THREE ESSAYS ON INNOVATION AND ENTREPRENEURSHIP:
DIVERSIFICATION, BOUNDARY EXPANSION, AND DIFFERENTIATION

By

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THREE ESSAYS ON INNOVATION AND ENTREPRENEURSHIP:
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Abstract

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This dissertation investigated the topics of innovation and entrepreneurship. The first essay discusses the relationship between diversification and innovation by integrating the insights of organizational search and contingencies literatures. The main argument is that a strategic fit between diversification and organizational contingencies leads to higher technological innovation. We find that a related diversification strategy leads to higher innovation when a local search is used by the company. In contrast, an unrelated diversification strategy leads to higher innovation when a broader search is used. Further, this study shows that technological capital is importance factor for a diversified firm to take an advantage of benefits from broader corporate scope.

The second essay explores young firms’ boundary expansion activities to develop its capabilities. Firms may differ in their search and renewal strategies based on their stage in the life cycle. Unlike the incumbents, young firms that just went through Initial Public Offering (IPO) may use different strategies contingent on their unique resources and the liabilities. Built on Resource Based View (RBV), we find that young firms with R&D resources develop an internal factor market to develop its competencies, while young firms with financial resource prefer to engage in boundary expansion activities. We also find that young firms’ boundary expansion
activities are further constrained in the presence of environmental uncertainty, and strong competition in the industry.

Finally, the third essay investigates the performance consequences of new venture’s strategic differentiation. We address how the patterns of differentiation affect the new venture’s short-term and long-term performance after going public. The main argument is that firms using a differentiation strategy will have higher performance than those with similarity strategy. Empirical support for the argument is found in the high technology industry. Additionally, the results show that in the IPO context, strategic differentiation is more beneficial under high uncertain environment.

Overall, the three essays in this dissertation 1) provide a more refined view of the relationship between diversification strategy and innovation, 2) explain young firms’ strategic choice to develop a capability, and 3) discuss the strategic behavior of new ventures and its implication for performance after IPO.
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Dedication

This dissertation is dedicated to Jihyun Kang, Suah Kim, and my family
who provided both emotional and financial support.
CHAPTER ONE
INTRODUCTION

The topics of innovation and entrepreneurship have been among the main subjects discussed in the strategic management field. The purpose of this dissertation is to provide a deep understanding about the behavior of the firm with respect to innovation, organizational boundary expansion, and IPOs. The first essay provides a new approach to account for the relationship between diversification and innovation by integrating the insights of organizational search and contingencies literature. Previous research on this relationship has provided inconclusive results. To reconcile the debate, we identify organizational contingencies to explain the conditions under which a diversified corporation has higher innovation output. The empirical results provide support for the idea that a strategic fit among the diversification strategy, the search behavior, and the technological capital all serve to increase innovation productivity, while misfit in these areas decrease innovation output. More specifically, firms using a related diversification strategy with local search are more likely to select the R&D projects that are related to their existing core technologies and improve their overall innovation productivity. Also, the results show that technological capital is a valuable resource that enables the firm to improve innovative performance as it diversifies into either a related or unrelated industry.

The second essay explores firm’s preference in their search and renewal strategies in the organizational life cycle. We particularly look into resource portfolio of young firms, and their strategic choice between internal development and boundary expansion activities. From capability perspective built on resource based view, we suggest that young firm’s unique resource portfolio accounts for the patterns of their organizational boundary expansion activities.
With 158 U.S. companies in high technology industry, we find support for the idea that boundary choice between internal and external market is consistent with the available, unique resource they possess. The results shows that internal market is preferred by young firms with high R&D resources, while young firms with high financial resources are more likely to take advantage of environmental opportunities through market transaction mechanisms, such as acquisitions, alliances, and joint ventures. We also find that young firms’ boundary expansion activities are further constrained in the presence of environmental uncertainty, and strong competition in the industry.

Finally, the third essay addresses an impact of particular strategy of new venture on short- and long-term performance. New ventures may pursue similarity or differentiation to increase their performance. We mainly focus on the technological differentiation of new venture before going public, and how the strategic choice taken before a firm’s IPO influences the firm’s performance after IPO. The main argument is that new ventures that use a differentiation strategy will have higher performance than those firms using a similarity strategy. Empirical support for the argument is found in the high technology industry. We also find that that in the presence of uncertainty, higher level of differentiation strategy is more positively related with new venture performance at the time of IPO.
CHAPTER TWO

PAPER ONE

SEARCH BEHAVIOR AND TECHNOLOGICAL CAPITAL OF THE DIVERSIFIED FIRM: THE IMPACT OF FIT ON INNOVATION

ABSTRACT

This paper provides a new approach to account for the relationship between diversification and innovation by integrating the insights of organizational search and contingencies literatures. Unlike the extant literature that suggests a direct effect, we argue that a strategic fit between diversification and organizational contingencies leads to higher technological innovation. With a longitudinal study of 248 manufacturing firms’ patenting activity, we find support for the idea that strategic fit is important for innovation output. More specifically, a related diversification strategy leads to higher innovation when a narrow technological search strategy is used by the company. In contrast, an unrelated diversification strategy leads to higher innovation when a broader technological search strategy is used. We also find that technological capital is importance for a diversified firm to take an advantage of benefits from broader corporate scope. Our analyses provide a more refined view of the relationship between diversification strategy and innovation.

Keywords:

Innovation, diversification, search, organizational contingency
INTRODUCTION

Corporate level strategy is concerned with answering what businesses a company should be in and how those businesses should be managed to create greater value (Montgomery, 1994; Porter, 1987). Accordingly, corporate level strategy is concerned foremost with examining how diversification affects performance. On this point, much research has been conducted over the last 30 years. From this research we know that a modicum of diversification is associated with superior performance, but too much diversification is actually detrimental. More specifically, the relationship between diversification and performance exhibits an inverted-U shape (Palich, Cardinal, & Miller, 2000).

While understanding the impact of diversification on performance is the primary focus of corporate strategy research, a related focus in this area of research is understanding how diversification affects innovation (Hoskisson, Hitt, & Hill, 1991). Given the importance of innovation on performance (Zollo, Reuer, & Singh, 2002), these two issues are likely not independent. On the one hand, scholars have suggested a negative relationship between diversification levels and innovation (Baysinger & Hoskisson, 1989; Hitt, Hoskisson, & Ireland, 1994; Hoskisson, Hitt, Johnson, & Grossman, 2002). As a firm diversifies, it may move away from its core business and gradually lose its ability to leverage its core competencies (Markides, 1992) particularly if those core competencies are not scalable (e.g. able to grow in relation to the size of the organization). Additionally, diversification also increases the marginal costs in an organization owing to the increased information processing demands (Bergh & Lawless, 1998; Hill & Hoskisson, 1987). Oftentimes, organizations adopt simpler structures and resort to the use of financial controls once the organization has grown significantly through acquisitions (Hoskisson, Hitt, Johnson, & Moesel, 1993). Although these activities allow the organization to
expand its span of control, these efforts reduce the amount of rich information used in decision making (Galbraith, 1974) and can have a vitiating effect on internal innovation. Furthermore, when business unit managers are evaluated strictly based on their unit’s financial performance, they become risk averse and unwilling to invest in uncertain technology needed for internal innovation. As a result, research has found that organizations which are more diversified tend to acquire innovation rather than develop it internally (Hoskisson et al., 2002). In sum, this research tends to evidence a negative relationship between diversification levels and innovation.

On the other hand, some scholars have suggested an alternative perspective and argue that diversification actually abets innovation. A firm which actively engages in diversification tends to have both a mindset of exploration and exploitation along with high R&D investment (Chen, 1996). Since diversified firms possess more opportunities for the internal use of knowledge, innovativeness may actually increase owing to the economies of scope arising through diversification (Katila & Ahuja, 2002). Such firms may also develop higher and diverse levels of absorptive capacity which, in turn increases innovativeness (Lane, Koka and Pathak, 2006). Additionally, transferring technology and skills may be easier within organizational boundaries than beyond organizational boundaries (Miller, Fern, & Cardinal, 2007a). In an international context, for example, Barkema and Vermeulen (1998) argued that higher levels of international diversification were associated with Greenfield ventures and the use of internally developed innovation whereas lower levels of international diversification were associated with acquisitions. They argued that the less-diversified firm will generally use acquisitions to acquire needed technology whereas the more-diversified firm will develop the technology internally as a result of superior capabilities for internal innovation.
Given these two apparently conflicting perspectives, it would seem that our understanding of the relationship between diversification and innovation has reached an impasse. With these issues in mind, we cannot simply conjecture about the relationship between diversification and innovation without understanding the innovation process and the search behavior of firms. Thus, we seek to identify when a diversified firm will have higher innovation outputs and how organizational contingencies (i.e. search scope and technological capital) influence the innovation. Overall, the purpose is to attempt to reconcile the above inconsistencies by suggesting a contingency approach (Govindarajan, 1988; Venkatraman, 1989) which combines organizational search theory, technological capital, and diversification strategy.

This paper contributes to the diversification and innovation literature by providing a more elaborate explanation concerning the effect of diversification strategy on innovation. Instead of assuming a simple positive or negative relationship between diversification and innovation, we show how existing capabilities as well as the existing diversification strategy affects innovation. Additionally, by taking into account firms’ search behavior, we are able to show that the type of search (e.g. local or distant) moderates the relationship between diversification type and innovation output. The paper is organized as follows. We first provide a brief review of the literature on innovation, and organizational search. Afterwards, we develop a model that accounts for the differences in innovation productivity in diversified firms. Hypotheses concerning innovation are then developed based on the concept of strategic fit (between diversification strategy and organizational contingencies). Next the hypotheses are tested on a sample of 248 U.S. manufacturing firms during the period 1991-1998. Finally, implications and topics for future research are discussed.
THEORETICAL BACKGROUND

It is difficult to conclude whether diversification improves a firm’s innovation and extant research addressing the relationship between diversification and innovation seems rather inconsistent. We believe that there are four underlying reasons for the apparently inconsistent findings. First, the labels given to corporate diversification strategies and the theories used to explain the reasons for diversification have necessarily given the notion that higher levels of diversification are driven primarily by agency motives (Montgomery, 1994). More specifically, as noted above, higher diversification levels are associated with managerial self-interest seeking as well as lower investment in uncertain technology because both actions reduce managerial employment risk. Indeed, in one of the most impactful papers on corporate strategy, Porter (1987) argued that an unrelated diversification strategy is only value creating in an inefficient capital market (which is not applicable in developed economies) or when a company uses it for restructuring purposes (wherein an acquiring company restructures a poorly performing company and then spins or sells it off afterwards). Based on Rumelt’s (1974) classification of diversification types, it is assumed that firms which are highly diversified such as Tyco Intl (Collis & Montgomery, 1998) utilize an unrelated diversification strategy and therefore seek to be run as lean as possible. From this research stream, the impression is that firms which are more highly diversified must necessarily be ‘low tech’ and focused on reducing costs as low as possible. However, this may not be true because there are companies like G.E. and Disney which maintain high levels of diversification and still exhibit high levels of innovation.

Second, most prior papers focus on one of the two sides of innovation (Ahuja, Lampert, & Tandon, 2008). Innovation, broadly defined as ‘the adoption of an idea or behavior related to a device, a process, or a product, that is new to the organization’ (Aiken & Hage, 1971;
Damanpour, Szabat, & Evan, 1989; Hage, 1999), can be separated into innovation inputs or efforts (also synonymous with innovation intensity), and innovation outputs (Ahuja et al., 2008). Although diversification scholars have primarily focused on innovation efforts (such as R&D intensity), innovative efforts differ from innovative outputs in that the former is associated with incentives, while the latter is related to productivity. Previous studies have assumed that there is a strong correlation between R&D intensity and valuable internal innovation, but this assumption may not be true (Trajtenberg, 1990). Again, innovation intensity should be a necessary condition, but not necessarily a sufficient condition for valuable innovation. In addition, innovation input and output may not be perfectly endogenous to corporate strategy. Some firms continue or even increase their investment in R&D activities, and engage in R&D projects more intensively after diversifying. Therefore, it is still unclear how diversification strategy influences the quality and productivity of technological innovation.

Third, there is a need to integrate organizational search activity in a more nuanced way into the diversification literature beyond the idea that some firms acquire innovation and some develop it internally. Research activity in firms can be modeled as a search for solutions in the knowledge domain (Ahuja & Katila, 2004; Fleming, 2001; Rosenkopf & Nerkar, 2001). And scholars have viewed innovation as the result of organizational search (Cyert & March, 1963; Greve & Taylor, 2000) or learning behavior (Levinthal & March, 1993; March, 1991). They have endeavored to understand how organizations explore new knowledge that can be applied to the existing knowledge and how those activities influence the magnitude of innovation. Similarly, diversifying firms tend to engage in broader search for technological innovation (Miller, 2006), and can take advantage of new knowledge across business units thereby leading to better prospects for realizing economies of scope in R&D activities by sharing knowledge.
Although organizational search behavior has often been treated as exogenous to diversification strategy, it does not provide a clear explanation about the effect of diversification on innovation productivity. Therefore, it would be valuable to account for how organizational search behavior in combination with the diversification strategy affects innovation.

Fourth, previous research examining the link between diversification and innovation has not taken into account the firm’s existing resources and capabilities. A firm with its own set of innovation capabilities in a technologically oriented industry may acquire another company which has complementary technology that can be used to further improve the existing core technology (Zahra, Ireland, & Hitt, 2000). Through this acquisition, the firm obtains and accumulates new technological capital (Ahuja & Katila, 2001). Although diversified firms have opportunities to explore new technology by integrating their existing technology with that which is acquired, these opportunities may not result in high innovation output unless the firms have sufficient R&D resources and capabilities to begin with. Thus, firm characteristics may significantly influence the ability to explore potential opportunities of increased corporate scope.

In this paper we specifically focus on how newly-obtained technology can be integrated with existing technology, and how a diversified firm improves its innovation productivity in the process. Technological innovation, which is defined as ‘a technology new to a given organization’ (Schoonhoven, Eisenhardt, & Lyman, 1990; Tornatzky et al., 1983), is an intangible asset which often plays a critical role in achieving competitive advantage (Barney, 2001; Grant, 1996).
INNOVATION, SEARCH, AND STRATEGIC FIT

Accessing external knowledge is important because it fosters innovation and enhances firm performance (Zollo et al., 2002). Knowledge search and its incorporation into the organization are very much a part of the innovation process. Since knowledge search is a central part of the innovation process, a key question from a corporate level strategy perspective is understanding how a diversified company goes about obtaining external knowledge.

From a corporate strategy perspective, technological innovation could be complementary to the firms’ diversification strategy. As noted above, diversification has both positive and negative effects on innovation. Simply investigating the direct relationship and drawing conclusions hinders the possibility of identifying what factors may affect the relationship between diversification levels and innovation. We argue that firms pursuing innovation must find the right ‘fit’ between their diversification strategy and the organizational contingencies needed for innovation. According to the strategic formulation literature, a strategic fit refers to the situation in which a firm’s strategy is congruent with environmental or organizational contingencies (Andrews, 1971; Siggelkow, 2001; Zajac, Kraatz, & Bresser, 2000). Organizations pursue strategic fit in order to achieve desirable performance and output (Miles & Snow, 1994). In this paper, search scope and technological capital are mainly focused among the organizational contingencies which are directly related to the implementation of innovation strategy.

Search Scope as Organizational Contingency

Cyert and March (1963) provided a basic frame for studying organizational search behavior in their classic book. Organizations engage in search behavior to find solutions and facilitate changes in organizational routines (Greve & Taylor, 2000). Thus, search behavior is
part of the organizational learning process (Huber, 1991) and an essential step in innovation dynamics (Nelson & Winter, 1982).

Organizational search can be classified into two types in terms of scope: 1) distant search which refers to exploration of new opportunities that emphasize more experimental and distant innovation beyond current organizational boundaries (Rosenkopf & Nerkar, 2001), and 2) local search which refers to exploitation that emphasizes immediate refinement and proximate alternatives in a firm’s R&D activity (Nelson & Winter, 1982). On the one hand, a firm may concentrate on a bounded set of technologies to cultivate valuable and commercially viable products, which is local search. On the other hand, a firm may expand its technological path into new areas that will serve as the seed for future technological developments, which is distant search (Levitt & March, 1988; March, 1991). For example, Stuart and Podolny (1996) found that organizations tend to engage in local search in order to develop a related technological domain from their existing knowledge store.

In terms of scope, local search is characterized as narrow or focused, while distant search is broad. Based on the nature of these search types, it would make sense that firms using a narrow diversification strategy would be more likely to utilize a narrow search since their strategy is associated with sharing activities among subunits. On the other hand, as a firm’s level of diversification increases the ability to share local knowledge would likely decline due to the diseconomies of sharing (e.g. increasing differences among business units would make it less useful to share the same knowledge across all units). As a result, we should expect to see broader search as the level of diversification increases and empirical results support this direct relationship (Miller, 2004). Since we are interested in testing the concept of fit in this paper, however, we are seeking to examine how diversification levels and search types affect
innovation outputs. If strategic fit is important (as we have argued thus far), then a lack of fit should lead to lower innovation output.

As noted above, search scope and organizational scope follow similar themes. That is, narrower search is consistent with related diversification in that both are associated with the pursuit of resources or technologies in a related area. Broader search is consistent with unrelated diversification in that both are associated with the pursuit of resources in a distant or unrelated area. For example, when a firm in the automobile industry focuses on improving its core technology and seeks to exploit possible complementary technologies in a similar industry, related diversification would support the firm’s R&D activity. This strategic action could lead to higher innovation productivity because the firm obtains a strategic fit between its corporate strategy and search behavior. In this case, higher relatedness could lead to what Markides and Williamson (1994) call ‘asset fission.’ After diversifying, the firm would have a greater number of potential combinations of knowledge to extend to the existing knowledge bases of each unit and thereby may develop new knowledge.

As a firm pursues greater diversification, it becomes more difficult to know which combinations of knowledge will provide the highest rewards. Likewise, when a firm with lower levels of diversification pursues more distant search, the same difficulty arises. It becomes increasingly difficult to understand how technologies beyond the core can easily be applied to current knowledge and it also becomes more difficult to extend this more distant knowledge to all of the firm’s business units. Further, when a firm attempts to utilize knowledge combinations outside of the core technologies, the ability to profitably utilize this knowledge will decline and impede innovation productivity. As such, familiarity and similarity with a technology obtained through local search should lead to a stronger ability to exploit this knowledge. Therefore, we
suggest that extending the existing technology through local search will be positively associated with the relationship between related diversification and innovation productivity.

*Hypothesis 1. Search scope moderates the relationship between related diversification and innovation productivity such that a diversified corporation in related industries is positively (negatively) related to innovation productivity when the firm pursues local (distant) search.*

Diversification which is carefully managed and implemented supports exploiting new opportunities by sharing and transferring resources across business units. While firms may stay within their technological trajectories (Dosi, 1982), they may also go beyond their technological trajectories in order to find novelty from the combination of inherent technologies and new ones across domains (March, 1991; Miller, 2006). Studies in search scope have found support for the argument that firms first diversify their technology in predictable ways, and then enter into new markets on the basis of the technological trajectory (Miller, 2004; Silverman, 1999). However, sharing complementary competencies in order to realize synergies between the existing units and new units (Hoskisson & Hitt, 1990) also may lead to information overload, information asymmetry, and complexity. Although there are more opportunities to develop innovation through integrating core technologies and newly acquired technologies, a different direction between diversification and search behavior results in decreased innovation productivity. In this situation when firms engaging in unrelated diversification seek sources for innovation in a close industry, a strategic misfit occurs. Additionally, simply having access to technologies in the distant industry does not guarantee the development of new innovation unless the firm
intentionally pursues innovation that integrates its existing technologies with the new technologies unrelated to its core technology. Therefore, we believe that a strategic misfit between organizational diversification levels and search behavior will decrease the firm’s innovation productivity. In contrast, a strategic fit exists when firms with a tendency for distant search diversify into unrelated industries, and this enables the firm to improve innovation productivity.

_Hypothesis 2. Search scope moderates the relationship between unrelated diversification and innovation productivity such that a diversified corporation in unrelated industries is positively (negatively) related to innovation productivity when the firm pursues distant (local) search._

**Technological Capital as Organizational Contingency**

To explain technological capital as an organizational contingency, this paper builds on the knowledge based view (KBV) of the firm, which views firms as heterogeneous, knowledge-bearing entities (Grant, 1996). KBV considers knowledge the most strategically important resource to achieve sustainable competitive advantage (Grant, 1996; Spender, 1996), and emphasizes the importance of human and technological capital since the investment in firm-specific human capital has a significant impact on learning and performance (Hatch & Dyer, 2004). According to this perspective, organizations should develop technological capital, which is defined as a firm’s capability in creating new technology, products, and processes (Ahuja, 2000; Cohen & Levinthal, 1990). In technology-oriented industries, technological capital is a necessary resource to gain a competitive advantage.
As Arora and Gambardella (1990) note, a firm’s successful history in innovative activities serves as signals of their accumulated technological capital. It also represents the firm’s innovation intensity in that the efforts in innovation are reflected by the accumulated knowledge stocks. Given this, diversified firms can be divided into two groups depending on their level of technological capital. An organization with high technological capital is capable of utilizing the technologies available from acquisitions, while another group with low technological capital would experience lower innovation productivity because of a lack of this capability. Even in the stage of selecting a target, other things being equal, firms prefer to acquire potential firms which possess higher levels of technological capital themselves (Ahuja, 2000).

Although increases in the level of diversification through acquisition allow a firm to access external sources for innovation and increase innovation productivity, this positive effect may reduce the firm’s R&D intensity for internal R&D development (Hoskisson & Johnson, 1992). For the firm with low technological capital, high diversification makes the firm less capable of developing new products and technology internally. This situation indicates a strategic misfit which occurs when a firm with little technological capital (e.g. lack of an ability to invent new technologies) highly diversifies in order to improve innovation productivity. However, when a firm has high technological capital, the firm is more willing to explore opportunities to combine available technologies. Thus, with high technological capital, the diversified firm is more likely to pursue potential opportunities from the more available resources, which positively influences the relationship between diversification and innovation productivity. The firm’s capability to develop new technology internally complementarily enhances innovation productivity. Therefore, a strategic fit exists when firms with high technological capital diversify.
Since the current position of a company in terms of technology is determined by the path it has pursued (Teece, Pisano, & Shuen, 1997), this paper suggests hypotheses that test the effect of a firm’s accumulated knowledge stock and R&D capability in the past, which represents the amount of technological capital. Therefore, we suggest that diversification strategy is positively associated with innovation productivity when a corporation has high levels of knowledge stock. This effect will be consistent with both unrelated and unrelated diversification.

**Hypothesis 3.** Knowledge stock moderates the relationship between both related and unrelated diversification, and innovation productivity such that a diversified corporation is positively related to innovation productivity when the firm has higher knowledge stock.

With little expertise in the technologies of an industry, firms are unable to innovate by using technologies available from a diversification strategy. Thus, we suggest that diversification strategy supports innovation activities when a firm has strong R&D capability.

**Hypothesis 4.** R&D capability moderates the relationship between both related and unrelated diversification, and innovation productivity such that a diversified corporation is positively related to innovation productivity when the firm has higher R&D capability.
FIGURE 2.1
Model of Strategic Fit for Innovation Productivity: Diversification, Search, and Technological Capital

METHOD

Data and Sample

The research sample was drawn from U.S. companies in the manufacturing industries. The data was mainly obtained from the COMPUSTAT Business Segment data and the National Bureau of Economic Research (NBER) Patent Citations data file. An updated NBER patent data contains information about patent, technological class, application year, citation, and assignee in the period 1975-2002 (Hall, Jaffe, & Trajtenberg, 2001). Although many scholars have used
patent data as a proxy measure for innovation (see Argyres & Silverman, 2004; Miller et al., 2007a; Rosenkopf & Nerkar, 2001). Patent data is not without limitations in that not all technological innovation is patented (Hall et al., 2001). Patent activities vary from industry to industry, and patents are a way to protect intellectual property rights rather than measuring the innovation output directly (Rodriguez-Duarte, Sandulli, Minguela-Rata, & Lopez-Sanchez, 2007). Additionally, patents represent invention rather than innovation (Becheikh, Landry, & Amara, 2006). However, these concerns are mitigated by the benefits of using patent data. First, NBER patent data allows scholars to measure a firm’s technological capital, flow of knowledge, and interfirm relationships for knowledge building. Second, the availability of panel data is helpful in determining the causality among variables. Additionally, Patel and Pavitt (1994) point out the complements between codified knowledge and uncodified knowledge (so unpatented data should not be a problem). Lastly, since this paper focuses on technological innovation, patent data would be an appropriate source to measure firms’ behaviors concerning technological innovation, and technological capital.

Using COMPUSTAT data, we collected all U.S. companies in the manufacturing industries in the period between 1991 and 1998. The manufacturing firms were determined based on 4-digit SIC codes 2011-3999. After matching the sample with patent data by using CUSIP numbers, 947 firms remained. Of these, only 248 firms met the criteria that patent data and financial data were available during 1987-2001, and that a firm existed at least 10 years which allowed us to obtain a minimum of five years of longitudinal data. The final sample was

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1 NBER patent data was available for the period 1963-2002, but data in 2002 were not considered because of the few citations and patent applications. Innovation productivity and knowledge stock were measured by the 4-year accumulative number of patents before and after the focal year, respectively. Thus, the overall time windows were 1987-2001 for patent data, and 1991-1998 for financial data.
248 companies in manufacturing industries in the period 1991-1998. The total number of longitudinal observations in the period was 1905².

**Measures**

**Dependent variable.** The dependent variable, innovation productivity, represents the degree to which a firm benefits from R&D activities. It was measured by the natural log of the accumulated number of patents applied for during the four years³ after the focal year. As noted earlier, the technological innovation process can be separated into two different points of view: innovation intensity (input side) and innovation productivity (output side) (Ahuja et al., 2008). Innovation intensity investigates the sources and determinants of innovation, while innovation productivity studies the output of R&D activities. To be consistent with the purpose of this paper and the notion that innovation intensity does not fully account for the direct results of innovation, we focused on the output side which is innovation productivity. The innovation intensity was controlled for, however, to avoid an alternative explanation.

**Independent Variable.** The independent variable, diversification, was measured by the entropy measure developed by Palepu (1985). There are multiple ways to measure the level of diversification, but Hoskisson et al. (1993) found evidence of construct validity for the entropy measure (Amit & Schoemaker, 1993; Jacquemin & Berry, 1979). It consists of two components (Total diversification (DT) = Related Diversification (DR) + Unrelated Diversification (DU)). To test the suggested hypotheses, we used related diversification (DR) and unrelated diversification

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² The minimum observation per firm was 5, and the maximum was 8. The average of the number of observation per firm was 7.7.

³ Increase or decrease in corporate scope requires substantial effort, time, and resources in the process of restructuring organizations. A four year span was chosen to reflect the change in innovation productivity both during and after the restructuring process.
(DU). The entropy measure was calculated from COMPUSTAT business segment data each target year.

**Organizational contingencies.** For three organizational contingency variables, we measured *search scope* for search behavior, and *knowledge stock* and *R&D capability* for technological capital. First, technological search scope refers to the degree to which a focal patent cites prior art from a variety of technological domains. Our measure is the same as the ‘originality’ measure in the paper by Trajtenberg, Henderson, and Jaffe (1997). The greater the search scope, the broader the technological roots of the underlying research (Trajtenberg et al., 1997). In other words, the more diverse the technologies cited by a focal patent, the broader was the search effort underlying the patent (Argyres & Silverman, 2004). We calculated the search scope of firm \( i \) in year \( t \) from the following equation:

\[
\text{Search Scope}_{it} = \frac{NC_{it}}{(NC_{it} - 1)} \left\{ 1 - \sum_{k=1}^{N_i} \left( \frac{N_{\text{Cited}_{ikt}}}{N_{\text{Cited}_{it}}} \right)^2 \right\}
\]

where \( N_{\text{Cited}_{it}} \) is the total number of citations that firm \( i \) made at year \( t \), \( N_{\text{Cited}_{ikt}} \) is the total number of citations that firm \( i \) made in the three-digit technological category \( k \) in year \( t \), and \( NC_{it} \) is the number of total citation that a focal company \( i \) has made in year \( t \). Technological search scope as the Herfindahl-type measure suffers from bias due to the count nature of the underlying data. The bias occurs when a patent with a small number of citations has a non-zero probability that no citations will actually be observed. To remedy this bias, we applied the procedure developed by Hall et al. (2001), which involves the search scope measure multiplied by \( N/(N-1) \). Overall, the average value in the four prior years was used to represent firm-level search scope.

Second, *knowledge stock* was measured by the total number of patents obtained by a firm in the four prior years as an indicator of a firm’s cumulated technical capital (Ahuja, 2000). The
past innovative activities and capabilities serve as signals of a firm’s technical competences (Arora & Gambardella, 1990). It is expected that the more patents the firm possesses, the greater the firm’s knowledge store is.

Third, innovation impact was used to measure R&D capability. Innovation impact indicates the degree to which a firm’s patents are subsequently cited by patents of other firms (Miller et al., 2007a). Since higher impact leads to more economic benefits (Harhoff, Narin, Scherer, & Vopel, 1999), impact itself is a good measure of R&D activity. When a firm has had higher impact in the past, it indicates that the firm has strong capabilities for developing new innovation. Innovation impact was calculated by measuring the average number of citations received from others during four years before the focal year; thus a higher score, indicates stronger impact. The equation to calculate innovation impact of firm $i$ in year $t$ is:

$$\text{Innovation Impact}_{it} = \frac{1}{\text{NP}_{it}}(0.05 + \sum_{j=1}^{N_i} \frac{\text{Nciting}_{ijt}}{\text{Avgciting}_{it}})$$

where $\text{Avgciting}_{it}$ is the average of citations received from other firms in the application year $t$, $\text{Nciting}_{ijt}$ is the number of citations that firm $i$’s patent $j$ received from other firms in year $t$, and $\text{NP}_{it}$ is the total number of patents that firm $i$ applied in year $t$. To handle the truncation problem, the fixed effects approach (Hall et al., 2001) was used. By dividing the number of citations received by the yearly mean (i.e. $\text{Avgciting}_{it}$), the approach controls for the year effect in each patent. Since many firms had 0 citations, a constant of 0.05 was added to the equation. The value was divided by the number of patents applied for by firm $i$ so that the overall value represents the firm-level impact.

**Control variables.** We included control variables to avoid an alternative explanation. All control variables were measured at the target year. First, R&D intensity (Chen, 2003; Cohen & Levinthal, 1990) has been considered innovation input that may influence innovation output.
R&D intensity was measured by the ratio of R&D expenses to total assets. It represents the firm’s inputs and efforts into the innovation process. Second, a firm’s financial performance may influence innovation productivity (Chen & Miller, 2007). Performance was measured by return on assets (ROA) which is the ratio of income to total assets.

Third, three types of slack resources were controlled for since slack can abet innovation (Nohria & Gulati, 1996). The three measures for slack include recoverable slack, potential slack, and available slack (Bromiley, 1991; Singh, 1986). Recoverable slack was measured as the selling, general and administrative expenses to sales ratio; potential slack was measured as the debt to equity ratio; and available slack was measured as the current ratio (Bergh & Lawless, 1998; Bromiley, 1991; Singh, 1986). Data to measure slack resources were collected from COMPUSTAT.

Fourth, the model also included firm size measured as the logarithm of the number of employees. Previous studies have reported a positive effect of size on innovation (e.g. Chaney & Devinney, 1992). Furthermore, larger firms may naturally hold more patents.

Fifth, there are external factors that make it more or less attractive to introduce new technology, such as market conditions and the general economic environment. These factors are changing over time and may significantly influence the patenting activities. Thus, the year effect was controlled for by including year dummies (1991-1997).

Analysis

The unit of analysis was the firm’s level of innovation. Since the dependent variable, innovation productivity, consisted of at least five observations (i.e. a natural log of all patents applied for) for each firm during the 1991-1998 time period, we used a longitudinal regression model with fixed effects for a cross-sectional time series panel data. We tested for serial
autocorrelation using the Hausman test. The null hypothesis stating that the difference in coefficients in the fixed effects model and the random effects model is not systematic, was rejected ($p < 0.001$). This suggests that a fixed effects model is more appropriate for the analysis (Benner & Tushman, 2003; Hsiao, 2003; Miller & Eden, 2006), in which we used \textit{Xtreg, fe} command in STATA. To correct for potential variable bias, time-varying firm specific factors, including R&D intensity, size, performance, and slack resources were included as control variables. Year dummies were also used to control for the time-invariant omitted-variable effect. Overall, this model allows us to test the effect of organizational contingencies on the relationship between types of diversification and innovation productivity after controlling for all potential biases. All continuous variables were centered in the analysis before testing the effect of interaction terms.
<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>S.D.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
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<tbody>
<tr>
<td>Innovation</td>
<td>4.22</td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>ROA</td>
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<td>0.08</td>
<td>0.08***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Available Slack</td>
<td>2.29</td>
<td>1.58</td>
<td>-0.25***</td>
<td>0.21***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Potential Slack</td>
<td>0.6</td>
<td>1.22</td>
<td>-0.02</td>
<td>-0.27***</td>
<td>-0.20***</td>
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<td></td>
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</tr>
<tr>
<td>Recoverable Slack</td>
<td>0.27</td>
<td>0.13</td>
<td>0.06**</td>
<td>0.06**</td>
<td>0.16***</td>
<td>-0.08***</td>
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<tr>
<td>Size</td>
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<td>1.25</td>
<td>0.62***</td>
<td>-0.02</td>
<td>-0.47***</td>
<td>0.12***</td>
<td>-0.21***</td>
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<tr>
<td>R&amp;D Intensity</td>
<td>0.06</td>
<td>0.05</td>
<td>0.23***</td>
<td>-0.05*</td>
<td>0.17***</td>
<td>-0.16***</td>
<td>0.47***</td>
<td>-0.23***</td>
<td>1</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DR (related div.)</td>
<td>0.26</td>
<td>0.45</td>
<td>0.14***</td>
<td>0.00</td>
<td>-0.18***</td>
<td>0.11***</td>
<td>-0.06*</td>
<td>0.29***</td>
<td>-0.11***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DU (unrelated div.)</td>
<td>0.23</td>
<td>0.36</td>
<td>0.04†</td>
<td>-0.06*</td>
<td>-0.19***</td>
<td>0.09***</td>
<td>-0.26***</td>
<td>0.33***</td>
<td>-0.29***</td>
<td>0.13***</td>
<td>1</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Search Scope</td>
<td>0.78</td>
<td>0.16</td>
<td>0.56***</td>
<td>-0.06**</td>
<td>-0.23***</td>
<td>0.01</td>
<td>-0.06*</td>
<td>0.48***</td>
<td>0.02</td>
<td>0.16***</td>
<td>0.15***</td>
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<td></td>
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<tr>
<td>Knowledge Stock</td>
<td>220.83</td>
<td>608.83</td>
<td>0.59***</td>
<td>-0.01</td>
<td>-0.15***</td>
<td>0.01</td>
<td>-0.02</td>
<td>0.48***</td>
<td>0.07**</td>
<td>0.23***</td>
<td>0.06*</td>
<td>0.30***</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>R&amp;D Capability</td>
<td>1.01</td>
<td>0.66</td>
<td>0.26***</td>
<td>0.05*</td>
<td>0.17***</td>
<td>-0.09***</td>
<td>0.20***</td>
<td>-0.15***</td>
<td>0.40***</td>
<td>-0.16***</td>
<td>-0.24***</td>
<td>-0.04†</td>
<td>0.06**</td>
<td>1</td>
</tr>
</tbody>
</table>

N=1905 (248 firms during at least 5 years from 1991 to 1998)
†   p < .10
*   p < .05
**  p < .01
*** p < .001
**TABLE 2.2**

Results of Regression Analysis with Fixed Effects Predicting Innovation Productivity

<table>
<thead>
<tr>
<th></th>
<th>Model1</th>
<th>Model2</th>
<th>Model3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>3.95***</td>
<td>3.96***</td>
<td>3.98***</td>
</tr>
<tr>
<td>ROA</td>
<td>0.23</td>
<td>0.26</td>
<td>0.29†</td>
</tr>
<tr>
<td>Available Slack</td>
<td>-0.01</td>
<td>-0.01</td>
<td>-0.01</td>
</tr>
<tr>
<td>Potential Slack</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Recoverable Slack</td>
<td>-0.36</td>
<td>-0.27</td>
<td>-0.30</td>
</tr>
<tr>
<td>Size</td>
<td>0.28***</td>
<td>0.25***</td>
<td>0.23***</td>
</tr>
<tr>
<td>R&amp;D Intensity</td>
<td>-0.72</td>
<td>-0.76</td>
<td>-0.47</td>
</tr>
<tr>
<td>Year Dummies</td>
<td>7***</td>
<td>7***</td>
<td>7***</td>
</tr>
<tr>
<td>DR</td>
<td></td>
<td>-0.03</td>
<td>0.04</td>
</tr>
<tr>
<td>DU</td>
<td></td>
<td>0.15*</td>
<td>0.21*</td>
</tr>
<tr>
<td>Search Scope</td>
<td></td>
<td>0.35**</td>
<td>0.39***</td>
</tr>
<tr>
<td>Knowledge Stock</td>
<td></td>
<td>0.14***a</td>
<td>0.20****a</td>
</tr>
<tr>
<td>R&amp;D Capability</td>
<td></td>
<td>0.07*</td>
<td>0.18***</td>
</tr>
<tr>
<td>DR x Search Scope</td>
<td></td>
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<td>-0.68***</td>
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<td>DU x Search Scope</td>
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<tr>
<td>DR x Knowledge Stock</td>
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<td>0.11a</td>
</tr>
<tr>
<td>DR x R&amp;D Capability</td>
<td></td>
<td></td>
<td>0.15**</td>
</tr>
<tr>
<td>DU x R&amp;D Capability</td>
<td></td>
<td></td>
<td>0.45***</td>
</tr>
<tr>
<td>R² Within</td>
<td>0.11</td>
<td>0.13</td>
<td>0.16</td>
</tr>
<tr>
<td>R² Between</td>
<td>0.33</td>
<td>0.47</td>
<td>0.51</td>
</tr>
<tr>
<td>R² Overall</td>
<td>0.31</td>
<td>0.43</td>
<td>0.48</td>
</tr>
<tr>
<td>F-value</td>
<td>16.35***</td>
<td>13.47***</td>
<td>13.09***</td>
</tr>
<tr>
<td>F test that all u_i=0</td>
<td>46.36***</td>
<td>27.70***</td>
<td>27.78***</td>
</tr>
</tbody>
</table>

N=1905; number of firms =248

* The regression coefficients were multiplied by 1000 in the purpose of report.

† \( p < .10 \)

* \( p < .05 \)

** \( p < .01 \)

*** \( p < .001 \)
RESULTS

Table 1 displays the descriptive statistics and correlations for each of the variables in the regression model. Since there were no high correlations between any pair of independent variables, multicollinearity was not the main concern (see Table 1).

Table 2 shows the results of the longitudinal regression model with fixed effect. Model 1 included all control variables; model 2 added related/unrelated diversification (i.e. DR and DU) and all organizational contingencies; and model 3 tested hypotheses 1 to 4 by including all interaction terms. The results indicate the importance of controlling for firm-level fixed effects. The null hypothesis that all unobserved firm-level characteristics are equal was rejected ($F=46.36, p<0.001$ in model 1; $F=27.70, p<0.001$ in model 2, and $F=27.78, p<0.001$ in model 3) thereby providing support for the use of the fixed effects model. The strong year effects ($p<0.001$) also indicates the importance of testing longitudinal data. Compared with model 1 with only control variables, model 3 with organizational contingencies explained much more of the variance in innovation productivity ($R^2=0.16$, and $F=13.09, p<0.001$).

Hypothesis 1 and 2 proposed the contingency effect of searching behavior on the relationship between each type of diversification strategy and innovation productivity. The results in model 3 supported these hypotheses. The coefficient for the interaction term between related diversification and search scope (DR x Search Scope) was negative and strongly significant ($\beta = -0.68, p<0.001$). Also, the coefficient for the interaction term between unrelated diversification and search scope (DU x Search Scope) was positive and also strongly significant ($\beta = 1.13, p<0.001$). The interpretation is that a strategic fit between search behavior and the types of diversification strategy is positively related to innovation productivity.
Hypothesis 3 and 4 predicted that technological capital plays a role in organizational contingency such that both types of diversification lead to higher innovation productivity when the firm has a large knowledge store and high R&D capability. The results in model 3 provided support for hypothesis 4 but not for hypothesis 3. The results in Model 3 show that although knowledge store increases innovation productivity ($\beta = 0.20, p<0.001$), the coefficients for the interaction terms (DR x Knowledge Store and DU x Knowledge Store) were not significant. It means that simply having more knowledge and technology does not help a firm develop more technology as it increases its level of diversification. Consistent with hypotheses 4, Model 3 shows that R&D capability positively moderates the effect of diversification on the development of new technology ($\beta = 0.15, p<0.05$ for related diversification, and $\beta = 0.45, p<0.001$ for unrelated diversification).

DISCUSSION AND CONCLUSION

Research on the relationship between diversification and innovation has provided inconclusive results (Ahuja et al., 2008). In this paper, we identified organizational contingences to explain the conditions under which a diversified corporation has higher innovation productivity. The empirical results provide support for the argument that a strategic fit among search, diversification, and technological capital increases a firm’s innovation productivity, while a misfit decreases innovation output. Thus, a related diversified firm improves its innovation when it pursues local search. This focused search should help the firm build on its core competencies and develop new knowledge. Local search prevents a firm from not only losing sight of its core competencies but it also helps a firm from being overwhelmed by the numerous opportunities arising in a diversification strategy. As a result, firms using a related
diversification strategy with local search are more likely to select the R&D projects that are related to their existing core technologies and improve their overall innovation productivity.

In the case of distant search, firms that pursue knowledge and resources from a distant industry may enjoy the opportunities available from the acquisition of businesses in a different industry. We find that unrelated diversified firms enjoy higher innovation when they engage in distant search. It appears that those firms are interested in the integration of technologies across industries, and unrelated diversification allows the firms to obtain these opportunities (See chart a) and b) in Figure 2). Firms using higher levels of unrelated diversification may be willing to expend greater resources after an acquisition to promote new innovation.
FIGURE 2.2
Effect of Organizational Contingencies on Innovation Productivity

a) The strategic fit between search scope and related diversification

b) The strategic fit between search scope and unrelated diversification
c) The strategic fit between technological capital (R&D capability) and related diversification

![Diagram](image)

- High R&D capability
- Low R&D capability

Innovation productivity

Low | High
--- | ---
Low | High

Related Diversification

R&D capability

d) The strategic fit between technological capital (R&D capability) and unrelated diversification

![Diagram](image)

- High R&D capability
- Low R&D capability

Innovation productivity

Low | High
--- | ---
Low | High

Unrelated Diversification

R&D capability
Also, technological capital is a valuable resource that enables the firm to improve innovative performance as it diversifies into either a related or unrelated industry. The results demonstrate that the opportunities for innovation generated from both types of diversification strategies can be exploited only when a firm has high technological capital to begin with. However, firms that are already well equipped with technological capital also may have lower incentives to recombine technologies (Ahuja, 2000). Therefore, technological capital does not simply reflect the positive effect on the relationship between diversification and innovation productivity. Even though more opportunities for knowledge recombination are available with increased diversification, only a firm that has high existing technological capital and is willing to expend the effort to recombine technologies (through higher R&D intensity) can take advantage of the opportunities (see chart c) and d) in Figure 2). Overall, this paper suggests that diversified firms can improve their innovation productivity when they achieve a strategic fit between diversification and organizational contingencies.

This paper builds on extant theory in four ways. First, this paper is one of a few that applies a contingency approach to research the effect of corporate strategy on innovation. The notion that changes in R&D investment caused by the change in corporate scope directly and indirectly affects innovation output, may overstate the effect of corporate scope. Firms explore and exploit opportunities so differently that the patterns of past behavior and accumulated resources have a significant impact on innovation efforts and output. The findings in the analysis confirm that firm-specific factors (i.e. past behavior and resources) should be taken into account to understand how corporate strategy influences innovation output.

Second, the findings imply that a firm’s innovation efforts differ from innovation productivity. Although corporate scope influences innovation efforts (i.e. R&D intensity), it is
still unclear if this effect is derived from economies of scope in R&D activities, or if a necessary
investment in organizational coordination and integration reduces resources that can be used for
R&D projects. The assumption that innovation intensity is exogenous to the corporate strategy
contrasts previous literature which mainly discusses how diversification strategy influences
innovation intensity. Future studies may derive more useful research ideas from this perspective.

Third, the current study implicitly emphasizes the importance of absorptive capacity
(Cohen & Levinthal, 1990) for a diversified firm, which refers to a firm’s ability to value,
assimilate, and apply knowledge obtained from external sources. In this sense, R&D capability
of a diversified firm can be interpreted as absorptive capacity. Access to external resources
through acquisition does not support R&D activities unless the firm possesses technological
know-how (i.e. absorptive capacity) for exploiting the opportunities.

Lastly, both related and unrelated diversification strategies were examined as well as
their relationship with innovation. The literature on innovation and diversification has mainly
investigated related diversification, and has paid less attention to unrelated diversification. By
including both of the components of the entropy measure, this paper contributes to the study of
unrelated diversification strategy and suggests that strategic fit accounts for the variation in
innovation for unrelated-diversified firms, as well as that in related diversified firms.

The findings also provide implications to managers in a diversified firm. When a firm
explores a new technology through diversification, managers may be concerned about a potential
negative effect on the company’s ability to develop new innovations afterwards given the
increased complexity, potential inflexibility, and information overload. However, the firm will
be able to improve its innovation if it possesses strong R&D capability and if its search patterns
are consistent with the nature of its corporate strategy. Thus, it is important to evaluate if a
diversified firm has strong internal R&D capability and if there is consistency between a firm’s strategy and R&D activity. In addition to these conditions, investment in organizational coordination and integration should be accompanied with investment in innovation in order to achieve economies of scope and effectiveness. After finishing coordination and integration activities, the firm should refocus on R&D activities to exploit the opportunities from richer knowledge stores and resources.

There are a few limitations in this paper. First, using patent data as a measure of innovation inherently involves some limitations as discussed in the methods session. Second, the causal relationship among diversification strategy, search behavior, and innovation was not specified. On the one hand, scholars have examined the causal direction from search behavior or innovation to diversification. For example, Chang (1996) argued that the search for new combinations of knowledge may account for patterns of a firm’s strategic actions, such as acquisition, restructuring, and divestitures. Silverman (1999) suggested that the technology classes in a firm’s patents predict the future industry-related direction of diversification. On the other hand, there has been research examining the causality of diversification on innovation. For example, Hoskisson and Johnson (1992), and Hoskisson and Hitt (1988) suggested that firms which increased organizational scope reduced R&D intensity by shifting from strategic control to financial control. However, Rodriguez-Duarte et al. (2007) suggested a bidirectional relationship between innovation and diversification. Thus, future search should seek to probe this issue further.

Lastly, environmental contingencies were not considered. Organizational contingency variables are part of all possible conditions that influence the relationship between innovation and diversification. Environmental uncertainty, industry competitiveness, and the economic
situation are external conditions that may affect the relationship. In addition to the identified organizational contingency variables, future research could contribute to the literature in diversification and innovation areas by identifying important environmental elements which have not been already identified.

In summary, this paper provides new insight to understand the relationship between diversification strategy and innovation. Building on a contingency approach, we have emphasized the importance of strategic fit among the types of diversification, search behavior, and technological capital to improve innovation productivity.
REFERENCES


CHAPTER THREE

PAPER TWO

RESOURCES AND ORGANIZATIONAL BOUNDARY EXPANSION IN THE EARLY STAGE

ABSTRACT

Search and renewal strategies differ based on the life-cycle stage of the firm. An incumbent generally expands via acquisition. However, a firm that has recently held an Initial Public Offering may use different strategies contingent on their unique resources and liabilities. For example, the firm may rather focus on the development of internal factor markets for meeting legitimacy demands. The priorities of a young firm may be further refined in the face of environmental contingencies resulting from the multiple liabilities and constraints of the market. We found that young firms with R&D resources create competencies by developing internal factor markets, while those with financial resources preferred to engage in boundary expansion activities. Further, we found that the boundary expansion activities of young firms are constrained in the presence of environmental uncertainty and strong competition.

Keywords:

Capability, resources, boundary expansion, environmental contingency
INTRODUCTION

Firms expand their boundaries in response to environmental contingencies and to the availability of resources (Iyer & Miller, 2008; Schilling & Steensma, 2001). The need to search for and renew competencies prompts firms to expand their boundaries through a variety of modes including acquisitions, alliances, and joint ventures. Acquisition is one of the more extreme modes of boundary expansion whereas alliances and joint ventures are more moderate (Poppo & Zenger, 1995; Steensma & Corley, 2001). Boundary expansion via such modes provides opportunities to gain resources as well as numerous competitive and comparative advantages (Santos & Eisenhardt, 2005). However, young firms that have recently undergone Initial Public Offerings (IPO)\(^4\) may have different priorities based on their unique position in the market. On the one hand, such firms possess unique resources and need additional investment for internal growth; on the other hand, they face close and constant scrutiny from the market and must continue to validate their claims of resource, role, and endorsement legitimacy (Higgins & Gulati, 2003; Robinson & McDougall, 2001).

Young firms’ unique resources and constraints may have a bearing on their search and renewal and organizational boundary decisions. They may focus on the development of internal factor markets in order to build capability and meet legitimacy demands. Alternatively, they may respond to the substantial pressures they face by seeking competencies (via modes such as acquisition or alliances) from the market consistent with the strategies of ‘upstream’ incumbents (Robinson & McDougall, 2001).

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\(^4\) IPO firms are organizations that offer their stock to the public market for the first time, when they are moving from private to public ownership. This move requires a substantial effort, particularly on the part of a company’s top management team.
We begin with the premise that a young firm may have different priorities in making boundary expansion decisions than incumbents. Early in the life cycle a firm may not want the burden of organizational and structural complexities inherent in some modes of boundary expansion. The organizational boundary literature considers capability and competence development an important motive for boundary expansion. However, it is unclear how various resources influence boundary expansion and how young firms’ preferences differ from those of incumbents. We begin by taking a resource based view (RBV) and focusing on the resource portfolio to explore the boundary expansion activities of the young firm.

The young firm generally faces multiple liabilities and constraints in the market, and the firm’s priorities may be further refined in the face of these environmental contingencies. Although not mechanistically determined (Aldrich, 1999; Aragon-Correa & Sharma, 2003), environmental contingencies substantially influence major strategic decisions. For example, environmental uncertainty can dampen acquisition activity by placing in doubt the value of new resource combinations (Hoskisson & Hitt, 1990). Further, when pursuing search and renewal activities (Aldrich, 1999; Scherer, 1980), firms are constrained by competitive dynamics. At the same time, strategic factors such as slack also influence boundary expansion decisions and the choice of expansion modes (Iyer & Miller, 2008; Patzelt, Shepherd, Deeds, & Bradley, 2008).

A more complete picture of the young firm’s competency search strategies and boundary expansion choices would emerge if, in addition to contingencies, we considered the firm’s unique resources. The purpose of this paper is to examine the impact of two key resources and two environmental contingencies on the young firm’s boundary choice. Specifically, we explore whether young firms should cultivate internal factor markets or expand organizational boundaries to renew competencies in the face of contingencies. The two strategic resources
considered are R&D and financial. We regard environment and industry as the environmental contingencies that influence the boundary decisions of young firms.

The paper is organized as follows. First, we discuss the literature on young firms’ boundary expansion decisions, particularly regarding investment in and development of existing competencies versus searching for new competencies beyond the firm’s boundaries. Next, we discuss the influence of unique resources and capabilities on young firms’ preferences regarding boundary expansion; we develop testable hypotheses regarding these strategic choices in the presence of environmental contingencies. Third, we detail the hypothesis testing methodology based on a sample of 158 young, high technology firms. We conclude with a discussion of the results, implications, and future research directions.

THEORETICAL BACKGROUND

Organizational boundary refers to “the demarcation between the organization and its environment” (Santos & Eisenhardt, 2005). The resource-based view (RBV) (Barney, 1991; Penrose, 1959) posits that possession of valuable, rare, inimitable, and non-substitutable (VRIN) resources is a source of competitive advantage (Barney, 1991). The young firms’ organizational boundaries can be dynamically determined prior to an IPO by identifying environmental opportunities that will allow the firm to gain a competitive advantage from their unique resources. A fit between a firms’ resources and the environment delivers market share and enhances legitimacy (Powell & DiMaggio, 1991). In the context of young firms, such a fit maximizes the value of the resource portfolio and provides competitive advantage.

According to Poppo (1995), firms generally make a boundary choice between internal (make) and external (buy /cooperate) markets. Cultivating the internal market allows firms to
develop competencies by investing in internal R&D projects and has the advantages of reduced information complexity and increased flexibility (Williamson, 1985). Expansion by venturing in external markets provides opportunities to gain needed resources and capabilities in the market through acquisition and inter-organizational relationships; this has the potential advantage of new search, improved efficiency, and greater adaptability. Building on the RBV\(^5\), the capability perspective argues that a firm’s boundary expansion choice is associated with its resource portfolio and emphasizes value maximization resulting from engagement in activities within or beyond the organizational boundary (Barney, 1999; Leiblein & Miller, 2003).

Firms set their boundaries at the point that maximizes the value of their resource portfolio with a focus on firm-specific, resource-based advantages for organizational growth (Chandler, 1977; Helfat, 1997; Santos & Eisenhardt, 2005). Prior literature suggests that new and young ventures often ensure viability by exploiting the knowledge capital of the parent firm which they subsequently increment through internal R&D (Gompers, Lerner, & Scharfstein, 2005; Levinthal & March, 1993). Klepper and Sleeper (2005) found that nearly every venture in the laser industry used internal R&D to improve lasers produced by the parent firms. Chatterji (2009) found that such ventures generally outperform other entrants in an industry and, arguably, had no

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\(^5\) A consensus is building in the management literature that the term ‘resources and capabilities’ could be used in parallel (Barney & Clark, 2007) because distinctions between these terms are likely to “become badly blurred” in practice (Barney, 2007). According to Barney and Clark (Barney & Clark, 2007, pp. 23-24) “in principle, distinctions among terms like resources, competencies, capabilities, dynamic capabilities…can be drawn. ...(however) they share the same underlying theoretical structure…(thus) the terms resources and capabilities will be used interchangeably and often in parallel (pp. 23-24)….what makes resources a potential source of sustained competitive advantage are the same as what makes capabilities…potential sources of competitive advantage (p. 249).” In essence, though we acknowledge the academic distinctions between resources and capabilities made by a number of scholars (e.g., Amit & Schoemaker, 1993, among others; Makadok, 2001; Teece, Pisano, & Shuen, 1997), we use the terms resources and capabilities together.
need to seek competencies beyond their boundaries early in the life cycle. Thus, if the resources and capabilities in the internal market are valuable, rare, inimitable, and non-substitutable, firms can gain competitive advantage by exploiting just these resources and may not need to seek outside competencies (Barney, 1991, 2001).

Concomitantly, young firms face a number of liabilities and resource constraints requiring them to balance competency development with efficiency in their operations and transactions. Environmental contingencies play a critical role in boundary expansion (Santos & Eisenhardt, 2005, 2009). In the face of contingencies, the manipulation of pre-IPO resources and development of new resource combinations in the form of capabilities becomes crucial. In uncertain environments, firms shape horizontal and vertical boundaries by blending existing and new resources into fresh combinations. Uncertainty can provide opportunities for combining path-breaking and path-dependent resources (Santos & Eisenhardt, 2005). Firms often expand their boundaries for the co-evolution of resources with environmental opportunities. Karim and Mitchell (2000) found that managers of U.S. medical firms use acquisitions to alter horizontal boundaries. Young firms may engage in path-breaking expansion into more distant domains using resource combinations from both the focal and acquired firms. Even established firms explore internal markets before looking beyond their boundaries. The CEO of Philips notes: “we used to start by identifying our core competencies and then looking for market opportunities. Now we ask what is required to capture an opportunity and then either try to get those skills via alliances or develop them internally to fit” (The Economist, Feburary 7, 2002).

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6 Capabilities development reflects specific organizational processes that manipulate resources for creating value by building new resources inside the firm, accessing resources from outside the firm, recombining existing resources in new ways, and eliminating no longer valuable resources (Eisenhardt & Martin, 2000; Teece et al., 1997).
Young firms must make a strategic choice to either continue exploiting their own resources and competencies or to explore new competencies from the market. Building on the resources- and -capabilities perspective, the following section looks at how a firm’s resource portfolio influences boundary expansion choices between internal and external markets.

**HYPOTHESES DEVELOPMENT**

Boundary decisions to gain access or develop resources and capabilities are contingent on the firm’s current resources and the resource requirements of the industry (Argyres, 1996). The literature suggests that various types of resources influence boundary expansion activities, such as strategic alliances and inter firm linkages (Ahuja, 2000; Das & Teng, 1998). For example, Mishina, Pollock, and Porac (2004) found that financial and human resources are directly and indirectly associated with product and market expansion. Firm-specific resources and capabilities (e.g., knowledge, proprietary research and innovations) are more likely to be coordinated within firm boundaries (e.g., Miller, Fern, & Cardinal, 2007; Zander & Kogut, 1995). Therefore, the firms’ resource- and capability-portfolio assumes importance in boundary decisions, particularly for young firms, because their resources and capabilities influence the decision between exploitation of existing capability and exploration of new capability from the market. Next, we discuss the role of R&D and financial resources in boundary expansion decision.

**R&D Resources and Boundary Choice**

R&D resources\(^7\) include expensive equipments, skilled researchers, continuous support, technological capital (e.g. patent), and substantial investments. Montgomery and Hariharan

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\(^7\) The concept of R&D resources has similarities to that of technological capital. However, they are conceptually distinct. Technological resource narrowly refers to technologies (e.g. patents, and uncodified technologies) pertinent to its business and R&D, while an R&D resource includes
(1991) found that higher R&D investment is related to greater diversification and is an outcome of boundary expansion activities. This may not be true, however, for firms that have recently gone public. The young firm’s boundary expansion strategy is influenced by their R&D resources and differs from incumbents’ boundary preferences for a couple of reasons. The newly public firm is obligated to meet the investor expectations for R&D investment. New ventures, go public to raise investment capital, and the potential value of intangible assets plays a major role in the firm’s valuation (Arkebauer, 1991; Certo, 2003; Nelson, 2003). Prior to an IPO, the new ventures signals investors and the market to highlight the promise of their promising technologies, patents, R&D, and human capital (Certo, 2003; Grabowski & Vernon, 1990; Graves & Langowitz, 1993; Nelson, 2003). The new ventures must continue to build on these signals after going public. The post-IPO stage is one of transition in terms of structure and governance. In this phase, they have an opportunity to focus on the exploitation of accumulated intellectual capital, patents, and R&D capabilities and to try to lead their product-market (Deeds, Decarolis, & Coombs, 1997; Jain & Kini, 2000). Hence, TMTs—who have already invested large sums in the propriety technologies favored by external stakeholders—would rather exploit this pre-existing intellectual capital through continued investment rather than expand their boundaries (e.g., acquire a new firm) and deal with the associated structural and governance complexities.

A second reason for the different boundary preferences of young firms is that the internal market may be more beneficial to young firms with considerable R&D resources. Further,
developing technologies within firm boundaries offers better control over property rights and issues of appropriability than does negotiating for technologies through acquisitions. Although choosing to develop technologies within the firm’s boundaries decreases exposure to opportunistic behavior, the growth of the strategic factor market via R&D investments promotes synergy, complementarity, and learning within business units in the hierarchy (Karim & Mitchell, 2000). The TMT of a young firm may prefer internal R&D over acquisitions (for both appropriation and coordination issues) given the constraints on managerial time, attention, and resources (Karim & Mitchell, 2000). Further, research and development divisions that grow from within have better communication and coordination both within and across organizational functions and hierarchies.

In addition, internal R&D investments develop strategic factor markets for the creation of innovative product-markets for long term success (Thompson & Strickland, 1980). Because firms’ innovation strategies often build on the absorptive capacity developed over time by internal R&D (Cohen & Levinthal, 1990), the existence of strategic factor markets has important implications for the development of technological strategy and choice of product-markets (Burgelman, 1986; Hoskisson & Hitt, 1990). Young firms need to develop such absorptive capacity sooner rather than later because they are in the early stage of life cycle. Internal R&D investment is higher priority than acquisitions from the external market. Even after developing large absorptive capacity, young firms still have less incentive than incumbents to expand capabilities through acquisitions or inter-firm relationships. The process of capability development tends to be path dependent (Leonard-Barton, 1992). Past R&D successes are likely to lead to stick on its preference on in-house development. Proponents of the resource allocation view suggest that resource allocation is a primarily internal process (Bower, 1970; Burgelman,
Founder preference for legacy projects may lead young firms to continue to focus resource allocation on the internal factor market.

The need for resource and competency development is another reason for the different boundary preferences of young firms. Young firms may first exploit resources from within organizational boundaries or internal markets (Chandler, 1962); focus on internal aggregation of resources; and efficiently use business units for resource and competency development (Galunic & Eisenhardt, 1996, 2001; Siggelkow, 2001). Because internal markets provide synergy between the development of resources and competencies and superior control and efficiency in the process of innovation (Jacobides & Hitt, 2005; Santos & Eisenhardt, 2005), young firms may create and maintain an optimal resource portfolio developed by R&D investments while reducing complexity and increasing control and efficiency (Williamson, 1985). In a study of new ventures, Santos (2003) found that entrepreneurs first develop resources around internal processes reflecting resources and competencies and only later pursue boundary expansion. Within the IPO context, given the advantages of expanding through the internal market, and considering the order of capability development, we propose that young firms with heavy R&D investment continue developing resources and capabilities internally rather than through boundary expansion.

**Hypothesis 1.** For young firms that have undertaken an IPO, R&D resources are negatively related to boundary expansion activities in the initial post-IPO stage.

**Financial Resources and Boundary Expansion**

Although internal markets are a useful way for young firms to develop resources and capabilities, they are costly and difficult to develop single-handedly (Barney, 1999).
Developing capabilities involves a difficult to identify, unique historical condition. Capability development is path dependent (Leonard-Barton, 1992) and requires engagement with complex social networks. Finally, actions to develop capabilities may be causally ambiguous (Reed & DeFillippi, 1990). Thus, firms are constrained from developing capabilities on their own, and are lead to rely on external markets. The use of external markets for this purpose via modes such as acquisitions or alliances has several advantages over such efforts in the internal market. They include resource sharing, low governance costs, resource reallocation, and increased market power (Hitt, Hoskisson, Johnson, & Moesel, 1996; Walter & Barney, 1990). Use of the external market to gain desired capabilities, however, is not risk free and requires substantial efforts. Among the various types of resources, the most important to boundary expansion is financial (Iyer & Miller, 2008; Santos & Eisenhardt, 2005).

Early-stage firms obtain financial resources in a number of ways, including venture capital, banks, family, and IPO. Financial resources refer to liquid funding (which is available for investment in new projects) and monetary-equivalent resources. The resources are easily accessible and therefore usually support the firm’s growth strategy (Penrose, 1959). Thus, financial resources provide a competitive advantage to firms (Barney, 1991; Latham & Braun, 2008). The existence of liquid financial resources demonstrate the firm’s ability to meet current capital needs and support operations (Mishina et al., 2004). Young firms with sufficient financial resources have more options and a different perspective on boundary expansion through acquisition, strategic alliances, and joint venture. In the presence of adequate financial resources, young firms may be motivated to engage in boundary expansion activities for the following reasons. After an
IPO, firms generally have sufficient capital (e.g., net proceeds) to support boundary expansion. The substantial cash infusion provided by an IPO can increase firm performance and survivability. The TMT should decide how to deploy IPO resources. Young firms may create value through vertical or horizontal boundary expansion by exploiting excess valuable resources (Teece, 1982), or by intensifying exiting strategies. Unlike R&D, financial resources enable young firms to engage in boundary expansion and gain access to additional resources and capabilities that are consistent with the firm’s current capabilities, potentially fueling future growth.

A second motivation for boundary expansion in the presence of adequate financial resources is that these if financial resources reduce the managerial risk that when the scope of the firm broadens derived by broadening scope of firms. Managers deploy their financial resources with the expectation of creating value, enabling them to consider a broader range of strategic options. Financial resources can be used to purchase equipment, employ expertise, build and expand plants, invest in R&D, and enhance operations (Amit & Schoemaker, 1993). Because firm size and executive compensation are highly correlated (Tosi Jr & Gomez-Mejia, 1989) and because diversification smooths cash flow and reduces employment risk (Amihud & Lev, 1981), managers have incentive to increase the size of the firm through boundary expansion.

Adequate financial resources also support the growth strategy of the firm through boundary expansion (Kumar, 2009). With these resources, the top management team (TMT) can take advantage of emerging opportunities in the market by acquiring capabilities from others or by working with others to develop new competencies. There is evidence that firms are more likely to expand their product lines through strategic
alliances when they have greater financial resources (Garrette, Dussauge, & Castaner, 2008). Iyer and Miller (2008) also found that financial resources increase the probability of acquisition. Because IPO firms are under strong demands for growth, they are less likely to conserve and more likely to deploy available capital to support their growth strategy. On the other hand, lack of financial resources constrains firm’s strategic options because strategic decisions regarding organizational boundary expansion are risky and uncertain. Therefore, we propose that financial resources facilitate boundary expansion in young firms.

_Hypothesis 2. For young firms that have undertaken an IPO, financial resources are positively related to boundary expansion activities during the initial post-IPO stage._

**Role of Environmental Contingencies**

In addition to availability of the above mentioned resources, environmental contingencies (e.g., environmental dynamism and industry competition) also influence boundary expansion decisions (Poppo & Zenger, 1998; Santos & Eisenhardt, 2005; Schilling & Steensma, 2001). We now examine the roles of environmental uncertainty and competitive intensity in boundary expansion decisions.

**Environmental uncertainty.** Firms adapt their strategies to match environmental changes. A firm’s preference for internal or external markets in searching out new competencies changes in the face of environmental uncertainty (Galunic & Eisenhardt, 2001; Gilbert, 2005). For a young firm that has recently undertaken an IPO, market uncertainty is a primary contingency that
must be considered before exploring opportunities for boundary expansion. In general, uncertainty is the inability to predict or foresee events (Anderson & Tushman, 2001). Uncertainty arises when a decision maker cannot reliably forecast future events based on the available information. Uncertainty influences boundary decisions for several reasons. First, young firms find it difficult to define the parameters of a changing environment and to find a fit with the changing environment. Secondly, in an unpredictable environment, resources such as knowledge and learning become obsolete more quickly and success is more difficult to reproduce (Leonard-Barton, 1992; Tushman & O'Reilly, 2002). Third, TMT becomes risk averse in an unpredictable environment. Risk-averse principals fear losing a dollar more than they value gaining a dollar (Benartzi & Thaler, 1995; Kahneman & Tversky, 1979). Consequently, the less predictable the outcomes, the more likely principals will avoid boundary expansion. Indeed, Christensen and Bower (1996) found that risk-averse managers do not experiment with new strategies or technologies unless benefits are guaranteed. In essence, faced with market uncertainty, TMTs of young firms are averse to investing time, attention, or resources in boundary expansion activities that are difficult to undo (Ghemawat, 1991).

Through the lens of transaction cost economics, uncertainty about the future is a source of inefficiency in establishing business relationships with outside parties (Pisano, 1990). An environment fraught with uncertainty makes it difficult to write, execute, or monitor contractual arrangements (Leiblein & Miller, 2003; Walker & Weber, 1987; Williamson, 1985). It is particularly difficult to specify boundary expansion contracts when uncertainty is high. An increase in uncertainty makes it difficult to complete the due diligence required for boundary expansion; the basic task of correctly evaluating potential boundary expansion modes becomes challenging due to market fluctuations and the resulting risk of paying abnormally high
premiums. Further, uncertainty exacerbates legal, structural, and governance related complexity. Any boundary expansion contract remains incomplete under such circumstances, potentially leading to a series of renegotiations. Each renegotiation opens the firm to the self-serving behavior of the other party. The potential for self-serving behavior leads to intensive monitoring and possible legal recourse, which, in turn, generates transaction costs and inefficiency. Thus, according to transaction cost economics, high levels of uncertainty make boundary expansion (through modes such as acquisition) problematic, pressuring firms to avoid such activities.

Young firms that have already invested in R&D and developed promising technologies would be further discouraged from taking boundary expansion initiatives in the face of uncertainty. Such firms would prefer to exploit intellectual capital, launch new products, and counter uncertainty by creating market demand. They would focus on developing absorptive capacity rather than acquire new firms and deal with the additional structural and governance complexities. Uncertain times motivate young firms to enhance their internal R&D efforts over boundary expansion modes for greater appropriation, control, and coordination from within the hierarchy. In addition, environmental uncertainty decreases the external market preference of young firms with excess of financial resources. When the future is unpredictable and unstable, managers do not take the considerable risk of boundary expansion; they are unwilling to make bold decisions, preferring to manage their careers in less risky ways. Instead, they back internal R&D projects where trajectory and demand are assured. In sum, uncertainty makes difficult for young firms to expand their boundaries.

**Hypothesis 3.** For young firms that have undertaken an IPO, environmental dynamism in the industry moderates the relationship between R&D resources and
boundary expansion such that when the level of environmental dynamism is high, R&D resource is more negatively related to boundary expansion.

Hypothesis 4. For young firms that have undertaken IPO, environmental dynamism in the industry moderates the relationship between financial resources and boundary expansion such that when the level of environmental dynamism is high, financial resources are less positively related to boundary expansion.

Industry competition. Competition provides pressures of inherent instability and change (D'Aveni, 1994). Young firms with unique resources will be motivated to focus on their competencies to exploit their intellectual capital and launch competitive products that create a niche for them in the market. Further, in highly competitive environments, young firms must respond to the environment and achieve a close fit with market demand; they must do so quickly in order to survive. Because competitors create frequent discontinuities in the stable industry structures, corporate forms, and business-specific resources (D'Aveni, 1994; Hamel, 2000; McNamara, Vaaler, & Devers, 2003); competitive pressures offer little room for delay in exploiting intellectual capital, resources, and capabilities. Competition pressures firms to rapidly exploit resources, capabilities, and core competencies, giving managers little time or opportunity for boundary expansion.

To be competitive, young firms with R&D resources would focus on developing new competencies and absorptive capacity in-house, rather than become involved in the complexities of building inter organizational relationships or acquiring another firm. Under competitive
pressures, the risks of technology spillover and espionage motivate young firms to take greater control and appropriation which are the characteristics of hierarchy.

In contrast, sufficient financial resources play the role of slack, giving the firm added flexibility. Under strong competitive pressures, the young firm’s preference for external markets is more pronounced. Choosing an external market gives the young firm access to the resources and capabilities of other firms. Through external markets, young firms are able to enter niche markets or deal with competitive pressure by increasing their market power. Competitive industries offer fewer opportunities for growth. Working with others and acquiring another firm would be of the best choice, even for post IPO firms with sufficient financial resources.

In sum, in the face of competitive pressures, young firms that have developed superior R&D resources should focus on enhancing their existing capabilities in house. In contrast, adequate financial resources provide young firms with some leeway for boundary expansion initiatives in face of competition.

Hypothesis 5. For young firms that have undertaken an IPO, industry competition moderates the relationship between R&D resources and boundary expansion such that when the level of competition is high, R&D resources are more negatively related to boundary expansion.

Hypothesis 6. For young firms that have undertaken an IPO, industry competition moderates the relationship between financial resources and boundary expansion such that when the level of competition is high, financial resources are more positively related to boundary expansion.
METHODS

Data and Sample

The initial sample consisted of 175 IPO firms between 2001 and 2005. The firms were in the U.S. high technology industry, which includes the two digit SICs 28 (chemicals and allied products), 35 (industrial machinery and computer equipment), 36 (electronics and other electric equipment), 38 (instruments and related products), 48 (communications), and 73 (Business services-software) (Bradley, Jordan, Yi, & Roten, 2001; Carpenter & Petersen, 2002; Loughran & Ritter, 2004). The time frame of 2001 to 2005 was selected to avoid selection bias. The number of IPO firms in the late 1990s, when Internet bubble occurred, could cause unbalanced sample sizes and possible over- or under-estimation of results.

We collected data from a variety of sources. The IPO data was collected from prospectuses (i.e., 424b form) provided to the Securities and Exchange Commission (SEC) electronic data gathering and retrieval system. Boundary expansion data were gathered from the Securities Data Company (SDC) platinum, and other financial data were retrieved from COMPUSTAT. After matching IPO, boundary expansion, and financial data, the final sample included 158 firms from 2001 to 2005 in 41 4-digit SIC industries, consisting of 19, 18, 24, 63, and 34 firms in each year.

Measures

Dependent variable. This paper examines the organizational boundary activities of a focal firm resulting from unique resources in the early stage. Therefore, organizational boundary expansion activity was measured by the aggregated number of acquisitions, strategic alliances,

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8 14 firms in the final sample could not be used in the analysis because of the lack of financial data or the unusual value (e.g. -838.2 of ROA). Three firms were excluded because the prospectuses could not be found for them.
and joint ventures (Keil, Maula, Schildt, & Zahra, 2008) initiated by a focal firm four years after an IPO. This measure captures the organizational boundary expansion intensity, in that the higher the firm’s boundary expansion intensity, the more the firm acquires, engages in strategic alliances, and forms joint ventures. The sample of IPO companies is belonged to relatively early stage in the organizational life cycle. Forty-eight percent of the sample firms reported no boundary expansion activities (zero). About 52 percent engaged in 1-11 (1 being the least and 11 the most) boundary expansion activities.

**Independent variables.** We had two independent variables: R&D resources and financial resources. First, R&D intensity has been used as a proxy for technological resources by many scholars (e.g., Hill & Snell, 1988; Montgomery & Hariharan, 1991). Although others use patent portfolio for technological resources, the concept of resources in this paper is broader and includes tangible and intangible resources that support R&D activities. Thus, we measured R&D resources using R&D intensity, which is the value of R&D expenses divided by total assets. Because more than 20 percent of young IPO firms in the sample did not have the amount of sales in the early years of product development, we used total assets as the denominator rather than total sales. We collected this data from the prospectuses of IPO firms.

Second, young firms may have sufficient financial resources to initiate new projects or expand their organizational boundaries. We measured financial resources using the number of months if the existing cash flows from operations, together with borrowings and net proceeds from IPO, are sufficient to fund its working capital requirements in the future without raising additional security. The data was collected from IPO prospectuses. The number of months varies from 6 to 42. It is expected that the higher the number, the more financial resources the firm has.
**Organizational contingencies.** Environmental uncertainty can be broken into three dimensions (e.g. complexity, munificent, and dynamism) (Dess & Beard, 1984). To capture the uncertain and volatile characteristics of environment, we used the environmental dynamism dimension and measured it as the natural logarithm of sales figures were entered into quasi-time series regressions with time serving as the independent variable. The antilog of the standard errors of the resulting regression slope coefficients were then used to capture environmental volatility (Dess & Beard, 1984; Keats & Hitt, 1988). For competition in the industry, literature measured a firm level competitive intensity as the firm’s market share (e.g., Mezias & Boyle, 2005; Swaminathan, 1995).

To measure the level of competition in the industry, we used the inverse of the four-firm concentration ratio obtained from the U.S. Census of manufacturers for the year of IPO. We collected this data from COMPUSTAT. Each value represents environmental uncertainty based on the four-digit SIC.

**Control variables.** We included several control variables to avoid alternative explanations. First, we controlled for the use of proceeds if an IPO firm disclosure expansion-related use of proceeds. IPO firms disclose how they intend to use the proceeds of the IPO. Uses can be categorized as debt repayment; distribution to pre-IPO shareholders; expansion or acquisitions; advertising, marketing, promotion, or sales; working capital; R&D; and general corporate purposes (Leone, Rock, & Willenborg, 2007). This variable was dummy coded 1 if the firm intended to use the proceeds for expansion (i.e. acquisition, joint venture, alliance, or expansion); otherwise it was coded as 0. This data was collected from SDC Platinum and prospectuses. Organizational boundary expansion may differ across industries. To control for the unobserved *industry effect*, dummy variables based on two-digit SIC codes were included.
The total number of patents was included in the model as a control variable. Patent data has been used as a proxy for technological resources or competencies (Silverman, 1999). Additionally, patent numbers may influence the young firm’s boundary expansion activities by providing more opportunities to build interorganizational relationships.

We included year dummies to control for the possible influence of yearly trends in IPO and acquisition. Founder and insider ratios in BOD were used to control for the influence of governance on expansion decisions. CEO as a founder and board of directors (BOD) consisting of large number of insider are more likely to prefer to internal market (Certo, Covin, Daily, & Dalton, 2001). Founder effect was dummy-coded based on whether the CEO was a founder. The insider ratio was determined from the number of insiders on the board of directors divided by the total number of directors. Finally, we controlled for two firm specific factors: firm size measured as the natural log of total assets at the time of IPO, and firm age as the difference between foundation year and IPO year.

**Analysis**

Because the number of boundary expansion activities is constrained, and a number of observations had a value of zero, we used the Tobit regression model to test the hypotheses. Tobit regression works better with censored data, which may be left or right censored (Greene, 2003). In the Tobit model, the independent variables are tested if they influence the probability that the dependent variable exceeds zero (or a given threshold value); the value of the dependent variable is tested if it exceeds zero (Bowen & Wiersema, 2004; Helfat, 1994). All continuous variables in the model were centered with mean to avoid multicollinearity problems between variables (Aiken & West, 1991). This procedure also makes it easier to interpret the results.
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<td>5. Number of patent</td>
<td>1.38</td>
<td>0.76</td>
<td>-0.03</td>
<td>0.00</td>
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<tr>
<td>6. Insider ratio</td>
<td>0.57</td>
<td>0.25</td>
<td>0.00</td>
<td></td>
<td>0.29</td>
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<tr>
<td>7. Environmental dynamism</td>
<td>1.12</td>
<td>1.01</td>
<td>0.03</td>
<td></td>
<td>0.17</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>8. Industry competition</td>
<td>1.70</td>
<td>2.70</td>
<td>0.19</td>
<td></td>
<td></td>
<td>-0.12</td>
<td>-0.18</td>
<td>-0.12</td>
<td>-0.09</td>
<td>0.02</td>
<td>-0.29</td>
<td></td>
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<tr>
<td>9. R&amp;D resource</td>
<td>0.25</td>
<td>1.34</td>
<td>-0.10</td>
<td></td>
<td>-0.49</td>
<td>-0.18</td>
<td>-0.68</td>
<td>-0.30</td>
<td>-0.16</td>
<td>-0.05</td>
<td>0.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Financial resource</td>
<td>14.92</td>
<td>6.42</td>
<td>-0.03</td>
<td></td>
<td>-0.34</td>
<td>-0.05</td>
<td>-0.17</td>
<td>0.12</td>
<td>-0.24</td>
<td>0.05</td>
<td>0.11</td>
<td>0.28</td>
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| a N=158                  |      |      |     |     |     |     |     |     |     |     |     |     |     |

| †  | p < .10          |
| *  | p < .05          |
| ** | p < .01          |
| ***| p < .001         |
TABLE 3.2  
Results of Tobit Regression Analysis for Boundary Expansion $^a$

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>3.07***</td>
<td>2.96***</td>
<td>3.39***</td>
</tr>
<tr>
<td>Control variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firm size</td>
<td>0.19</td>
<td>0.22</td>
<td>0.16</td>
</tr>
<tr>
<td>Firm age</td>
<td>0.06</td>
<td>0.02</td>
<td>0.20</td>
</tr>
<tr>
<td>ROA</td>
<td>-1.19*</td>
<td>-2.29***</td>
<td>-2.29***</td>
</tr>
<tr>
<td>Number of Patent</td>
<td>0.20</td>
<td>0.26*</td>
<td>0.34*</td>
</tr>
<tr>
<td>Use of Proceed</td>
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<td>-0.03</td>
<td>-0.29</td>
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<tr>
<td>Founder</td>
<td>-1.14*</td>
<td>-1.13*</td>
<td>-1.00*</td>
</tr>
<tr>
<td>Insider ratio</td>
<td>0.29</td>
<td>1.18</td>
<td>0.89</td>
</tr>
<tr>
<td>Sic28</td>
<td>-2.20**</td>
<td>-3.04***</td>
<td>-2.96***</td>
</tr>
<tr>
<td>Sic35</td>
<td>-3.36**</td>
<td>-2.97*</td>
<td>-3.74**</td>
</tr>
<tr>
<td>Sic36</td>
<td>-1.54*</td>
<td>-1.02</td>
<td>-1.54*</td>
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<tr>
<td>Sic38</td>
<td>-3.03***</td>
<td>-2.80**</td>
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<tr>
<td>Sic48</td>
<td>-4.78**</td>
<td>-5.10***</td>
<td>-4.99***</td>
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<tr>
<td>Year01</td>
<td>-0.33</td>
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<tr>
<td>Year02</td>
<td>-1.01</td>
<td>-1.08</td>
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<td>Year03</td>
<td>0.09</td>
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<td>Year04</td>
<td>-0.47</td>
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<td>Direct effect</td>
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<tr>
<td>Environment dynamism</td>
<td>1.05</td>
<td>-2.10</td>
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<tr>
<td>Industry competition</td>
<td>0.91*</td>
<td>-0.10</td>
<td></td>
</tr>
<tr>
<td>R&amp;D resource</td>
<td>-3.44**</td>
<td>-2.22*</td>
<td></td>
</tr>
<tr>
<td>Financial resource</td>
<td>0.13**</td>
<td>0.11*</td>
<td></td>
</tr>
<tr>
<td>Two way interaction effect</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>R&amp;D resource X Environment dynamism</td>
<td>-18.86**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R&amp;D resource X Industry competition</td>
<td>-8.20***</td>
<td></td>
<td></td>
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<tr>
<td>Financial resource X Environment dynamism</td>
<td>-0.20</td>
<td></td>
<td></td>
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<tr>
<td>Financial resource X Industry competition</td>
<td>0.04</td>
<td></td>
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<tr>
<td>Log likelihood</td>
<td>-254.77</td>
<td>-248.36</td>
<td>-242.82</td>
</tr>
<tr>
<td>Chi-square</td>
<td>31.28*</td>
<td>44.10**</td>
<td>55.18***</td>
</tr>
<tr>
<td>Chang in Chi-square</td>
<td>12.82***</td>
<td>11.08***</td>
<td></td>
</tr>
</tbody>
</table>

$^a$ N=158, † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$
RESULTS

The descriptive statistics of all variables and correlations among dependent variables, independent variables, and control variables are reported in Table 1. The correlation matrix shows that there is no high correlation between any two variables, proving that multicollinearity is not a problem in this model. We also did a more conservative check of multicollinearity using robust regression analysis. The tolerance and variance inflation factor (VIF) demonstrate that multicollinearity among the independent and control variables was not severe.

The results of the Tobit regression model are in Table 2. Model 1 includes all control variables. In Model 2, direct effects were tested, and two-way interaction terms were included in Model 3. All models were statistically significant ($p<0.05$). Model 3, with interaction terms, significantly improved the model fit on Model 1 and Model 2 as indicated by the change in chi-square ($p<0.001$). Hypothesis 1 proposes that R&D resources are negatively associated with boundary expansion. The regression coefficient for R&D resource in model 2 was negative and significant ($\beta = -3.44, p<0.01$). Thus, the results from Model 2 provide support of hypotheses 1. As suggested, young firms with high R&D investment are less likely to build capability through boundary expansion activities in the industry.

In hypothesis 2, we argue that higher levels of financial resources increase the levels of boundary expansion activity. The coefficient associated with financial resource in Model 2 is significant and positive ($\beta = 0.13, p<0.01$). Thus, hypothesis 2 is supported.

In hypotheses 3 to 6, we suggest that the relationship between unique resources and boundary expansion activities depends on environmental contingencies in the industry. It is expected that both environmental uncertainty and industry competition affect the young firms’ strategic choices in terms of boundary expansion. Model 3 in table 2 supports hypotheses 3 and 4.
($p<0.01$ for hypothesis 3, and $p<0.001$ for hypothesis 4), but not hypotheses 5 and 6. Only, the interactions between R&D resources and environmental contingencies have significant and consistently negative coefficients.

To further explore the nature of these relationships, we plotted the two-way interactions using ±1 standard deviation from the mean of environmental uncertainty and industry competition (Aiken & West, 1991). The one standard above from the mean represents high level of environmental contingency, and *vice versa*. The graph a) in Figure 1 shows that R&D resources are more negatively associated with acquisition for young firms in highly dynamic environments, than for those in stable environments. Graph b) can be interpreted to show that as industry competition increases, boundary expansion activities implemented by young firms with high R&D resources decrease. In stable environments with low industry competition, however, R&D resources are less negatively related to acquisition, and the number of acquisitions, alliances, and joint ventures increase. However, the relationship between financial resources and boundary expansion is unaffected by environmental factors. Overall, the results are consistent with the argument regarding two contingencies and R&D resources and show that with which resources firms are more or less exploring outside of firm boundaries.
FIGURE 3.1
Interaction Effects among R&D Resource, Environmental Dynamism, and Industry Competition

a) The Interaction Effect of Environmental Dynamism

b) The Interaction Effect of Industry Competition
DISCUSSION AND CONCLUSION

Firms prefer different search and renewal strategies depending on their life-cycle stage. Incumbents expand boundaries through acquisitions, alliances, joint ventures, and other means to seek new competencies and renew existing competencies. However, there is a gap in the literature regarding the preferences of young firms’ for various boundary expansion options under contingencies—how young firms differ from incumbents in this regard and how their unique resources and inherent liabilities affect their preferences. This study examines the boundary choices made by young firms’. From the capability perspective, we suggest that the unique resources of a young firm can explain patterns of organizational boundary expansion. The results of this study, based on a sample of high technology firms, suggest that young firms’ boundary expansion decisions are consistent with the available, unique, resources they possess. Young firms with substantial R&D resources are more likely to continue developing internal capability due to the obligations and legitimacy needs of the IPO firm, the advantages of the internal market, and the order of capability development. In industries such as biotechnology, product development cycles are extremely long (seven to ten years) and the need for cash investments is immense (Burrill & Lee, 1993). Continuous exploiting capability within organization boundary is necessary and more preferred than exploring new capability in the market.

In contrast, young firms with high financial resources prefer to take advantage of environmental opportunities beyond their current organizational boundary through market transaction mechanisms such as acquisitions, alliances, and joint ventures. Young firms need continued funding to grow and prosper (Jain & Kini, 1999). Going public provides sufficient capital to support the growth of a young. When managers identify opportunities in the market,
they have strong incentive to exploit them using IPO capital. This strategic choice allows young firms to gain access to a greater variety of opportunities and to increase the firm’s potential value (Sirmon, Hitt, & Ireland, 2007).

Considering the characteristics of environment, R&D resources are more deterministic than financial resource regarding organizational boundary decision. That is, young firms with substantial R&D resources rely more on the internal factor market to develop competence and capability in competitive and dynamic environments. This could be due to the increased management costs associated with uncertainty (Dundas & Richardson, 1980). In situations of uncertainty and rapid technological change, where divisions are connected by investment in specific technological assets, the advantages of being closely linked evaporate (Hill & Hoskisson, 1987). Strong competition also pressures young firms with R&D resources to focus on developing new competencies and absorptive capacity in-house rather than shouldering the complexities associated with acquisition.

However, the boundary expansion decisions of young firms with sufficient financial resources are not affected by environmental contingencies. This can be interpreted to mean that financial resources as slack have stronger effect on boundary decisions regardless of the market context. Financial resources provide a cushion that gives firms discretion (Bourgeois, 1981), allowing them to adapt to internal and external pressures, and to change strategies. Given that slack resources could be diverted or redeployed to achieve organizational goals (George, 2005), it seems logical then that the existence of these liquid financial resources—which indicate that the firm has resources in excess of what is required to meet current obligations and support sales levels (Mishina et al. 2004)—would permit IPO firms to engage in boundary expansion activities without worrying much about the specific context. Although external markets have greater risks
in uncertain markets, managers consider acquisitions and joint ventures to be superior means of accessing to capabilities and exploiting market opportunities.

**Theoretical and Practical Implications**

This study has several important implications for boundary expansion research, IPO firms, and practitioners. Firm boundary research has typically examined decisions such as performing internal R&D, or using a technological alliance (Pisano, 1990; Robertson & Gatignon, 1998), making or buying car parts (Monteverde & Teece, 1982), pursuing a joint venture or a wholly owned subsidiary (Hennart, 1991). Similarly, this paper focuses on the decision of whether to continue investing in R&D or gain access to capabilities through the market. More specifically, we focus on high technology IPO firms. This article contributes to the literature by moving away from the traditional focus on well-established firms. The motivations and behaviors of managers are different in pre and post-IPO firms where market scrutiny and the need to deliver results every fiscal quarter are increased (George, 2005). This paper provides support for the capability perspective in the boundary literature. IPO context differs from the general context where incumbents are experiencing. Net proceeds from going public give IPO firms a substantial advantage in capability development. Our findings suggest that, in the IPO context, the most important factors influencing boundary choice are the firms resources specifically R&D and financial. It implies that the nature and potential value of different types of resources (Walter & Barney, 1990) should be understood differently over the life cycle.

From a managerial perspective, resources should be taken into account when making boundary expansion decisions. Evaluating strategic options based on transaction costs may not be sufficient to create value for the firm. Although transaction costs in the external market are low and attractive, seeking capabilities beyond the organizational boundary, will likely fail
without a solid analysis of the available internal resources and firm’s capability needs. Thus, managers should first understand their resource portfolio and then decide whether exploitation is beneficial and increases their long-term competitive advantage.

**Limitations and Future Research**

Despite the care taken in data gathering and statistical analysis, this study has some limitations. First, although this study included a fairly broad range of firms from different industries, the unique characteristics of high-tech firms may have influenced the results. A focus on less technology-intensive IPO firms, or firms in more stable industries might reveal additional insights into the search and renewal strategies of IPO firms. Second, the exclusive focus on R&D and financial resources limits the study. Other resource dimensions, such as physical or commercial, might significantly influence a firm’s boundary choice. Third, boundary expansion can be narrowed down in terms of industry and national boundary, and future research may examine how different types of resources influence these dimensions of boundary expansion. Fourth, organizational boundary can be explained through a number of different perspectives—power, competency, efficiency, and identity (Santos & Eisenhardt, 2005). In this paper, we discuss boundary primarily from the competency perspective using resource-and capability-views because they arguably explain boundary expansion more completely than others (such as efficiency or power) (Jacobides & Hitt, 2005). Future research may compare and contrast all four perspectives with comprehensible sample. Finally, this paper does not consider the implications of boundary choice on performance. Although, not part of the study, we found that high R&D intensity in early stage firms is positively related to market-based performance (measured by Tobin’s q). Future research may investigate the best time for IPO firms to engage in boundary
expansion. Additionally, researchers may examine conditions affecting how timing and the choice of mode influences the market performance of a young firm.

In conclusion, this study investigates the various search and renewal strategies of young firms. Based on the resources- and -capability perspectives, this study found that R&D resources increase the boundary expansion activities in early stage firms, contingent on environmental uncertainty and competitive intensity. Financial resources also influence the extent to which firms engage in boundary expansion activities. These findings help to explain the implications of resources on exploitation and exploration decisions, and contribute to the boundary expansion and capability development literature, particularly in the IPO context.
REFERENCES


CHAPTER FOUR

PAPER THREE

INITIAL PUBLIC OFFERING AND THE STRATEGIC BEHAVIOR OF FIRM:
DIFFERENTIATION AND PERFORMANCE

ABSTRACT

This study examines the role of new ventures’ differentiation strategy on their short- and long-term performance after the IPO—particularly, at the time of IPO (initial public offering) and during post-IPO stages. New ventures in the high technology industry strategically differentiate themselves by exploring novel technologies rather than continuing to exploit existing technologies or mimicking other firms’ technologies. We argue that the new ventures’ use of novel technologies developed upon their unique resources and capabilities provide an initial setting for competitive advantage both in the short- and long run. We find that new ventures that use differentiation as their innovation strategy would yield superior performance as compared to the ventures that mimic existing technologies. Further, we find that the presence of environmental uncertainty enhances the performance of those new ventures that have developed novel technologies drawing upon their unique resources and capabilities.

Keywords:

New venture, differentiation, performance, IPO
INTRODUCTION

Scholars in strategic management and organization theory have argued that firms particularly a new venture, is in direct competition with its competitors in the industry and also faces indirect competition with other actors in the external environment (Baum & Haveman, 1997; Deephouse, 1999; Lieberman & Asaba, 2006). New ventures’ technology strategy regarding differentiation or mimicry plays an important role in their future performance (Chatterji, 2009; Phillips, 2002; Ruef, Aldrich, & Carter, 2003; Vesper, 1990). On one hand, a new venture’s performance is related to its ability to differentiate itself from its competitors. By differentiating their resources and market position from those of incumbents, new ventures are able to reduce the likelihood of imitation and place themselves in a more competition position (Lieberman & Asaba, 2006). Additionally, differentiation of resources from competitors reduces competition for them in the market (Barney, 1991; Porter, 1991), leading to higher performance. On the other hand, new ventures may rely on conformity to the industry norm. Entrepreneurial ventures may mimic incumbents’ behavior in the industry because they face of high levels of uncertainty regarding technology strategy (Meyer & Rowan, 1977; Pfeffer & Salancik, 2003). Strategic similarity allows the new venture to be recognized as following legitimacy, reducing risks inherent in exploration (DiMaggio & Powell, 1983). However, it is still less understood which approach is more beneficial in an initial public offering (IPO) context.

IPO is a process through which a new venture goes public. IPO provides new ventures an opportunity to obtain financial capital from investors, increase recognition and visibility of the new ventures by exposing to investors, and often obtain higher values as the acquisition targets (Brau & Fawcett, 2006; Certo, Holcomb, & Holmes Jr, 2009; Nelson, 2003; Pagano, Panetta, & Zingales, 1998). In addition, going public allows new ventures not only to increase their
legitimacy in the business community but also to gain improved access to debt financing (Cohen & Dean, 2005; Deeds, Mang, & Frandsen, 2004; Higgins & Gulati, 2005; Pollock & Rindova, 2003; Sutton & Benedetto, 1988). IPO also involves disadvantages, such as a loss of ownership, increased financial and operational scrutiny of the business, vulnerability to the external environment, and high cost of going public (Certo et al., 2009). For a new venture, delivering correct signal to the market is important (Daily, Certo, Dalton, & Roengpitya, 2003) and as such managers of recently IPO firms should find a mechanism to manage the quality of their new venture for reducing uncertainty and attracting more investors. Signals, such as the characteristics of top management team, help in gaining legitimacy in the market (e.g., Deeds et al., 2004; Gulati & Higgins, 2002; Higgins & Gulati, 2003; Pollock & Rindova, 2003). However, literature is yet to focus its attention on how a new venture’s technology strategy influences its performance both in the short and long term.

This study builds on signaling theory (Spence, 1973, 1974b) and explores which strategic action, technological mimicry or differentiation, delivers superior performance in the IPO and post-IPO context. We consider mimicry and differentiation as a continuum of strategic actions and choices. We consider differentiation as one end of the continuum whereas mimicry is other end. In the context of technology strategy, we define differentiation as those technology choices that help distinguish a new venture from others whereas strategic similarity refers to strategic actions that lead to technological mimicry and help resemble other firms in the industry. A new venture’s choice on this continuum delivers appropriate signal to the potential investors in the market. We propose that a new venture’s strategic choice before IPO plays a critical role in its short- and long-term performance after the IPO because investment decisions of shareholders at
the time of IPO and subsequent investments depend on the new venture’s potential to create high return on investment.

This paper is structured as follows: First, we discuss the role of information asymmetry and signaling theory on IPO- and subsequent performance. Second, we explain strategic actions and technological choice from signaling perspective. Third, we develop hypotheses explicating the role of such actions and choices on new venture’s short- and long-term performance. Fourth, we test the proposed hypotheses and finally, we discuss the findings and implications.

THEORY AND HYPOTHESES

Information Asymmetry and Signaling Theory

IPO is characterized by information asymmetry because the current owners (i.e., internal managers) have access to more information about the internal operations while potential investors in the market have access to relatively less information (Downes & Heinkel, 1982). Information asymmetry is created because IPO takes place when potential investors have relatively less knowledge than the security owners and such asymmetry open up the potential for opportunistic behavior by owners (Carter & Manaster, 1990; Stuart, Hoang, & Hybels, 1999).

The available information in the market plays the role of a signal from owners to the potential investors. Signaling theory (Spence, 1973, 1974b) suggests that certain indicators about quality of IPO new venture provide signals to potential investors, increasing the future value of the new venture (Deeds, DeCarolis, & Coombs, 2000). Signaling activities are useful, especially when high information asymmetry exists (Spence, 1973). When there is significant difference in the amount of information between owners and investors, the signal reduces the information asymmetry because signal is both observable and costly to imitate (Certo, Daily, & Dalton, 2001;
Spence, 1973). Because IPO new ventures must release their internal information in the market through prospectus, signaling mechanisms play a major role in the IPO process. Since the potential investors make a decision based on the signal, the IPO new ventures may delay IPO until they can provide more positive signal (e.g. demonstrating high performance) to the potential investors (Jenkinson & Ljungqvist, 2001).

To be effective, market signal should meet the conditions that it is observable, difficult to change, costly to produce and imitate, and persistent (Riley, 1975; Spence, 1974a). Although market signal is difficult to imitate, IPO new ventures are more likely to imitate the strategies practiced in past so as to gain legitimacy and enhance the value. Next, we discuss types of strategic actions a new venture may adopt.

**Performance Implications of Strategic Similarity vs. Differentiation**

Scholars have discussed strategic actions in two perspectives, and each perspective provides different conclusions. First, institutional theory (DiMaggio & Powell, 1983; Powell & DiMaggio, 1991) supports the strategic similarity perspective. Incumbents or society generates prevailing norms in the institutional environment. Additionally, a collective, particular pattern exerts pressures on organizations to adopt legitimate structural element (Burns & Wholey, 1993). From IPO perspective, legitimacy represents the perception that new venture would act on the behalf of shareholder wealth generation (Cohen & Dean, 2005), and that new ventures would meet implicitly necessary requirements in their industry. When one or more organizations use a particular practice, inter-organizational imitation can increase the likelihood of that practice being adopted by other organizations (Haunschild & Miner, 1997). This mimicry behavior, such as imitating entry strategy of industry peers, is rooted in institutional theory (DiMaggio & Powell, 1983; Meyer & Rowan, 1977; Powell & DiMaggio, 1991; Scott, 2008).
Institutional theory is a theory that explains why there is a high homogeneity of organizational structures and practices among actors in an industry (Donaldson, 1995). The core idea is that organizations are more likely to survive if they obtain legitimacy and approval from actors in the surrounding institutional environment (Zucker, 1988). According to the institutional theory, individual organizations adapt to their institutional environment via isomorphic mechanisms. Meyer, Scott, Strang, and Creighton (1988) offered evidence of increase institutional isomorphism by showing that increasing similarity across the different states of the USA indicating the increased homogenization of the nation.

Scholars use a concept of mimicry to explain the strategic similarity. Mimicry, which refers to a strategic action to respond to uncertainty through imitating other actors’ actions (DiMaggio & Powell, 1983), is one of isomorphic mechanisms to explain the homogeneity among organizations, and occurs when organizations imitate successful role models in order to avoid deviation or to be perceived as rational actions (Greenwood & Meyer, 2008). Organizations model themselves after other organizations that they perceive to be more legitimate or successful. Thus, strategic similarity is an outcome of a standard response to uncertainty, where new ventures adopt solutions used by others to deal with problems (DiMaggio & Powell, 1983). Heugens and Lander (2007) found support for the effect of mimetic pressures on organizational isomorphism. Adoption of a legitimated structure or strategic actions helps the new venture secure funding and eases its transactions with other organizations. Overall, strategic similarity through mimicry allows the new ventures to achieve legitimacy by adapting to institutional environment in the industry (Van de Ven & Hargrave, 2004) and survive longer than others which do not achieve legitimacy (Lee & Pennings, 2002). Therefore, scholars in the institutional theory suggest that legitimacy is more important than uniqueness.
On the other hand, resource-based view (RBV) (Barney, 1991; Penrose, 1959) supports for strategic differentiation perspective for superior performance. RBV argues that resources are “stocks of available factors that are owned or controlled by the firm” (Amit & Schoemaker, 1993). RBV further proposes that valuable, rare, inimitable and non-substitutable (VRIN) resources are the genesis of competitive advantage through value creation (Barney 1991; Mahoney and Pandian 1992; Penrose 1959; Wernerfelt 1984). Because resources consist of a bundle of potential services that can be used for rent generation (Penrose, 1959), idiosyncratic differences among firm-resources (e.g., technologies, knowledge base, managerial experience and vision) and their use leads to variance in performance with some firms gaining competitive advantage over others (Barney, 1991; Barney, 2001; Wernerfelt, 1984). In the context of new ventures, RBV suggests that new ventures with differentiated resources have more avenues for engaging in local and distant search and recombine such resources for developing superior capabilities. The unique combination of technologies across organizational boundary and technological boundary leads to higher innovation and increase the new venture’s performance (Miller, 2006; Rosenkop & Nerkar, 2001). Summarizing, new ventures that use differentiation strategy developing resources and capabilities that are valuable, rare, inimitable, and non-substitutable gain competitive advantage (Alvarez & Barney, 2004; Alvarez & Busenitz, 2001).

A new venture’s choice for differentiation also reduces resource competition in the factor market. Moreover, such new ventures have the opportunity to create a new market or position their differentiated products and services in a niche market (Porter, 1998; Rumelt, Schendel, & Teece, 1994). Niche markets offer less competition as compared to generic markets. In essence, the strategy to focus on novel technologies positions such new ventures for competitive advantage in the industry irrespective of competition or industry characteristics (Afuah, 2001).
The use of differentiation strategy also provides an effective signal to the potential investors because of the inherent nature of valuable, rare, inimitable and non-substitutable resources.

We weighed the potential importance of strategic similarity and differentiation in the context of new venture. We believe that though strategic similarity enables a new venture to conform to the industry norms and achieve legitimacy, mimicry also has substantial disadvantages such as high levels of competition with incumbents and other competitors, lack of novel technology, limited scope of exploitation and lack of powerful signal to the market. On the other hand, differentiation strategy develops a niche with the use of VRIN resources and capabilities, lowers the levels of competition in the factor and target markets, thrives on the benefits of exploration and pioneering novel technologies, and generates excitement in the market sending powerful signal to the potential investors (Afuah, 2001; Deephouse, 1999; Gimeno, Hoskisson, Beal, & Wan, 2005; Katila & Ahuja, 2002). Overall, although the effects of differentiation strategy on performance could be debatable, our hypothesis is that the use of differentiation strategy by new ventures should deliver above advantages to the new venture, leading to superior performance at the time of IPO.

*Hypothesis 1. New ventures’ use of differentiation strategy is more positively associated with the new venture performance at the time of IPO rather than their use of similarity strategy.*

In the high technology industry, development of technological resources and capabilities can provide value far in excess of the initial investments in the long run. Valuation of high technology initiatives must be oriented towards the future revenue generation potential and
associated risks (Nolan, 1994, p. 4). A new venture’s technological capital must be assessed by considering its association with both the level and the risk of current and future profitability. This is because of the following reasons: 1) The true potential of novel technology is often unknown as it unfolds over time, 2) The antecedents of technological resources and capabilities consist of intangibles such as knowledge base and learning curve.

Further, intangible organizational resources for the development of novel technologies include not just the presence of specific ‘technology asset (e.g., prior patent)’ but also the knowledge and capabilities of the skilled employees continually integrate and recombine resources for developing new technological capabilities to match or surpass market needs (Eisenhardt & Martin, 2000; Matusik & Hill, 1998; Prahalad & Hamel, 1990). We believe that such knowledge-based capabilities get embedded in the venture and are valuable, rare, inimitable and non-substitutable. Moreover, we argue that such new ventures would have developed a ‘pioneering’ culture that focuses on continual exploration of new technologies with appropriate culture along with organization structure, controls, communications, and rewards systems. In summary, new ventures that differentiate themselves on the basis of novel knowledge and technologies develop VRIN resources and capabilities that are generally realized over time. Such resources and capabilities become venture-specific and are complex to acquire by competitors or incumbents leading to competitive advantage. As the differentiation strategy may take years to add value to a firm and its impact shows more in the long term, we propose that the use of differentiation strategy would allows the new venture to have superior performance after IPO.
Hypothesis 2. New ventures’ use of differentiation strategy is more positively associated with the new venture’s market performance rather than their use of similarity strategy.

However, stock prices may be a less reliable indicator of fundamental values for new ventures that are smaller and less known. Extant literature suggests that shareholder returns, from owning a portfolio of IPOs for up to five years after the companies go public, perform well below other benchmark returns (Aggarwal & Rivoli, 1990; Loughran, Ritter, & Rydqvist, 1994; Ritter, 1991). It has been suggested by Grinblatt and Titman (2002) that the poor performance of firms, having recently gone public, is related to IPO markets which are not informationally efficient. Often, inefficient IPO markets provide corporate managers the opportunity to successfully time the market (Loughran & Ritter, 1995). This suggests that corporate managers issue stock when it is overpriced.

Bhide (2000) argues that the really significant risk for a venture occurs not at the start-up stage but at the point when major irreversible investment in growth is required. At this stage, an entrepreneur puts all of his or her financial resources into “one basket.” According to Bhide, “growth involves developing formal structures and systems that increase the firm’s fixed costs and hence the risk of bankruptcy” (2000: 293). Whether entrepreneurs escalate their commitment at this stage—in the face of increasing bankruptcy risk—often determines whether their firms will eventually succeed or not. Thus, in addition to the performance, we also consider the possibility of bankruptcy as another result of differentiation strategy of new venture. First, differentiation strategy requires developing relatively new technologies and products. The superior capability and resource support for radical and incremental innovation. The new
ventures with differentiating their resources and capabilities from others are able to or have at least more novel technological resources than others simply using mimicry. Therefore, new venture with novel technologies are more likely to survive than are non-innovative firms (Cefis & Marsili, 2006). It is believed that innovative firms grow faster, are more profitable, and are survivors in shake-outs (Geroski, 1995). This is because firms with technological resources have better odds of facing the shake-out phase of lifecycle based on the niche target market for their innovation. These firms survive on the basis of superior technical capability developed through process of innovation and their attempts to drive down cost (Knott & Posen, 2005; Nelson & Winter, 1982). Second, development of novel technologies protects new ventures from ‘liability of newness’ as they are better at: (a) exploiting their superior resources and capabilities, (b) learning and adapting to market needs; (b) development of novel technologies based on resources and capabilities; (c) establishment of innovation culture; and (d) some connection with potential customers and suppliers who demand novel technologies (Klepper, 1996; Levinthal, 1991; Nelson & Winter, 1982).

Lastly, new venture with superior technological capital derived from differentiation strategy also ward off competition by not competing with generic firms and incumbents for common resources, thereby reducing their mortality rate (Carroll & Hannan, 1989; Hannan & Freeman, 1989). Extant literature suggests that new ventures go bankrupt if they fail the tests of selection and competition. New ventures with novel technologies have better odds of selection in the presence of population density. Such firms survive in the long-term, even when there is the threat of excess entry (Knott & Posen, 2005) as well as strong competition in the industry (Aghion, Harris, Howitt, & Vickers, 2001).
Hypothesis 3. New ventures’ use of differentiation strategy is more positively associated with the new venture’s survival by avoiding bankruptcy rather than their use of similarity strategy.

Role of Environmental Uncertainty

In general, uncertainty is the inability to predict or foresee (Anderson & Tushman, 2001). Uncertainty arises when decision makers such as investors cannot reliably forecast future events based on the available information. Environmental uncertainty disrupts underlying equilibrium and renders existing resources obsolete (Leonard-Barton, 1992; Schumpeter, 1942). In the face of uncertainty, new ventures that develop novel technologies and create new markets have greater odds of success because these characteristics provide relative stability in terms of future market demand, potential of success with emerging technological trajectories and likely dominant design (Anderson & Tushman, 1990; Benner & Tushman, 2003). They continue exploring emerging technologies and following growth patterns with better odds for providing value proposition even in the face of difficult to predict conditions—they can maintain technological and competitive edge or at least sustain themselves as the uncertainty resolves over time (Anderson & Tushman, 1990; Henderson & Clark, 1990). Technological edge and novel technologies hedge against such uncertainty by providing a window on multiple emerging competencies and potential for market demand for emerging technologies (Folta & Miller, 2002; Steensma & Corley, 2001). Technological resources and capabilities provide opportunities for continual learning throughout the uncertain period that could facilitate in pioneering new technologies during the period itself or just later (Chesbrough, 2002; Dushnitsky & Lenox, 2006).
Additionally, extant literature suggests that for such new ventures, rate of obsolescence for innovative new ventures is also relatively lower despite uncertainty because such firms have developed routines and capabilities that could renew their capabilities and develop new products (Leonard-Barton, 1992; Tushman & O'Reilly, 2002). Differentiated resources provide a source of competitive advantage especially under uncertain environment. In the presence of uncertainty, investors are more likely to invest in the new ventures with novel technologies (Galunic & Eisenhardt, 2001; Gilbert, 2005) that could sustain because such ventures’ signals are relatively safe and sound as compared to those from average firms.

Even if the uncertainty remains for a longer period of time, odds are high that the valuation of such ventures will be higher. They are better able to retain their market base despite uncertainty because the market put more values in their innovations and a new venture’s technological capital provides effective signals for future profitability. Such ventures also have superior knowledge base, absorptive capacity and capabilities of the skilled employees that could help in further development of new technologies. A culture of continual exploration of new technologies with appropriate culture along with organization structure, controls, communications, and rewards systems further helps them alleviate the effects of uncertainty in the long run. They remain better positioned as compared to their competitors in the market with market recognizing their potential and delivering higher valuation.

Such ventures will also be able to avoid bankruptcy in the face of uncertainty because they have better odds of facing the shake-out phase of lifecycle due to the presence of niche target market for their innovation. Even in the face of uncertainty, these firms survive on the basis of superior technical capability developed through process of innovation and their attempts to drive down cost. Such firms also save themselves from ‘liability of newness’ by exploiting
their superior resources and capabilities, learning and continual development of novel technologies based on resources and capabilities.

Overall, we propose that environmental uncertainty strengthen the relationship between technological differentiation and performance of new ventures after IPO. That is, in the presence of uncertainty, new ventures following differentiation strategy would deliver higher performance both in the short-term and in the long-term.

*Hypothesis 4. There is a stronger, positive relationship between the use of differentiation strategy and the new venture performance at the time of IPO when uncertainty is high.*

*Hypothesis 5. There is a stronger, positive relationship between the use of differentiation strategy and new venture’s market performance as measured by Tobin’s q when uncertainty is high.*

*Hypothesis 6. There is a stronger, positive relationship between the use of differentiation strategy and new venture’s survival by avoiding bankruptcy when uncertainty is high.*
METHOD

Data

The initial sample consists of all U.S. IPO firms between 2001 and 2005 in the U.S. high technology industry, which is defined as those in 2digit SIC of 28 (chemicals and allied products), 35 (industrial machinery and computer equipment), 36(electronics and other electric equipment), 38 (instruments and related products), 48 (communications), and 73 (Business services-software) (Bradley, Jordan, Yi, & Roten, 2001; Carpenter & Petersen, 2002; Loughran & Ritter, 2004). The primacy data sources include Securities Data Company (SDC) Platinum, COMPSTAT, the National Bureau of Economic Research (NBER) Patent Citation data file and Securities and Exchange Commission (SDC) filing (424b). The time window of 2001-2005 was selected to avoid the effect of internet bubble and to match the initial sample with patent data which is available in the 1975-2006. Firms are excluded from sample if financial data is not available in the database and if firms are not listed in SDC platinum, COMPUSTAT, and patent data. After matching process, the final sample was 114 IPO firms in 35 four digit SIC industries.

The new NBER patent data project updated information about patent, technological class, application year, citation, and assignee in the period 1975 -2006. Though many scholars have used patent data as a proxy measure for innovation and strategic behavior in the internorganizational relationships (see Argyres & Silverman, 2004; Miller, Fern, & Cardinal, 2007; Rosenkopf & Nerkar, 2001), patent data is not without limitations in that not all technological innovation is patented (Hall, Jaffe, & Trajtenberg, 2001). Patent activities vary from industry to industry, and patents are a way to protect intellectual property rights rather than measuring the innovation output directly (Rodriguez-Duarte, Sandulli, Minguela-Rata, & Lopez-Sanchez, 2007). However, these concerns are mitigated by the benefits of using patent data.
NBER patent data allows scholars to measure a firm’s technological capital, flow of knowledge, and interfirm relationships for knowledge building. Additionally, since this paper focuses on the level of strategic differentiation, patent data would be an appropriate source to measure the degree of which firms imitate other’s technologies in the same category or different categories.

**Measures**

*Dependent variables.* The short-term and long-term performance was measured by three different variables. First, we measured the short-short term IPO performance using IPO underpricing, which was calculated by the difference between the offer price and the stock price at the first date of transaction divided by the offer price. This measure was used by many scholars in the IPO literature (e.g. Arthurs, Busenitz, Hoskisson, & Johnson, 2009; Nelson, 2003; Pollock & Rindova, 2003).

Second, the market-based performance of IPO firms was measured by Tobin’s Q, which refers to the ration of the firm’s market value to the replacement cost of its assets (Chung & Pruitt, 1994). Tobin’s Q is employed as IPO firms’ performance from long-term perspective. It is expected that the lower value of Tobin’s Q indicates low value (or performance) because the firm is poorly managing its resources, while higher value indicates high value of the firm because the firm is effectively using resources, creating value. Use of this measure allows us to measure a new venture’s future performance potential while avoiding some of the problems associated with the accounting measures. We use this measure to capture the new venture’s technologies’ intangible value because the use of Tobin’s Q for measuring intangible value is based on the assumption that the long-run equilibrium market value of a firm must be equal to the replacement value of its assets, giving a Tobin’s Q value close to unity. Deviations from this relationship (where q is significantly greater than "1") are interpreted as signifying an
unmeasured source of value, and generally attributed to the intangible value enjoyed by the firm. In using this measure, we follow similar studies (e.g., Bharadwaj, Bharadwaj, & Konsynski, 1999) that explored the relationship between intangible value created by constructs such as brand equity, R&D, and advertising and Tobin’s q.

Third, we use the level of bankruptcy to test the long-term effect of mimicry behavior on the IPO firms. Distance from bankruptcy is measured by Altman Z score (Chen & Miller, 2007). A firm that is experiencing significant operational and financial trouble and is on the verge of bankruptcy is said to be in financial distress (Chen & Miller, 2007). Altman’s (1968, 1993) Z-score is used to measure the degree of which a firm is from bankruptcy. A high Altman’s Z represents that firms are at risk of bankruptcy, vice versa. We measure Altman’s Zs using firms’ accounting information regarding their working capital, retained earnings, earnings before interest and taxes, market value of equity, and sales in the end of year of IPO event. The equation is (1.2 X working capital divided by total assets) + (1.4 X retained earnings divided by total assets) + (3.3 X income before interest expense and taxes divided by total assets) + (0.6 X market value of equity divided by total liability) + (1.0 X sales divided by total assets). It is expected that the higher value of Altman Z score, the lower change of bankruptcy.

**Independent variable.** Most research on interorganizational imitation has tended to adopt indirect measures of the existence of mimetic behavior, such as the use of the percentage of adoptions of some organizational change or innovation, branching behavior (Barreto & Baden-Fuller, 2006), or the relationship between adoption and density of previous adoptions (Haunschild, 1993). To be consistent with this approach and apply it to IPO context, this study measured the level of strategic differentiation regarding technology using patent citations before IPO. Firms may cite either patents developed by competitors in the same technological class, or
those developed by firms in the different technological classes. Strategic differentiation was calculated by inversed value of the number of cited patents in the same technological class divided by the total number of cited patents before going public. It represents firm’s strategic behavior regarding the extent to which the firm focuses on technologies outside of its core industry. Using patenting measures as proxies for similarity or differentiation is appropriate because firm’s capability of innovation is one of the critical competences in the high technological industry (Matraves, 1999; Rotheaemel & Boeker, 2008). Patents as innovation output are more appropriate than R&D expenses which should be treated as input for innovation (Ahuja, Lampert, & Tandon, 2008). The higher value indicates higher level of strategic differentiation and more novel technologies.

**Moderator.** Environmental uncertainty can be broken into three dimensions (e.g. complexity, munificent, and dynamism) (Dess & Beard, 1984). To capture the uncertain and volatile characteristics of environment, we used environmental dynamism dimension and measured it as the natural logarithms of sales figures in the 4-digit industry during five years before IPO year were entered into quasi-time series regressions with time serving as the independent variable. The antilog of the standard errors of the resulting regression slope coefficients resulting regression slope coefficients were then used to capture volatility of environment (Dess & Beard, 1984; Keats & Hitt, 1988).

**Control Variables.** We include several control variables to avoid alternative explanation. First, NASDAQ index on the day before IPO was used to control for the market effect. In a good market climate, firm may enjoy higher value since investors are more willing to pay for higher premium (Ritter, 1991). Second, the log-transformed values of years since founding and the number of employees at the time of IPO were used to measure firm age and firm size,
respectively. Strategic actions of larger and older organizations are easily observed and paid attention to by potential investors. Third, since the characteristics of mimicry patterns vary industry by industry, we control for the industry effect by including dummy variables. The primary 2-digit SIC code was categorized into one of three major industry groups according to Dun & Bradstreet classification (e.g. 20-39: manufacturing, 40-49: transportation, communications, electric, gas and sanitary services, and 70-89: service and software) and included in the analysis. In results, industry variables were coded into 2 SIC dummy variables. Forth, the venture capital backing was dummy coded as controls: 1 if IPO firm uses venture capital; 0 if the firm does not use venture capital (Hsu, 2006). Literature in IPO research suggests that monitoring and certification by venture capitalist may increase IPO performance (Brav, Geczy, & Gompers, 2000). Fifth, the effect of non-compete clause in the state of headquarter was controlled. Each state in the U.S. has different agreement about non-compete clause. When a firm writes an employment contract with non-compete clause that prohibits an employee from direct competition with its employer after leaving the firm, the citation activities and knowledge sharing are less likely to occur (Liebeskind, 1996). The effect of non-compete clause was dummy-coded 1 if the headquarter of IPO firm is located in the state without non-compete clause and 0 if the headquarter is located in the state that support non-compete clause. Sixth, we controlled the underwriter reputation by using scores developed by Carter and colleagues (1990; 1998). The underwriter reputation has 0-9 scale (Loughran & Ritter, 2004). Seventh, our model included lockup provision as control. The lockup dummy was coded 1 where there is an agreement between managers of the issue and exiting shareholders not to sell their holding for a prescribed period after the date of IPO and 0 where there is no agreement on lockup provision. Eighth, we also controlled the amount of net proceeds. Offer size was measured as the natural
logarithm of total proceeds raised at IPO (Cohen & Dean, 2005). Ninth, to distinguish the pure offer from other purpose, the empirical model controlled for the spin-off firms which was measured as dummy variable. Lastly, we also included year dummies to control for potential influences associated with yearly trends regarding IPO performance.

Analysis

Since we tested the effect of strategic differentiation on three different measures of performance, Multivariate Regression Analysis was used to test our hypotheses. Differentiation was measured on the basis of citation behavior before IPO, while the performance measures were calculated at the end of IPO year. This lagged measurement allows testing the performance consequence resulted from the strategic differentiation before IPO.

Three models with each dependent variable were specified in the analysis. The first model includes the control variables with the short-term performance measure and the long-term performance measures as DV. The second model includes the controls as well as the variables used to test the main effect of strategic differentiation on the performance. The third model adds the interaction terms between environmental uncertainty and differentiation strategy in order to examine the moderating effect of environmental uncertainty on the relationship between strategic differentiation and performance. To reduce multicollinearity, all continuous variables in the model were centered using the mean value of each variable.
## TABLE 4.1
Descriptive Statistics and Correlation Matrix

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>S.D.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Underpricing</td>
<td>0.1</td>
<td>0.2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Tobin’s Q</td>
<td>3.6</td>
<td>2.3</td>
<td>0.18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Altman Z</td>
<td>14.4</td>
<td>18.0</td>
<td>0.19</td>
<td>0.59</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Differentiation</td>
<td>2.8</td>
<td>2.3</td>
<td>0.06</td>
<td>0.27</td>
<td>0.46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>5. NASDAQ index</td>
<td>1990.9</td>
<td>214.7</td>
<td>0.13</td>
<td>-0.15</td>
<td>0.03</td>
<td>-0.08</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Firm age</td>
<td>2.2</td>
<td>0.6</td>
<td>-0.07</td>
<td>0.09</td>
<td>-0.07</td>
<td>-0.02</td>
<td>-0.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Firm size</td>
<td>5.4</td>
<td>1.5</td>
<td>0.15</td>
<td>0.13</td>
<td>-0.21</td>
<td>-0.22</td>
<td>-0.15</td>
<td>0.48</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>8. Reputation</td>
<td>7.5</td>
<td>2.9</td>
<td>0.03</td>
<td>0.00</td>
<td>-0.10</td>
<td>-0.38</td>
<td>0.04</td>
<td>0.01</td>
<td>0.24</td>
<td></td>
<td></td>
<td></td>
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<td>9. Net proceeds</td>
<td>138.5</td>
<td>260.4</td>
<td>0.03</td>
<td>0.42</td>
<td>0.18</td>
<td>-0.08</td>
<td>-0.12</td>
<td>0.26</td>
<td>0.61</td>
<td>0.09</td>
<td></td>
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<td>10. Non-compete</td>
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<td>0.10</td>
<td>0.10</td>
<td>0.21</td>
<td>0.18</td>
<td>-0.06</td>
<td>-0.21</td>
<td>-0.07</td>
<td>0.06</td>
<td>-0.08</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Lockup</td>
<td>0.9</td>
<td>0.3</td>
<td>-0.01</td>
<td>0.08</td>
<td>0.07</td>
<td>0.01</td>
<td>-0.17</td>
<td>-0.05</td>
<td>-0.20</td>
<td>-0.04</td>
<td>-0.19</td>
<td>0.03</td>
<td></td>
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<tr>
<td>12. Venture-back</td>
<td>0.7</td>
<td>0.5</td>
<td>0.06</td>
<td>-0.04</td>
<td>0.13</td>
<td>-0.03</td>
<td>0.06</td>
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<td>-0.43</td>
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<td>-0.32</td>
<td>0.09</td>
<td>0.11</td>
<td></td>
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<tr>
<td>13. Uncertainty</td>
<td>1.1</td>
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<td>-0.13</td>
<td>0.09</td>
<td>0.09</td>
<td>-0.02</td>
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<td>0.01</td>
<td>-0.01</td>
<td>0.06</td>
<td>0.08</td>
<td>-0.08</td>
<td>-0.11</td>
<td>-0.11</td>
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TABLE 4.2
Results of Multivariate Regression Analysis Estimating Short-Term and Long Term Performance of New Ventures

<table>
<thead>
<tr>
<th></th>
<th>Underpricing</th>
<th>Tobin’s Q</th>
<th>Altman’s Z</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Model1</td>
<td>Model2</td>
<td>Model3</td>
</tr>
<tr>
<td>Stock index</td>
<td>0.17</td>
<td>0.20†</td>
<td>0.21†</td>
</tr>
<tr>
<td>Venture-back</td>
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<td>-0.04</td>
<td>-0.01</td>
</tr>
<tr>
<td>Sic1</td>
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<td>0.04</td>
<td>0.03</td>
</tr>
<tr>
<td>Sic2</td>
<td>-0.02</td>
<td>-0.02</td>
<td>-0.02</td>
</tr>
<tr>
<td>Year01</td>
<td>0.31**</td>
<td>0.37***</td>
<td>0.32**</td>
</tr>
<tr>
<td>Year02</td>
<td>0.05</td>
<td>0.12</td>
<td>0.11</td>
</tr>
<tr>
<td>Year03</td>
<td>0.21*</td>
<td>0.22*</td>
<td>0.19†</td>
</tr>
<tr>
<td>Year04</td>
<td>0.17</td>
<td>0.20</td>
<td>0.15</td>
</tr>
<tr>
<td>Spin flag</td>
<td>-0.21*</td>
<td>-0.19†</td>
<td>-0.18†</td>
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<td>Non-compete</td>
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<td>0.10</td>
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<td>0.29†</td>
<td>0.31†</td>
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<td>-0.10</td>
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<tr>
<td>Net proceeds</td>
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<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Dynamism</td>
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<td></td>
</tr>
<tr>
<td>Differentiation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Differentiation X Dynamism</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>114</td>
<td>112</td>
<td>112</td>
</tr>
<tr>
<td>F statistics</td>
<td>2.50**</td>
<td>3.63***</td>
<td>4.65***</td>
</tr>
<tr>
<td>R²</td>
<td>0.19</td>
<td>0.24</td>
<td>0.26</td>
</tr>
<tr>
<td>ΔR²</td>
<td>0.05*</td>
<td>0.02†</td>
<td></td>
</tr>
</tbody>
</table>

† p < .10  
* p < .05  
** p < .01  
*** p < .001
RESULTS

Table 1 provides the descriptive statistics among all variables. There was not a strong correlation between a pair of variables. To further diagnose the presence of multicollinearity, we checked the value of variance inflation factors and found all independent variables below the commonly accepted threshold of 10. This suggests that there is no harmful collinearity.

Hypothesis 1 proposed that there is positive association between differentiation strategy and IPO performance, and hypotheses 2 and 3 also suggest the positive relationship with the long-term performance and survival. The coefficient for differentiation in model 2 of each DV in Table 2 was positive and strongly significant (p<0.01). As expected, hypotheses 1, 2, and 3 were supported. That is, the differentiation strategy before IPO increases the firm’s IPO performance, market-based performance and the possibility of survival in the later stage.

Hypotheses 3, 4, and 5 proposed that environmental uncertainty make stronger the relationship between differentiation and both short-term and long-term performance. It was argued that new venture with differentiation strategy is more positively related with performance after IPO when IPO firm face highly uncertain environment rather than when the future is more predictable. The coefficient of the interaction terms in Table 2 was positive and significant only in the model 2 of underpricing (p<0.001). Thus, the hypothesis 4 was supported, but hypotheses 5 and 6 testing interaction effect on the long-term performance were not supported. It appeared that under uncertain environment, differentiation strategy is more beneficial in the short-term, but it does not have consistent effect on the long-term performance (see Figure 1).
FIGURE 4.1
Interaction Effects between Differentiation and Environmental Dynamism on the Short-Term Performance

DISCUSSION AND CONCLUSION

This study sought to examine the nature and extent of influence that a new venture’s strategic choices before IPO have on its short- and long-term performance after the IPO. The argument that new ventures’ short and long-term performance is influenced by its strategic choice of differentiation versus similarity strategies is central to research in strategic entrepreneurship—the use of novel technologies by combining VRIN resources and capabilities to develop an initial setting for competitive advantage both in the short- and long run for a new venture. Understanding how this process works can help direct researchers to more carefully...
examine the role of VRIN resources and capabilities in relation to IPO performance, valuation and avoiding bankruptcy and provide some guidelines to managers for estimating new venture’s potential for creating higher return on investment.

Our results confirm the importance of the technological differentiation strategy on the short- and long-term performance, specifically IPO performance, valuation and avoiding bankruptcy. The differentiation strategy of a new venture is shown to have a positive effect on new venture performance at the time of IPO because differentiation strategy develops a niche with the use of VRIN resources and capabilities, lowers the levels of competition in the factor and target markets, thrives on the benefits of exploration and pioneering novel technologies, and generates excitement in the market sending powerful signal to the potential investors. Such a strategy also helps in the superior valuation of the new ventures because such ventures can differentiate themselves in the long run on the basis of novel knowledge and technologies derived from VRIN resources and capabilities, and valuation of high technology initiatives is based on the future revenue generation potential of these novel technologies. We also find that the use of differentiation strategy also result in greater survival by avoiding bankruptcy in the long run.

Further, our findings suggest that in the presence of uncertainty, higher level of differentiation strategy is more positively related with new venture performance at the time of IPO, however, our prediction that such a strategy would be as effective with long term valuation and avoidance of bankruptcy was not supported. It is plausible that uncertain environment enhances short term performance by giving powerful and positive signal as well as resolving information asymmetry but over a period of time, the value of signal subsides. Uncertainty is not beneficial in the long run.
Theoretical Contributions and Implications

Prior literature has discussed the value of technological capital from the lens of resource-based view. However, the effects of novel technology based differentiation strategy on the short- and long term performance, particularly in the presence of uncertainty have not been examined in past research. Our research highlights the role of novel technology based differentiation strategy on the new venture performance at the time of IPO, firm valuation and survival avoiding bankruptcy.

We contribute to the strategic entrepreneurship literature by applying the concepts of VRIN resources and capabilities in the context of new ventures and their performance at different stages of their lifecycle. We also contribute to the new venture creation and performance literature by finding that exploratory strategy such as differentiation plays an important role in providing right signals to the investors and this in turn, results superior performance in the short- and long-term. Exploration provides greater opportunities for generating more recombinations that result in the development of novel technologies which, in turn have the potential to deliver competitive advantage. We illustrate how a new venture can choose to differentiate by focusing on novel knowledge and deliver superior returns as compared to firm that just mimic.

We apply resource-and capabilities based theories of the firm to the context of new venture performance. We demonstrate that new ventures’ choice in terms of differentiation versus mimicry results in performance differential. While institutional theory argues that legitimacy determines firm’s survival and overall performance in the market, our results provide support for the RBV perspective in that initial uniqueness derived from differentiation is more important, especially for new ventures who are preparing for IPO. Lastly, this research also have
implications for the technology strategy of new ventures. A high level of technological differentiation delivers superior performance at least in the short-term even under high uncertain environment.

**Limitations and Future Research**

An important limitation of this study is our reliance on patent-based data to evaluate the differentiation strategy—the limitations of patent-based data as indicators of technological differentiation are well-documented (Alcacer & Gittelman, 2006; Benner & Waldfogel, 2008). However, use of such data is appropriate and usually most accurate and comprehensive for measuring novel technologies and technological resources (Ahuja, 2000; Miller et al., 2007). Nevertheless, we would like to see future research use survey and interview methodologies to capture differentiation strategy. Additionally, this paper mainly discusses technological differentiation of a new venture, and investigates its implication for performance. Since our fining provides support for capability perspective, scholars may find an interest in comparing institutional theory and resource based view directly by investigating strategic factors that supports legitimacy and uniqueness separately, and their implication for performance. Lastly, longitudinal data could also be used to address questions regarding the role of differentiation and performance through various stages of new ventures’ life cycle.
REFERENCES


CHAPTER FIVE

DISSERTATION SUMMARY AND GENERAL CONCLUSION

This dissertation investigated the issue of innovation and entrepreneurship with three different concepts: diversification, boundary expansion, and differentiation. The first essay looks into the conditions under which the diversified firm improves their innovation output. By integrating the insights of organizational search and contingencies literature, we argue that there is a strategic fit among diversification, search scope, and technological capital, and the fit leads to higher innovation productivity. With the longitudinal data analysis, it is found that related diversification strategy increase innovation productivity when the firm pursues local search, while the unrelated diversification strategy increase innovation output when the firm pursues distant search. Also, the empirical results provide support for that argument that the technological capital is important factors to take advantage of opportunities from broader corporate scope. Our findings mainly contribute to the diversification literature in that the effect of diversification on innovation is not simple.

The second essay investigates organizational boundary expansion activities in the early stage. We focus on young firm’s preference between internal market and external market to search and renew their competencies. The main argument is that young firms’ boundary choice is influenced by both their resource portfolio and external factors, which are the characteristics of environment and industry. The analysis of U.S. sample provides evidence of our argument. Theoretically, it implies not only that the nature of potential value of resources should be
understood differently in the life cycle, but also that capability perspective derived from resource based view is useful to explain young firms’ boundary expansion.

Finally, the third essay explores the performance implication of differentiation strategy. Using signaling theory, we address how the patterns of differentiation in the pre-IPO influence the new venture’s short-term and long-term performance in the post IPO stage. It is found that the external investors perceive that new firms with differentiation strategy will better compete with others in the industry, especially under uncertain environment. Thus, this finding support for our argument that differentiation is more beneficial than similarity to the new venture who is preparing for IPO.

In sum, three essays contribute to the literature in the strategic management field by showing that a particular strategy and resource have different implications for performance, boundary expansion, and innovation. Additionally, we suggest scholars to use contingency approach in that the organizational and environmental contingencies may provide better lens to understand the behavior of the firms.