values above, and in some cases well above, 0.20. A further investigation of effect sizes conducted on each of these variables showed that the effect of each variables on firm innovativeness independently was small (Table 13), with relationships between Firm Innovativeness and: Technical Knowledge ($F^2 = .018$), Managerial Attitude Towards Change ($F^2 = .011$) and Professionalism ($F^2 = .018$) failing to even achieve a relationship even considered small by previous research (Cohen, 1998). These

conflicting results with prior research provide additional indications that the limited data set used in this analysis may not be large enough to provide a representative sample. But given the very large p-values in some of these cases, such as Professionalism where we saw a p-value of 0.465 and , it is hard to envision becoming significant even in a larger data set. This could demonstrate some differences in the scope of Damanpour study vs the scope of this study. One significant difference in scope is that Damanpour was looking at all organizations while this study looked very specifically at NTBFs, this could account for some of the differentiation between these results and those seen in Damanpour's study and would be an interesting area for additional research.

Table 13: Effect Size Of Determinants Of Innovation

Effect Tested	Models Compared		Change in R Squared	Effect Size	
	Full Model	Partial (Nested) Model		F Squared	Size
Admin Inten -> Innovativeness	Admin Inten, Tech Knowl, Funct Diff, Mgr Att Chg, Slack Res, Professionalism, Internal Comm, Res Spec -> Innovativeness	Tech Knowl, Funct Diff, Mgr Att Chg, Slack Res, Professionalism, Internal Comm, Res Spec -> Innovativeness	0.021	0.032	small
Tech Knowl -> Innovativeness		Admin Inten, Funct Diff, Mgr Att Chg, Slack Res, Professionalism, Internal Comm, Res Spec -> Innovativeness	0.012	0.018	minimal
Funct Diff -> Innovativeness		Admin Inten, Tech Knowl, Mgr Att Chg, Slack Res, Professionalism, Internal Comm, Res Spec -> Innovativeness	0.035	0.053	small
Mgr Att Chg -> Innovativeness		Admin Inten, Tech Knowl, Funct Diff, Slack Res, Professionalism, Internal Comm, Res Spec -> Innovativeness	0.011	0.017	minimal
Slack Res -> Innovativeness		Admin Inten, Tech Knowl, Funct Diff, Mgr Att Chg, Professionalism, Internal Comm, Res Spec -> Innovativeness	0.073	0.110	small-medium
Professionalism -> Innovativeness		Admin Inten, Tech Knowl, Funct Diff, Mgr Att Chg, Slack Res, Internal Comm, Res Spec -> Innovativeness	0.012	0.018	minimal
Internal Comm -> Innovativeness		Admin Inten, Tech Knowl, Funct Diff, Mgr Att Chg, Slack Res, Professionalism, Res Spec -> Innovativeness	0.035	0.053	small
Res Spec -> Innovativeness		Admin Inten, Tech Knowl, Funct Diff, Mgr Att Chg, Slack Res, Professionalism, Internal Comm -> Innovativeness	0.013	0.020	small

Conclusion and Areas for Additional Research Based on Study 3

The analysis of this sample provided very interesting, and in some cases unexpected, results. The significant moderating impact of lifecycle stage on the relationship between Internal Communications and firm innovativeness, as well as the near significant impacts of lifecycle stage on several other determinants of innovation, including Functional Differentiation, Technical Knowledge, Professionalism, and Administrative Intensity, does highlight instances where determinants of innovations are impacted by firm lifecycle. The lack of a significant impact of lifecycle stage on some determinants of innovations highlights both the limitations of this study, due to the small data set, and the fact that not all

determinants of innovation are impacted by lifecycle stage. Understanding which relationships are, and are not, impacted by lifecycle stage provides a more thorough understanding of the determinants of innovation for a NTBF. This is a critical piece of information required to ensure results are generalizable and can drive practical advice for NTBFs. These results show that without taking this important characteristic into account, previous research around determinants of innovation may not be accurate for some NTBFs based on their lifecycle stage and therefore would be challenging to effectively deliver actionable information useful for firms focusing on driving innovativeness. This research begins to build a foundation that lifecycle stage is a critical attribute to take into account when investigating possible determinants of innovation for NTBFs.

This study also provided an interesting new view of determinants of innovations, previously investigated by Damanpour. This study fails to demonstrate a significant relationship in many cases where one existed in the Damanpour study. This conflict provides further potential indication that the small sample size in this study was not adequate to test the significance of all of these relationships. This highlights a possible area for additional research to see if a larger sample size provides results consistent with this study or more aligned with the results in the Damanpour analysis, as well as to further test the moderation impact of lifecycle stage to see if the moderation impact becomes statistically significant for more determinants of innovation. Along with challenging the sample size, these conflicting results also bring into questions the uniqueness of determinants of innovation for NTBFs, highlighting another opportunity for additional research to

understand how the determinants of innovation could be different for NTBFs vs other types of firms. Lastly, due to the number of variables involved and the small sample size this data set did not allow for additional control variables such as amount of sales, number of employees or specifics around industry and funding size. If a larger data set was available, it would be good to understand the impacts of some of these areas to understand how they impact the results of the analysis.

While the small data set of this study provided some limitations, and failed to demonstrate significant moderating impacts in all areas they were hypothesized to exist, these results build on Koberg's research (Koberg, et al, 2006) showing that there is an impact of lifecycle stage on some determinants of innovation, and it is an important variable that needs to be taken into account to provide effective and generalizable research to understand what the determinants of innovation are for a NTBF. It would again be interesting to see if a larger sample size and possibly additional methods of analysis impact these relationships and shows more areas where lifecycles stage has a significant impact, but even in this limited data set the impact of lifecycle stage provides key insight into previously demonstrated determinants of innovation.

CHAPTER 5

CONCLUSION

As researchers develop theory they hope to successfully explain the unknown, but for most this is not enough, they also look for some practical application of that theory that enables people to change the way they behave. In the case of most business research this means allowing organizations and leaders to apply those theories in ways that allow them to drive desired impacts in their organization. To effectively enable adoption of theory in real world situations, theories need to not only to be accurate in the sample population studied but they must also consider differences between individual companies that may impact a theory. The goal of this research was to provide insight into the impact of one of those key differences in organizations, lifecycle stages of the firm, to demonstrate how this variable can impact applicability of theories and must be taken into account to allow theories to be effectively generalized and applied in practical situations.

Lifecycle stage is a well-researched area, and the concept of organizations experiencing different sets of problems overtime and adjusting to address those issues is a broadly accepted concept (Kazanjian 1988, Van de Ven, 1986; Galbraith, 1982). Over the past three decades NTBFs have emerged and driven change at an unprecedented rate, and these firms have grown and navigated consistent patterns of change rapidly that can be demonstrated in their own life cycle models (Wasserman 2003, Kazanjian 1988). Research around these lifecycle models have

provided us with predictable and repeatable patterns of growth these NTBFs undergo, enabling us to categorize individual organizations into a predictable lifecycle stage (Kazanjian & Drazin 1989). This provides us with a method to quickly understand attributes of organizations and the problems they are facing based on where they fit within a lifecycle mode. This paper aims to demonstrate that this understanding can allow more effectively generalize the impact of other theories on individual organizations.

This paper investigated the impact of NTBF lifecycle on two specific areas of strategy: CEO attributes driving firm success, and Determinants of Innovation. Both of these areas have been shown to be critical to success of NTBFs and also something that NTBFs currently heavily invest behind to try to effectively accomplish (Stevens, Burley 1997; Wasserman 2003). The mixed results of this paper do not provide clear insight into all the impacts of Lifecycle stage on these two areas, but it did show some areas where lifecycle stage had significant or nearly significant moderating impact on relationships demonstrated in previous research. While this moderating impact was not significant on all previously demonstrated relationships for NTBFs, the existence in some areas does highlight the importance of looking at the impact of lifecycle stage when researching NTBFs in order to provide more complete and generalizable results that can effectively be translated into practice.

This research also highlights several opportunities for additional research in the future. Access to the data required to analyze many of these relationships is challenging to get in large quantities, entering this investigation it was known that

sample size would potentially be limiting, and this was supported in the analysis. There were several areas where this analysis resulted in relationships were near, or approaching the boarder, of significance and it would be interesting to investigate how this changes with a larger data set.

Overall this study highlights how NTBFs change throughout their lifecycle and how taking the lifecycle into account enables researchers to factor in these changes and provide more reliable and useful results.

REFERENCES

Almus, M., & Nerlinger, E. A. (1999). Growth of new technology-based firms: which factors matter? *Small business economics, 13*(2), 141-154.

Audia, P. G., & Rider, C. I. (2005). A garage and an idea: what more does an entrepreneur need? *California Management Review, 48*(1), 6-28.

Autio, E., & Parhankangas, A. (1998). Employment generation potential of new, technology-based firms during a recessionary period: the case of Finland. *Small business economics, 11*(2), 113-123.

Barclay, D., Higgins, C., & Thompson, R. (1995). *The Partial Least Squares (pls) Approach to Casual Modeling: Personal Computer Adoption Ans Use as an Illustration*.

Block, Z., & MacMillan, I. C. (1985). Milestones for successful venture planning. *Harvard Business Review, 63*(5), 184-&.

Brush, C. G., Greene, P. G., & Hart, M. M. (2001). From initial idea to unique advantage: The entrepreneurial challenge of constructing a resource base. *The academy of management executive, 15*(1), 64-78.

Carter, N. M., Stearns, T. M., Reynolds, P. D., & Miller, B. A. (1994). New venture strategies: Theory development with an empirical base. *Strategic Management Journal, 15*(1), 21-41.

Chandler, A. D. (1962). Strategy and structure: Chapters in the history of the American enterprise. *Massachusetts Institute of Technology Cambridge*.

Child, J. (1972). Organizational structure, environment and performance: The role of strategic choice. *sociology, 6*(1), 1-22.

Chin, W. W. (1998). The partial least squares approach to structural equation modeling. *Modern methods for business research, 295*(2), 295-336.

Cohen, J. (1988). Statistical power analysis for the behavioral sciences . Hilsdale. *NJ: Lawrence Earlbaum Associates, 2*.

Colombo, M. G., & Grilli, L. (2010). On growth drivers of high-tech start-ups: Exploring the role of founders' human capital and venture capital. *Journal of Business Venturing, 25*(6), 610-626. doi:http://dx.doi.org/10.1016/j.jbusvent.2009.01.005

Damanpour, F. (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of management journal, 34*(3), 555-590.

Damanpour, F., & Schneider, M. (2006). Phases of the adoption of innovation in organizations: Effects of environment, organization and top Managers1. *British journal of Management, 17*(3), 215-236.

Downs Jr, G. W., & Mohr, L. B. (1976). Conceptual issues in the study of innovation. *Administrative Science Quarterly*, 700-714.

Ejermo, O., & Xiao, J. (2014). Entrepreneurship and survival over the business cycle: how do new technology-based firms differ? *Small business economics, 43*(2), 411-426.

Ensley, M. D., & Hmieleski, K. M. (2005). A comparative study of new venture top management team composition, dynamics and performance between university-based and independent start-ups. *Research policy, 34*(7), 1091-1105.

Galbraith, J. R. (1982). Designing the innovating organization. *Organizational dynamics, 10*(3), 5-25.

Gilbert, B. A., McDougall, P. P., & Audretsch, D. B. (2006). New venture growth: A review and extension. *Journal of management, 32*(6), 926-950.

Goodhue, D. L., Lewis, W., & Thompson, R. (2012). Does PLS have advantages for small sample size or non-normal data? *Mis Quarterly*, 981-1001.

Greiner, L. E. (1997). Evolution and revolution as organizations grow. 1972.

Guo, W., Straub, D., & Zhang, P. (2014). A sea change in statistics: A reconsideration of what is important in the age of big data. *Journal of Management Analytics, 1*(4), 241-248.

Gupta, A. K., & Govindarajan, V. (1984). Business unit strategy, managerial characteristics, and business unit effectiveness at strategy implementation. *Academy of Management journal, 27*(1), 25-41.

Guthrie Datta, J. P., & Deepak, K. (1997). Contextual influences on executive selection: Firm characteristics and CEO experience. *Journal of management studies, 34*(4), 537-560.

Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of management review, 9*(2), 193-206.

Hanks, S. H., Watson, C. J., Jansen, E., & Chandler, G. N. (1993, 1993 Winter). Tightening the life-cycle construct: a taxonomic study of growth stage configurations in high-technology organizations. *Entrepreneurship: Theory and Practice, 18,* 5+.

Hellmann, T., & Puri, M. (2002). Venture capital and the professionalization of start‐up firms: Empirical evidence. *The journal of finance, 57*(1), 169-197.

Hodgson, G. M. (1998). Competence and contract in the theory of the firm. *Journal of Economic Behavior & Organization, 35*(2), 179-201.

Jennings, D. F., & Young, D. M. (1990). An empirical comparison between objective and subjective measures of the product innovation domain of corporate entrepreneurship. *Entrepreneurship Theory and Practice, 15*(1), 53-66.

Jovanovic, B. (1979). Firm-specific capital and turnover. *Journal of political economy, 87*(6), 1246-1260.

Kazanjian, R. K. (1988). Relation of Dominant Problems to Stages of Growth in Technology-Based New Ventures. *The Academy of Management Journal, 31*(2), 257-279. doi:10.2307/256548

Kazanjian, R. K., & Drazin, R. (1989). An Empirical Test of a Stage of Growth Progression Model. *Management Science, 35*(12), 1489-1503.

Kazanjian, R. K., & Drazin, R. (1990). A stage-contingent model of design and growth for technology based new ventures. *Journal of Business Venturing, 5*(3), 137-150. doi:http://dx.doi.org/10.1016/0883-9026(90)90028-R

Khan, A. M., & Manopichetwattana, V. (1989). Innovative and noninnovative small firms: Types and characteristics. *Management Science, 35*(5), 597-606.

Koberg, C. S., Uhlenbruck, N., & Sarason, Y. (1996). Facilitators of organizational innovation: The role of life-cycle stage. *Journal of business venturing, 11*(2), 133-149.

Lazear, E. P. (2004a). Balanced skills and entrepreneurship. *The American Economic Review, 94*(2), 208-211.

Lazear, E. P. (2004b). Balanced skills and entrepreneurship. *American Economic Review, 94*(2), 208-211.

Little, A. D. (1977). *New technology-based firms in the United Kingdom and the Federal Republic of Germany: a report*: Anglo-German Foundation.

Miller, D., & Friesen, P. H. (1982). Innovation in conservative and entrepreneurial firms: Two models of strategic momentum. *Strategic management journal, 3*(1), 1-25.

Mintzberg, H. (1985). The organization as political arena. *Journal of management studies, 22*(2), 133-154.

Mintzberg, H. (1991). Planning on the left side and managing on the right. *Creative management*, 58-71.

Normann, R. (1977). *Management for growth*: John Wiley & Sons.

Phelps, R., Adams, R., & Bessant, J. (2007). Life cycles of growing organizations: A review with implications for knowledge and learning. *International Journal of Management Reviews, 9*(1), 1-30.

Rothwell, R., & Zegveld, W. (1982). Innovation and the small and medium sized firm. *University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship*.

Roure, J. B., & Keeley, R. H. (1990). Predictors of success in new technology based ventures. *Journal of Business Venturing, 5*(4), 201-220. doi:http://dx.doi.org/10.1016/0883-9026(90)90017-N

Scott, M., & Bruce, R. (1987). Five stages of growth in small business. *Long Range Planning, 20*(3), 45-52. doi:http://dx.doi.org/10.1016/0024-6301(87)90071-9

Shrader, R., & Siegel, D. S. (2007). Assessing the relationship between human capital and firm performance: evidence from technology‐based new ventures. *Entrepreneurship Theory and Practice, 31*(6), 893-908.

Smith, K. G., Mitchell, T. R., & Summer, C. E. (1985). Top level management priorities in different stages of the organizational life cycle. *Academy of management Journal, 28*(4), 799-820.

Snow, C. C., & Hrebiniak, L. G. (1980). Strategy, distinctive competence, and organizational performance. *Administrative Science Quarterly*, 317-336.

Spencer, A. S., & Kirchhoff, B. A. (2006). Schumpeter and new technology based firms: Towards a framework for how NTBFs cause creative destruction. *International Entrepreneurship and Management Journal, 2*(2), 145-156.

Stevens, G. A., & Burley, J. (1997). 3,000 raw ideas= 1 commercial success! *Research-Technology Management, 40*(3), 16-27.

Trochim, W. M. (2006). Qualitative measures. *Research measures knowledge base, 361*.

Tushman, M., & Nadler, D. (1986). Organizing for innovation. *California management review, 28*(3), 74-92.

Utterback, J. M., & Abernathy, W. J. (1975). A dynamic model of process and product innovation. *Omega, 3*(6), 639-656. doi:http://dx.doi.org/10.1016/0305-0483(75)90068-7

Van de Ven, A. H. (1986). Central problems in the management of innovation. *Management Science, 32*(5), 590-607.

Walsh, J. P., & Dewar, R. D. (1987). FORMALIZATION AND THE ORGANIZATIONAL LIFE CYCLE [1]. *Journal of management studies, 24*(3), 215-231.

Wasserman, N. (2003). Founder-CEO succession and the paradox of entrepreneurial success. *Organization Science, 14*(2), 149-172.

West, G. P., & Noel, T. W. (2009). The impact of knowledge resources on new venture performance. *Journal of Small Business Management, 47*(1), 1-22.

Wiklund, J., & Shepherd, D. (2003). Knowledge‐based resources, entrepreneurial orientation, and the performance of small and medium‐sized businesses. *Strategic management journal, 24*(13), 1307-1314.

APPENDIX A

SURVEY TEXT

Q1: What was the name of the early stage technology firm worked with (if filling out for more than one firm please submit individual surveys):

Q2: Approximately what years did you work for the firm?

Q3: What was your role at the company:

a) CEO/President; b) Marketing Executive; c) Sales Executive; d) R&D Executive; e) Product Executive; f) Finance/Operations Executive; g) Other

Q3: Please provide some details about the firm:

Q3a: Number of people

Q3b: Approximate Sales

Q3c: Industry (HW, Software, other)

Q3d: Was this firm venture or private equity funded? (yes/no)

Q3e: Were you managing (and will you be commenting on) a stand along company or a division within a company?

Q4: Was this a stand-alone company or a new line of business in an established company?

a) Stand Alone; b) New Line of Business; c) Other (please specify)

Q5: How was this organization initially funded?

a) Venture Capital; b) Private Equity; c) Other (please specify)

Q6: What was the main type of business for this organization?

a) Hardware; b) Software; c) Web Technologies; d) Services; e) Other (please specify)

Q7: What was the business model of this business?

a) Business to Business; b) Business to Consumer; c) Other (please specify)

Q8: What was the approximate number of people when you were with the organization?

- When you began with the organization?
- When you left the organization?

Q9: What was the approximate annual sales when you were with the organization?

- When you began with the organization?
- When you left the organization?

Q10: Out of the options below please select the one that best reflects your organization when you started with and left the organization. While none of these

may fit perfectly please select the one that most closely represents your organization at these times:

a) The primary focus is product development/design, securing financing, and market development. Most employees had technical tasks but acted as generalists. Process was almost nonexistent, and the CEO/Leader was central to all functions/communications
b) We had a product that performed well and met a need in the market. We could produce and sell product but had to firmly establish ourselves in the market. The CEO/Leader was central to communications. We had some revenue and a backlog of orders
c) We had high sales and headcount growth. The main focuses were how to produce, sell and distribute the product at scale while attaining profitability. We were developing formal org structure/communications, more specialists and had a single product
d) The main goals were: creation of 2nd/3rd generation and new products, growth funding, growing market share, penetrating new geo's. There was a formality of org structure/rules/procedures, with a management team of industry/experienced leaders.

Q11: Who was the CEO or head of that line of business at the time you started with and left the organization?

- When you began with the organization?
- When you left the organization?

Q12: How successful was the organization against their objectives at the time you joined and left? (Very Successful, Somewhat Successful, Neutral, Somewhat Unsuccessful, Very Unsuccessful)

- When you began with the organization?
- When you left the organization?

Q13: Please indicate if you agree or disagree about the following statements at the time you joined the organization (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)

- At this time our functional resources were very specialized
- Most of the resources shared a similar functional background at this time
- The work environment and culture was very formal and professional at this time
- Managers were focused on driving change at this time
- We had industry leading technical resources at this time
- The firm had well established formal processes at this time
- Resource availability was not an issue at this time
- There were open and frequent internal communication processes at this time

Q14: Please indicate if you agree or disagree about the following statements at the time you left the organization (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)

- At this time our functional resources were very specialized
- Most of the resources shared a similar functional background at this time
- The work environment and culture was very formal and professional at this time
- Managers were focused on driving change at this time
- We had industry leading technical resources at this time
- The firm had well established formal processes at this time
- Resource availability was not an issue at this time
- There were open and frequent internal communication processes at this time

Q15: Please select more fitting description of the organization:

There was a strong emphasis on the marketing of tried/true products/services

Vs

There existed a very strong emphasis on R&D, technological leadership, and innovation (1 = Emphasis on Tried and True, 3 = Mixed, 5 = Strong R&D/Innovation)

- When you began with the organization?
- When you left the organization?

Q16: Please select more fitting description of the organization:

No new lines of business or products were released at this time

Vs

Several new lines of business were released during this time (1 = No new lines of business, 3 = Mixed, 5 = Several new lines of business)

- When you began with the organization?
- When you left the organization?

Q17: Please select more fitting description of the organization:

Changes in products were mostly of a minor nature during this time

Vs

Changes in product lines were dramatic during this time (1 = Minor Product Changes, 3 = Mixed, 5 = Dramatic Product Changes)

- When you began with the organization?
- When you left the organization?