INNOVATION AND VALUE CREATION: A CROSS-INDUSTRY EFFECTS STUDY OF PATENT GENERATION

by

Randy D. Baker

JOHN MACHNIC, PhD, Faculty Mentor and Chair

DIANE STOTTLEMYER, PhD, Committee Member

JAMES KROLIK, PhD, Committee Member

Barbara Butts Williams, PhD, Dean, School of Business and Technology

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Philosophy

Capella University

NOV 2014

ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 - 1346

Abstract

This study examined the relationship between innovation strategy, as represented by assignee patents, and the financial performance of firms traded on stock exchanges in the United States. Building upon previous industry-specific research, this study broadens these investigations to relationships across multiple industries with respect to innovation and value creation. As a basis for examining the aforementioned relationships, this study was based on a framework shaped by Schumpeter's (1934) economic value of innovation theory. This study seeks to answer three research questions: (a) To what degree does innovation and a company's financial performance correlate across different industries, (b) To what degree does innovation strategy for publicly traded mid-capitalized firms and a company's financial performance correlate across different industries, and (c) To what degree does innovation strategy for publicly traded large-capitalized firms and a company's financial performance correlate across different industries? In addressing these questions, the study analyzed secondary data from the United States Patent and Trade Office and company financial data from the Electronic Data Gathering, Analysis, and Retrieval (EDGAR) online system. Regression analysis was conducted to analyze the relationship between company financial data and innovation as a function of patent awards. While no significant relationship was found to exist across a range of financial measures, significance was found for selected measures of mid-capitalized firms over a seven-year period. Recommendations for future research was provided in the conclusions to the study.

Dedication

I dedicate this dissertation to my wife Marsha, family, and friends who have been understanding, patient, and supportive throughout these past few years.

Acknowledgments

To Dr. John Machnic, mentor and advisor who provided steadfast guidance, counsel, and encouragement throughout the dissertation process.

Table of Contents

List of Tables

CHAPTER 1. INTRODUCTION

Introduction to the Problem

Innovation is of particular interest to companies and individuals as the needs of society evolve given the pace of changes in transportation, communication, and internet-based commerce; that is, market segments have changed in very short timeframes (Armstrong & Green, 2007; Gummesson, 2005). Change, be it from societal demands on technology or from reducing variation in operational processes drives the requisite need for innovative solutions. Consequently, today's leaders are concerned with properly targeting the firm's innovative pursuits and committing the appropriate level of resources that identify, develop, and deploy innovative processes and/or technologies that create or improve competitive products and services (Cooper & Edgett, 2010; Peeters & van Pottelsberghe de la Potterie, 2006; Smith, Bust, Ball, & Van der Meer, 2008).

It follows that industries, corporations, and entrepreneurs operating within or across the product and/or service life cycle must be anticipative of new and emerging needs in order to make timely investments, or collaborate with partners, to provide innovative and competitively attractive solutions. To be successful and timely, innovators and/or their partners must understand future needs identified from market research, conceptualize solutions, perform trade studies, identify risk mitigation strategies, and enter developmental phases using structured development and/or rapid prototyping constructs (Herbert & Brazeal, 2004; Schulz, 2008; Seidler-de Awls &

Hartmann, 2008; Withers, Drnevich, & Marino, 2011). As noted by Chiang (2006), the velocity of purposeful and directed research is a significant factor towards securing investors and maintaining highly competitive processes. Thus, the concept of every employee being an innovator and/or early adopter of innovations is important to the sustainability of competitive advantage (Yolles, 2009).

More specifically, company leaders need the confidence to respond to resource allocation challenges and leverage their organization so that employees are engaged, contributing to innovation-enabling ideas and process improvements. Researchers have posited that achieving a culture wherein everyone is innovating and/or engaged in developing innovative-enabling processes acts as an engine that continuously propels the organization ahead of its competition (Schulz, 2008; Yolles, 2009). Thus, as an organization increases its propensity to generate innovative solutions with respect to service, product, production and administrative processes, its competitive advantage is increased along with its value in the marketplace (Schulz, 2008). More research is needed to instill confidence in leaders that investments in innovation leads to value creation. Correspondingly, the purpose of this quantitative, non-experimentally based cross-industry study, is to investigate the relationship between innovation, and value creation across multiple industries by evaluating changes in firm performance with respect to patent generation.

Background to the Study

Modern day researchers and the extant literature is replete with findings that emphasize the importance of innovation with respect to companies, industries, and

economies alike. Researchers argue that jobs in today's global economy are created and sustained by innovation-fueled competitiveness, which is essential to economic growth and prosperity (Kiron, Kruschwitz, Haanaes, Reeves, & Goh, 2013; Sakkab, 2011). These findings parallel the seminal works of Joseph A. Schumpeter (1934), who posited a growing economic cycle wherein customers' wants and needs are ever changing, satisfied and sustained through the introduction and/or new combinations of continuous innovative offerings. Consequently, an economic cycle driven by innovation ultimately drives knowledge creation (Cromer, Dibrell, & Craig, 2011; Mazzucato & Tancioni, 2012).

Reflective of Schumpeterian theory relative to innovation's effects on the economy, research suggests that various industries have evolved over time through a dynamic combination of both incremental and radical, or game-changing, innovation (Aboulnasr, Narasimhan, Blair, & Chandy, 2008; Acs, Anselin, & Varga, 2002; Artz, Norman, Hatfield, & Cardinal, 2010). Using secondary data from the pharmaceutical and biotechnology industries, Cromer, Dibrell and Craig's (2011) quantitative study of firm performance supported strategies wherein companies invest in knowledge creation to innovate, prototype and transition new products or extend product lines to capture business, and move into adjacent global markets. In short, given the competitive intensity and reduced product life cycle that is characteristic of multiple industries, company leaders must invest resources that fosters intellectual energy, generates new ideas, and proffers innovative products and/or service offerings (Artz, Norman, Hatfield, & Cardinal, 2010).

Fundamental to enabling innovation, it is incumbent upon decision-makers, investors, entrepreneurs and managers alike to quantify risks and achieve the requisite confidence that investments in innovation will generate value creation over time. That is, the business leaders need the confidence that the continuous introduction of innovation in processes, products, services, or administrative areas will provide a firm with opportunities for future growth and/or the sustainment of competitive advantage (Schulz, 2008). To that end, company leaders seek ways to facilitate innovation-enabling strategies throughout their organizations as they strive to achieve and/or maintain their firm's competitive advantage (Craig, 2009). Given the competing demands for company resources, a recurring dilemma for management is the proper allocation of resources between research and development funding and the need to support ongoing operations to generate revenues from current product lines (Yolles, 2009).

Company leaders responsible for resource allocation should gain confidence from research findings that evaluates innovation and project execution with respect to firm performance. Studies indicate that a focus on process and product innovation coupled with disciplined project execution delivers competitive performance levels and creates value for company stakeholders (Freedman, 2003; Sull, 2007). Recent studies have focused on the economic implications of innovations by valuing, protecting, targeting, and/or bulking patents as components of innovation strategies (Cromer, Dibrell, & Craig, 2011; Malewicki & Sivakumar, 2004; Nissing, 2005; Reed & Storrud-Barnes, 2011; Wang, 2008).

Studies reveal that patent data has provided a rather reliable and objective foundation for assessing innovation activity in business (Acs, Anselin, & Varga, 2002;

Cromer, Dibrell, & Craig, 2011). Thus, a substantial share of the extant research on innovation value has been conducted utilizing various attributes from patent filings. For example, many of the initial and ongoing research studies are designed to assess patent quality as a function of citation counts (Goetzke, Rave, & Triebswetter, 2012; Oettl & Agrawal, 2008; Phene & Almeida, 2008; Powers & Campbell; Singh, 2007; Ziedonis, 2004). Additionally, and integral to the purpose of this study, are research designs using patent counts as a function of innovation to assess its effects on the financial performance of firms (Cromer, Dibrell, & Craig, 2011; Reed & Storrud-Barnes, 2011; Wang, 2008).

Statement of the Problem

Industry-specific research is supportive and generally accepts the Schumpeterian concept positing that innovation fuels economic activity and competiveness, which leads to new revenues, higher profits, and/or lower costs. Schumpeter acknowledged that effective engagement and understanding of the customer's wants and needs is critical. However, he also noted that industry's development, application, and proffering of innovation brings about economic change, and that industry must often educate the consumer to adopt new and/or improved technology offerings (Schumpeter, 1934). Consequently, given the importance of innovation, managers within individual firms must show time and again that their innovation strategy works. That is, their approach to innovation must embody both systematic and specific changes necessary to effectively produce products and services to compete in an increasingly challenging global market.

Having confidence in developing innovation strategy presents a management dilemma. This dilemma arises given that the benefits of innovation projects are typically difficult to quantify in advance due to innovation's exploratory nature. Adding to this difficulty is that details of successful innovation projects are very difficult to obtain as other firms tend not to share the scope of change across ancillary processes, let alone specifics related to successful innovation projects. This often leaves managers to struggle with business cases where real costs are matched with uncertain and/or intangible results.

Implicit in assessing innovation's uncertainty is the understanding that not all ideas are of equal and tangible value. That is, management's approach to allocating resources requires discretion, rigor, and discipline to refuse and/or discontinue projects. Managerial discretion and communication is especially important in order to maintain an environment where it is not considered shameful for an idea to be turned down or for an idea to fail. That is, if employees perceive a culture that stifles initiative, the people may think it is better to do nothing than to conceptualize greatly and to fail or be told no. Thus, management must balance the need to test innovation initiatives at appropriate intervals to confirm that the value proposition holds, with the corresponding risk of stifling an innovation-enabling culture. Striking this balance leads back to management's dilemma that given the Schumpeterian construct, which suggests that an enduring focus on innovation fuels economic success, how should management formulate an effective innovation strategy? More specifically, can management anticipate that there is a relationship between a long-term innovation strategy and a company's financial performance? This discussion led to this study's primary research question: what is the relationship between long-term innovation strategies, as demonstrated by a firm's

propensity to generate assignee patents year-over-year, and a company's financial performance?

Purpose of the Study

Acknowledging that the allocation of scarce resources continues to be at the forefront of management's concerns, this study attempts to help managers gain confidence relative to innovation investment decisions. Multiple researchers attempting to address innovation relative to this management dilemma is indicative of a recurring interest in this topic. That is, previous industry-specific studies have noted that an innovation strategy coupled with the continuous investment of limited resources by management positively affects firm performance (Cromer, Dibrell, & Craig, 2011; Moorthy & Polley, 2010; Reed & Storrud-Barnes, 2011; Wang, 2011). Correspondingly, the purpose of this research was to take a broader perspective by performing a cross-industry study to provide additional information regarding the generalizability of continuously investing resources in innovation and its relationship, or effect, on firm performance.

The need to broaden studies regarding innovation strategy and its relationship to business results has been noted by researchers with related focus (Cromer, Dibrell, & Craig, 2011; Moorthy & Polley, 2010; Reed & Storrud-Barnes, 2011; Wang, 2011). Thus, it was important for this research to be undertaken in that future researchers and company decision-makers may acquire a better understanding of innovation strategy's relationship with respect to firm performance. More specifically, if broader studies like the one herein are not undertaken, management concerns to invest in long-term

innovation strategies that are outside of historic pursuits, that is, to imagine boldly, will not be assuaged by the research community.

Rationale

A multi-industry review of the relationship between innovation strategy and firm performance has been recommended by previous researchers who have conducted similar, but more narrowly focused studies on these relationships (Cromer, Dibrell, & Craig, 2011; Moorthy & Polley, 2010; Reed & Storrud-Barnes, 2011; Wang, 2011). These recommendations provide the rationale for this study that adds to the developing body of knowledge by having conducted the aforementioned research using a multiple industry approach. Also inherent in the study's design was a focus on demonstrated innovation strategy without regard to technology or innovation type. A study by Moorthy and Polley (2010) explored a similar relationship between technological fit, without regard to innovation type, and firm performance where the dependent variables included return on invested capital, sales growth, and Tobin's q.

This study's focus on innovation strategy is relevant to the dilemma faced by managers when allocating scarce resources. That is, managers must determine how to best satisfy the needs of both ongoing operations as well as innovation investments that will sustain future competitive advantage. More specifically, it is important that management be aware of strategy approaches that allocate resources to include reuse/imitation of existing innovations, incremental process innovations, and radical new product/service development pursuits (Arnold, Fang, & Palmatier, 2011; Moorthy & Polley, 2010; Stadler, 2011; Xin, Yeung, & Cheng, 2008; Yoo, Reed, Shin, & Lemak,

2009). Thus, this study purposed to find multi industry evidence in order to provide management with a better understanding of investing in a broad-based innovation strategy.

Research Questions

The study's hypotheses statements addressed the research question with purpose to understand to what degree innovation strategy and a company's financial performance correlate across different industries. More specifically the research questions ask: what is the relationship between a long-term innovation strategy, as demonstrated by a firm's propensity to generate assignee patents year-over-year, and a company's financial performance? In addition, firm size was treated as a control variable based on findings from recent studies thereby influencing the study's structure of the null (H_0) and alternate (H_A) hypotheses (Aboulnasr, Narasimhan, Blair, & Chandy, 2008).

For example, consistent with Schumpeter's (1934) theory, Tung's (2012) empirical study found that innovative products and services provide firm profits in the short term due to competitors' entry into the market. Thus, Tung's (2012) research is also in alignment with recent studies on innovation that also emphasized the importance of maintaining a continuous stream of innovation that provides competitive discriminators to sustain profits and maintain a healthy company (Cromer, Dibrell, & Craig, 2011; Moorthy & Polley, 2010; Reed & Storrud-Barnes, 2011; Wang, 2011). These findings provided a foundation for evaluating the research questions by testing the study's multi industry hypotheses, which states:

$H1_0$: There will be no correlation between innovation strategy and a firm's financial performance across different industries.

$H1_A$: There will be a positive correlation between innovation strategy and a firm's financial performance across different industries.

Kim and Huarng (2011) noted that mid-sized firms may be more reliant on government contracts and grants to secure innovation funding than larger firms. Kaufmann, Tsangar, and Vrontis' (2012) European cross-country study of mid-sized firms found similar innovation funding challenges. Thus, mid-capitalized (mid-cap) sized firms were used to provide parameters to help establish firm size as a control variable in order to test the following hypotheses:

$H2_0$: There will be no correlation between innovation strategy for mid-cap publicly traded firms and a firm's financial performance across different industries.

$H2_A$: There will be a positive correlation between innovation strategy for mid-cap publicly traded firms and a firm's financial performance across different industries.

According to Aboulnasr, Narasimhan, Blair, and Chandy, (2008), large firms update their innovation strategy with an emphasis on large-scale growth drivers. Moreover, the expected returns required of large firms necessitates a multiyear prioritization of innovation deliverables. Thus, large firms tend to focus on innovations that have large entry thresholds and a corresponding market of sufficient size to overcome risk levels and satisfy corresponding investment requirements (Almeida, Hohberger, & Parada, 2011). As such, large firms may avoid innovation investments wherein the market size does not provide a requisite probability of return to meet growth demands. For these reasons, the following hypotheses was developed for testing and

specifically targeting large-capitalization (large-cap) firms in addressing the aforementioned research question:

$H3_0$: There will be no correlation between innovation strategy for large-cap publicly traded firms and a firm's financial performance across different industries.

$H3_A$: There will be a positive correlation between innovation strategy for large-cap publicly traded firms and a firm's financial performance across different industries.

Significance of the Study

An instructive example of the importance of innovation strategy can be found in a review by Cooper and Edgett (2010) relative to the Corning Glass company's profitable reemergence from their difficulties in the late 1990s. Although Corning Glass is currently a vibrant market-leading company, this is due in large part to management's refocus on a robust, multi year, competitively focused, and multi-faceted innovation strategy (Cooper & Edgett, 2010). Interestingly, Corning's current innovation strategy is consistent with findings from an industry specific study by Nybakk and Jenssen (2012) that an effective innovation strategy fosters a culture of innovativeness, which leads to positive financial performance.

Hence, the primary significance of this study is to add to the body of knowledge with respect to the effects of a demonstrative multi-year innovation strategy on firm performance. The importance of maintaining a strategy that drives new innovative products and services is grounded in Schumpeter's (1934) theory that the value proposition of a firms' offerings will diminish over time. For instance, Wanasika and Conner (2011) found that a continuous innovation producing strategy is important to

competitive advantage given the diffusion of technology and intellectual knowledge that occurs across industries. According to the researchers, in the long run, firms cannot rely solely on the protections afforded by patents, trade secrets, and difficult-to-imitate design strategies. In summary, Wanasika and Conner (2011) found that the rapidity of knowledge transfer in today's information-based economy and corresponding spillover effects from aggressive research by competition analysts, require firms to engage in ongoing innovation efforts.

While there exists a large amount of research focused on technology and/or industry-specific innovation strategy and its impact on competitive advantage, there is limited information addressing innovation strategy's effects on firm performance across multiple industries. These limitations may instill a lack of confidence on the part of managers responsible for allocating resources towards innovation pursuits wherein return on investments may not be clearly discernable. Thus, this study builds on previous studies by expanding across industries and utilizing a recognized measure for financial performance in the form of operational earnings. The intended audience for this study would be other researchers interested in innovation strategy and its effect on the economic profit of firms, as well as managers who are faced with making decisions regarding the allocation of a firm's resources to improve competitive advantage. Prior to the outcomes, this study was expected to provide an improved understanding of how producing new knowledge can impact firm performance. Further, results from this research may increase management's confidence when determining the level of innovation alignment across the organization with respect to allocating limited resources.

Definitions of Terms

The following definitions and terms are applicable throughout this study:

EBITDA. An acronym that represents earnings before interest, taxes, depreciation and amortization. For the purposes of this study, the EBITDA term will be a measure of a firm's financial performance that relates to a firm's profitability, market value, and as a proxy-type indicator of cash flow (Anderson, Bey, & Weaver, 2008; Borshell & Dawkes, 2010; Maditinos, Chatzoudes, Tsairidis, & Theriou, 2011; Sonnier, Carson, & Carson, 2007) .

Innovation. For this study, innovation parallels a Schumpeterian (1934) based definition in that it embodies a firm's adoption of ideas from others, creation of new ideas, and/or new combinations that propagate Schumpeter's (1934) creative destruction and/or continual renewal constructs (Cromer, Dibrell, & Craig, 2011).

Patent. For this study, a patent will be defined as a documented representation of inventive and/or innovative outcomes that have been acknowledged by a government as exclusive and/or proprietary rights that have been allotted to its holder (Meyer, 2011).

Assumptions and Limitations

The Schumpeterian (1934) economic value theory of innovation provides the theoretical framework for this study. Originally posited by Schumpeter (1934), the economic value of innovation theory asserts that members of corporations and/or entrepreneurs are charged with introducing innovative processes or products; with purpose to disrupt routine economic patterns in order to create economic advantage (Cromer, Dibrell, & Craig, 2011). Accordingly, patent awards have been recognized as

objective indicators of knowledge creation that in effect protect a firm's ability to derive economic value for a limited period of time (Balasubramanian & Lee, 2008; Nissing, 2005; Reed & Storrud-Barnes, 2011; Wang, 2008). Thus, this theoretical framework was used to establish indicators of innovation, such as year-over-year assignee patents, and their relationship to firm performance. Although it is recognized that many factors contribute to firm performance, this study used EBITDA and other traditional financial performance measures, to test the noted hypotheses across multiple industries.

Limitations

Inherent in the research design criteria is a limitation related to mid- and large-market capitalization companies that are traded on U.S. stock exchanges. In addition, the innovation construct has been limited to U.S. issued assignee patents that are directly related to the aforementioned publicly traded companies. Thus, companies not traded on U.S. exchanges and innovations not filed using the United States' patent process, as well as U.S. publicly traded small-market capitalization, private, academia, government research agencies, and not-for-profit entities are excluded from this study.

Although simple patent counts have been used in numerous research studies, the use of this simple measure for innovation strategy in this study must be accompanied by generally acknowledged limitations. That is, patent counts are imperfect measures of innovation activity given that many innovations, such as trade secrets, administrative improvements, process improvements, etc., are not documented by patents. In addition, patent counts are not indicators of the impact or value of the innovation's economic and/or societal worth (Artz, Norman, Hatfield, & Cardinal, 2010).

Another limitation of this study is the adoption of a singular financial performance measure for the dependent variable in the form of EBITDA. Notwithstanding that the use of EBIDTA as a dependent variable is well established within related research. That is, EBITDA is recognized as a good method for valuing innovation and performing comparative analysis across large companies and industries alike. For instance, EBITDA provides a good indication of a company's operational earnings, including innovation's influence, since it is not directly impacted by accounting distortions arising from large interest-related debt effects, depreciation from asset intensive operations, and/or large acquisitions. (Anderson, Bey, & Weaver, 2008; Gerpott, Thomas, & Hoffmann, 2008; Sonnier, Carson, & Paula, 2007; Yong & Ingham, 2012).

However, a singular financial measure may provide results different from other financial performance measures that have been used to evaluate this relationship. For example, innovation constructs have been used to predict financial performance using measures such as: return on sales, profit margin, stock returns, return on assets, return on investment, and value added intellectual capital (Faems, de Visser, Andries, & van Looy, 2010; Heeley & Jacobson, 2008; Wang, 2011; Xin, Yeung, & Cheng, 2009). Consequently, this study included the traditional measures: Revenue, Return on Assets (ROA), and Return on Equity (ROE).

Other limitations include the impact that high salaries may have on depressing EBITDA values. Additionally, DiBemardino (2011) noted that traditional financial measures perform poorly when attempting to segregate performance impacts stemming from human capital investments. This limitation may make it difficult to determine the

performance impact of incremental or process-based innovations in terms of affecting a company's economic returns. Lastly, Greve (2008), inferred that unless specific protocols are in place to capture service-oriented innovation inflows, traditional financial performance measures may under-report innovation-improved business services. Hence, any service related innovations that are not reflected in transaction-based accounting methods may not have been accurately represented in the study's results.

Assumptions

Assumptions associated with this study presumes that there is homogeneity over the period of interest in the data collection and storage methods used by the cognizant U.S. agencies responsible for maintaining the publicly available databases used in the study. For instance, it is assumed that the financial data was correctly and accurately created, reported, and consistently archived in the government databases. Correspondingly, the researcher assumed that the secondary data retrieval, time period of inquiry, and quantitative analysis was an adequate measure of the variables and their relationships in response to the research questions and hypotheses presented.

Inherent in this study's design was that random sampling and selection would be adequate to avoid bias of the results. That is, coding of the companies and using a random number generator for selection is considered a strength to minimize selection bias. A related assumption is that the sample size is appropriately large as the design calls for the usage of a small effect size and large power in selecting the sample.

Nature of the Study

Plans for the approach or nature of the study called for the identification and characterization of the population based on market capitalization levels and confirmation that individual firms are traded on U.S. stock exchanges. Once the population was determined, a random number generator was used to select firms as candidates for the study. Firms were accepted into the sample provided that they had continuous financial performance over the period of interest and a history of patents as confirmed by interrogating the USPTO database. Thus, it should be noted that firms were accepted into the sample without regard to industry affiliation, except for companies in the consumer goods or financial services type industries

The $H1_A$ required that the entire sample be used to test the first hypothesis in response to the overarching research question relative to the degree of influence that innovation strategy has on firm performance. With purpose to test the remaining two hypotheses, market capitalization was used as a control variable to segregate the sample into two groups characterized as mid- and large-cap firms. Similarly to testing of the first hypothesis, these groups were tested with regard to the relationship between innovation strategy and firm performance.

The study considered two other independent variables: (a) patent referenced citations, and (b) the number of inventors per assignee patent. The purpose of these follow-on inquiries within the study was to evaluate the degree of the aforementioned relationship. Depending on the results obtained from these quantitative analyses, the research would have evaluated the value of forming a multiple regression equation with

purpose to further explain the hypothesized relationships. However, as noted in Chapter 4, data issues prevented this analysis from taking place.

Organization of the Remainder of the Study

The study is organized and described in five chapters to include (a) Chapter 1: Introduction, (b) Chapter 2: Literature Review, (c) Chapter 3: Methods, (d) Chapter 4: Results, and (e) Chapter 5: Conclusions. Chapter 1 has presented the reader with (a) an introduction to the problem, (b) the background to the study, (c) the statement of the problem, (d) a review of the purpose of the study, (e) rationale for the study, (f) the study's research questions and accompanying hypotheses, (g) the significance of the study, (h) definitions and terms, (i) assumptions and limitations, (j) the nature of the study, and (k) this overview of the study's organization.

The remaining four chapters begins with a review of the extant literature providing a foundational framework for which the study builds. The remainder of the study will provide method and process descriptions and their subsequent execution in carrying out the study's design and resulting conclusions. Thus, Chapter 2 presents the literature review with particular focus on innovation types and innovation strategy. The literature review will be followed by Chapter 3 that will entail a complete description of the study's methodology to include data collection procedures, sampling, data analysis, and hypotheses testing. Chapter 4 will present the study's analysis along with a focus on results based on executing the study's design. A detailed discussion, resulting conclusions, and considerations for future research will comprise Chapter 5 and serve to complete the study.

CHAPTER 2. LITERATURE REVIEW

Overview

Innovation is considered a key success factor for companies to achieve and maintain competitive advantage in today's dynamic and challenging global marketplace. Research asserts that companies that seek to continuously introduce new and/or improved products, services, and/or operational processes have been shown to deliver strong performance in highly competitive markets (Cooper & Edgett, 2010; Schulz, 2008). Correspondingly, Smith, Bust, Ball, and Van der Meer (2008) found that an organization's culture plays a key role in the management of innovation. Thus, it is important for researchers and managers to understand the innovation strategies that have enabled patent authors to transform their ideas into performance-enhancing discoveries (Craig, 2009; Seidler-de Alwis & Hartmann, 2008).

The primary objective of this study is to examine publicly traded mid- and large-cap firms traded on exchanges in the United States in order to understand to what degree innovation strategy affects firm performance. Using assignee patents as a measure of innovation strategy, the study analyzed the degree that innovation and a company's financial performance correlate across different industries. In support, the study presents this literature review of innovation with emphasis on the predominate research relative to innovation types along with a review of broad-based innovation strategy. That is, the study will update the reader on research regarding specific innovation types, studies highlighting a broad-based innovation strategy, and their perceived value based on relevant research.

The following literature review provides an overview of the targeted innovation types and supporting research for each to include (a) incremental, (b) radical, and (c) imitative innovation. The review then returns to the focus of this study with a discussion of related research in support of the study from a broad innovation strategy perspective. Included in the summary discussion is an appreciation of how research methodologies from related studies are supportive of the current study's research. Finally, the chapter will close with a review of the study's objectives with respect to the research questions being addressed.

Innovation Types

The extant literature discusses and classifies organizational related innovations to include a broad spectrum of changes and/or new approaches affecting business processes, products, services, and administrative offerings (Baba, 2012; Lee, 2012; Stadler, 2011). However, Joseph Schumpeter (1934) provided a theoretical connection for three types of innovation that current studies often refer to as radical, incremental, and imitative innovation. Interestingly, there continues to be an abundance of scholarly research offering different perspectives on how these three innovation types support various innovation and performance measures. However, researchers frequently disagree as to their relative importance in terms of maintaining a firm's competitive advantage and/or sustainability. Consequently, such limitations in the extant literature may contribute to management's dilemma in confidently allocating scarce resources (Aboulnasr, Narasimhan, Blair, & Chandy, 2008; Cromer, Dibrell, & Craig, 2011; Hoonsopon & Ruenrom, 2009; Mazzucato & Tancioni, 2012; Xin, Yeung, & Cheng, 2008).

It should be noted that Schumpeter alluded to these innovation types in discussing the actions of firms and/or entrepreneurs when he stated, "…the producer who as a rule initiates economic change, and consumers are educated by him if necessary; they are, as it were, taught to want new things, or things which differ in the habit of using" (1934, p. 65). This is not to imply that customer inputs are not important to advancing innovation as Schumpeter also acknowledged the importance of meeting customer-driven wants and needs. Cromer, Dibrell, and Craig's (2011) study affirmed this Schumpeterian framework by asserting that a firm's innovation strategy is instrumental in adapting the technological approach to competitive markets. Thus, in order to study the effect of innovation strategy on firm performance it is important to recognize the existence of radical, incremental, and imitative innovations (Luo, Sun, & Wang, 2011; Salavou & Avlonitis, 2008).

Further, reviews of the existing scholarly research provides a solid rationale for describing and classifying innovation types as well as implications for managers with respect to innovation strategies. However, this study does not attempt to differentiate between publicly traded firms that emphasize one innovation type over another. Instead, the researcher intended to add to the body of knowledge by highlighting the importance, and increasing the understanding, that a consistent innovation strategy proffers with respect to firm performance. Thus, the focus of inquiry seeks to understand the relationship between a long-term innovation strategy, as demonstrated by a firm's propensity to generate assignee patents year-over-year, and a company's financial performance. Asked differently, is a consistent innovation strategy predictive of firm performance without regard or emphasis on innovation type?

Radical Innovation

With many researchers today conveying a philosophical worldview positing that radical innovation is fundamental to a firm's survivability, the extant literature is replete with studies emphasizing the importance of this type of innovation (Goktan & Miles, 2011; Golder, Shacham, & Mitra, 2009). However, radical innovation pursuits are like rainfall in that they can bring prosperity when balanced or calamity if insufficient or excessive. That is, attempts to attain radical innovation are often accompanied with costly failures or missed objectives. Conversely, managers and firms that experience success from radical innovations often realize high rewards and/or recognition. Incidentally, the more frequent experiences related to failed attempts at radical innovation can shake management's confidence. Consequently, if resources are not properly balanced, unproductive attempts at radical innovation may lead to significant losses.

Golder, Shacham, and Mitra's (2009) study of radical innovations' pre commercialization phases highlights the risks and determination required to pursue this type of innovation. The study also defined radical innovation as having two components: a) a new offering provided to customers, and b) an offering that provides new or a higher level of benefits than previous products and/or services. In an effort to quantify the patterns and relationships associated with radical innovations, the researchers conducted correlation and logistic regression analyses to evaluate the pre commercialization phases of historical global innovations. Using preexisting historical methods to assess archived records, the researchers identified 29 innovations wherein data from the pre commercialization phases could be acquired and analyzed. The findings determined that only 1 of the 29 companies that launched or realized full commercialization of the

innovation was the original developer. They also found that most studies of radical innovation, which concentrate on the commercialization phase, often convey the perception that radical innovations or breakthroughs tend to be associated with development periods of relatively short-term durations. Indicating the contrary, this pre commercialization focused study suggested that developments of radical innovation are more likely to encompass a combination of related developmental endeavors that are in excess of twenty years.

There are limitations in the Golder, Shacham, and Mitra's (2009) study that may impact the generalization of the study's findings to the broader population of radical innovations. For example, the data collected for this study focused on durable goods and did not include other areas such as services, industrial applications, pharmaceuticals, and other sectors with a history of radical innovations. Also, the study's data was inclusive of successful innovations alone and did not address the pre commercialization phases associated with failed or unsuccessful radical innovation attempts. Consequently, the sample was biased in that it did not represent the full spectrum of pre commercialization experiences for radical innovations. Finally, the researchers recognized that the access and speed of customer knowledge during the pre-commercialization phase may influence future studies involving radical innovation phases. Although the study's findings are insightful for managers to consider in terms of allocating resources, they may not be generalizable to the current set of radical innovation development projects.

In contrast to Golder, Shacham, and Mitra's (2009) study, Inauen, and Schenker-Wicki (2012) conducted a study to examine the commercialization of ideas that incorporate external distribution channels. More precisely, the study purposed to

evaluate how an inside-out, or open-innovation approach, influences a firm's likelihood of creating radical innovations. Focusing on companies with stocks listed on Austrian, German, and Swiss publicly traded exchanges, the researchers examined 141 research and development (R&D) manager responses from firms included in the study. In addition to excluding banks and insurance companies, the study removed responses due to inconsistencies in country level under- and over-reporting; yielding a low response rate of just 18%.

In their study, Inauen and Schenker-Wicki (2012) assigned innovation strategies as key independent variables and dependent variables that measured performance. By conducting linear regression analysis, the research findings' indicated that open-innovation strategies positively influences the creation of radical innovations and also increases new product sales. Conversely, the study indicated that firms employing closed-innovation, or in-house exploitation strategies, were more likely to realize increased performance with incremental product innovations. However, although this study was focused on firms in German-speaking countries and further limited due to inconsistencies in representation levels within each country, the results are important considerations for managers determining innovation strategies and allocating limited R&D resources.

Xin, Yeung, and Cheng (2008) measured firm performance from radical product innovations using: (a) return on assets (ROA), (b) return on sales (ROS), and (c) relative sales growth as dependent variables. In an effort to quantify whether radical product innovation predicted firm performance, the researchers used an event-study method to select 78 publicly traded manufacturing firms within the United States. The event-study

method was used to construct the sample by selecting radical product innovation announcements over a defined period of interest. More specifically, exploitative or incremental innovation types were not included in the study. A control group was also selected wherein each of the 78 firms in the sample was paired with a firm of similar size in terms of return on assets and total assets.

Given the design consisted of an event study, parametric tests were conducted using the paired-sample t-test. In addition, non-parametric testing was performed using the Wilcoxon Signed Ranks test and the Sign test. Similar to the findings of Inauen and Schenker-Wicki (2012), the study's results indicated that radical product innovations are a good predictor in terms of sales growth and return on sales. However, it was not a strong predictor of return on assets. This study had similar findings with respect to revenue and return on assets.

There are inherent limitations within the Xin, Yeung, and Cheng (2008) study that may impact the generalization of the study's findings to other industries. First, having based the study on the event-study methodology using innovation announcements as the source for the independent variable, may have biased the results due to probable confounding effects. For instance, the influence of radical product innovations' advertising campaigns on sales was not considered. Other considerations are the effects of moderating factors such as firm size, industry type, and improved productivity on firm performance.

Incremental Innovation

The extant literature reveals that, although research on incremental innovation is limited as compared to radical innovation, researchers agree that incremental innovation

has played a more prevalent role relative to the execution of innovation strategy than radical innovation (Hoonsopon & Ruenrom, 2012). Thus, an overemphasis on radical innovation may undermine a firm's financial livelihood if current processes and/or services have been sacrificed in terms of insufficient resourcing for incremental innovation initiatives. For instance, a longitudinal study by Phelps (2010) focused on telecommunication equipment manufacturers offers an insightful perspective by noting that firms often seek competitive and/or operational solutions through the construct of incremental innovations. Implicit in this and studies with similar findings is that managers often realize more immediate, though short-term, tangible solutions as a function of investing in incremental innovation. Thus, these types of investments often lead to managers experiencing an increased level of confidence when allocating resources to incremental innovative pursuits. However, many researchers argue that incremental solutions do not lead to maintaining a sustained competitive advantage in the marketplace as do, less frequent but potentially highly profitable, radical innovations (Aboulnasr, Narasimhan, Blair, & Chandy, 2008; Cromer, Dibrell, & Craig, 2011; Hoonsopon & Ruenrom, 2009; Ivica & Prester, 2008; Story, Hart, & O'Malley, 2009; Xin, Yeung, & Cheng, 2008).

In contrast to those stressing the importance of radical innovations, many researchers argue that incremental innovation and/or improvements can play a significant role in achieving and maintaining a firm's competitive advantage within existing markets. With focus on how customer behaviors affect radical and incremental innovation, Arnold, Fang, and Palmatier (2011) used interview data collected from 225 strategic business units within the financial and retail industries. Using three-stage least square analysis

methods, the researchers found that each unit's approach or focus on customer acquisition and retention orientations influences performance from its radical and incremental innovation pursuits. More specifically, the findings indicated that units realized higher levels of performance from incremental innovation pursuits when customer retention was a central component of their customer engagement strategy. Conversely, the study revealed that those business units focused on a customer acquisition strategy experienced stronger performance from radical innovations and a correspondingly lower performance from incremental innovation initiatives.

Similarly, Nissing (2005) stressed the importance of firms adopting a strong innovation and/or invention strategy and also argued the value of acquiring intellectual capital for use in incremental product/process improvements. More specifically, the paper emphasized the potential value of obtaining knowledge to develop changes to an existing product over time. It is not that radical innovation cannot also be realized with the reuse of intellectual capital, however, research indicates that such discoveries are less certain than incremental innovative solutions.

Furthermore, intellectual capital derived from incremental innovation tends to directly benefit from documented or explicit knowledge, as well as tacit knowledge from the larger set of the firm's stakeholder population. As previously noted, incremental innovation has been described in research as being more certain and of greater frequency than radical innovation. This is in part attributed to the larger and more diverse group of stakeholders involved in conceptualizing and solving problems across a firm's business processes, products, and/or services. That is, the existence of explicit/documented knowledge coupled with the integration of a diverse set of problem-solving ideas leads to

ad-hoc experimentation and a multiplicity of potential solution sets (Gupta, Woodside, Dubelaar, & Bradmore, 2009; Heiman & Nickerson, 2004; Phelps, 2010; Stadler, 2011; Styhre, Ollila, Roth, Williamson, & Berg, 2008).

From a process perspective and using a mixed methods embedded case study design, Stadler (2011) selected five companies from the oil industry to investigate process innovation. The selected companies in this process oriented industry differed significantly from traditional product-oriented industries wherein patents play a significant role. Findings from this study revealed that process-oriented industries may rely more on trial and error, and less on formal research and development projects, to achieve incremental process innovations; and correspondingly, less reliance on radical innovations. The research also indicated that incremental innovation in process-oriented settings is dependent upon explicit knowledge via information and communication technologies in addition to collaboration among its multi-disciplined experts.

Recent studies, such as Dumay, Rooney, and Marini (2013), have supported the overarching findings of Arnold, Fang, and Palmatier (2011), Nissing (2005), and Stadler (2011) that a firm's response to its competitive environment and market demands often drives the level of performance realized from a firm's investment in radical and/or incremental innovation pursuits. In the case of Dumay et al. (2013), the researchers conducted a cross-sectional study involving 27 executives of publicly traded Australian companies. Using grid-based staging methods to identify data patterns, the researchers collected 54 narratives equally divided between innovation successes and failures. The findings indicated that while each type of innovation is purposeful in meeting a firm's needs, each innovation type has different enablers. Hence, it is important that managers

responsible for allocating scarce resources also recognize the need for targeting innovation enablers leading to successful outcomes.

Although the results are aligned with previous research, it is evident that the Dumay et al.'s (2013) study is fundamentally limited in scope. Namely, the researchers used data from only 27 executives operating in Australian business environments. Consequently, this exploratory research has limited generalizability and is more profitable for gaining insights rather than ascribing executable policies.

Imitative Innovation

Imitation innovation as a component of competitive strategy within industries is often found as an ancillary topic throughout the extant literature on innovation. Implicit in the literature is that the use of imitative innovation in pursuit of competitive advantage has coalesced since the 1960's. That is, current literature reveals that many of today's researchers agree with Levitt (1966) who posited that the ongoing outpouring of new products and services, across multiple industries, is not innovation in the strictest of definitions. Moreover, many argue, that companies select imitative innovation as a viable pathway to attaining goals related to competitive advantage, market growth, and profits (Andersén, 2007; Grahovac & Miller, 2009; Lee & Zhou, 2012; Lieberman & Asaba, 2006; Quintane, Casselman, Reiche, & Nylund, 2011).

From a research perspective, innovation has a more exacting meaning in the current literature than imitation. For instance, innovation is often associated with the introduction of a solution set that is new and unforeseen by users and/or consumers in regards to form, fit, function or service offerings. By contrast, the literature on imitation

innovation describes the process of imitation as producing a product or service that has similar but different attributes to the original innovation. In addition, the literature on imitation innovation typically associates, either directly or indirectly, both positive and negative connotations with the process. Positive in the sense that imitation innovation may allow for a competitor or new market entrant to improve the product or service while bringing it to market with lower costs and greater speed than the original innovator (Bessen & Maskin, 2009; Heeley & Jacobson, 2008). Conversely, imitation innovation can have negative implications for basic research conducted by original innovators. According to Bessen and Maskin (2009), successful imitation may reduce the incentive for innovators to conduct basic and/or risky innovative research requiring governments to incentivize industry to continue research. For the imitator, businesses that pursue an imitative strategy spend resources to create/recombine processes and/or modify products using reverse engineering techniques, which are also subject to being imitated (Boldrin & Levine, 2006; Ghosh & Wu, 2007; Inauen & Schenker-Wicki, 2012; Peeters & van Pottelsberghe de la Potterie, 2006; Pfeffer, 2007; Reed & Storrud-Barnes, 2011; Wanasika & Conner, 2011; Zhou, Brown, & Dev, 2009).

As with initial market offerings by innovators, time-to-market is also critical to imitators. Research reveals that resources targeting the development of innovative production processes and services by imitators have proven to mitigate the advantage of the early entrant of radical innovations. As inferred by Trott, and Hoecht (2007), few companies can afford to be first in innovating, or being the most economical provider, in every technology or process that is necessary to be competitive or increase market share. Hence, firms employing an imitative innovation strategy have had demonstrated

successes by awaiting and seeking information relative to the competition's radical innovation offerings.

More specifically, a longitudinal study by Abel (2008) described how Apple leveraged its resources, branding, and innovative processes and services to minimize research and development costs, all-the-while timing and shaping the MP3 market. The study's findings indicated that original innovators and early entrants to the digital audio player (DAP) market did not capitalize from the pioneering advantage they held. That is, the study did not find evidence to support that initial market entrants attained a long-lasting market advantage from pioneering reputations or early entry. Conversely, the study noted that Apple's organizational strengths, market branding, and distribution advantages overwhelmed the early innovator's/market entry advantage. That is, although a late market entrant, Apple became the dominant leader in the MP3 market despite being an innovation imitator and market follower according to this study.

Abel's (2008) study is consistent with a longitudinal study of 95 firms within the computer-equipment industry by Yoo, Reed, Shin, and Lemak (2009) regarding late entrants. Using multiple regression to analyze their data, Yoo et al. (2009) selected external ties of imitators and return on assets (ROA) as the independent and dependent variables respectively for this study. Whereas Abel (2008) linked imitator success to organizational strengths, branding, and distribution channels, Yoo et al. (2009) also identified the external ties of management to the success of imitators. According to Yoo et al. (2009), a contributing factor to success of resource imitators is the management team's connections to intra-industry trade associations.

Generalizability for Abel (2008) and Yoo et al. (2009) is limited given the highly specialized technological industries that research was performed. However, both studies revealed that in addition to allocating appropriate resources, an imitation strategy should be coupled with certain firm characteristics in order to improve the probability of success. Andersén (2007) examined the strategies adopted by firms in order to execute an imitative strategy as a means of achieving competitive advantage. After considering the disadvantages of being a market innovator, Andersén (2007) discussed how firms have approached imitating their industry's product and service offerings as an approach to competitive advantage.

Andersén (2007) briefly reminds the reader of processes and terminologies used in the past to help identify opportunities and allocate resources to imitate competitive practices. Implicit in this discussion of firms imitating others in their industry includes the performance of competitive analysis, benchmarking, and best practice reviews. Such reviews are described as being targeted towards a cohort of firms involved in comparable or adjacent technologies. Andersén (2007) advanced the knowledge base regarding imitative strategy by focusing on those factors that may impede a firm's ability to imitate others in order to gain competitive advantage.

Complementary to Andersén's (2007) imitative strategy discussion, Greve's (2012) quantitative study provided an interesting contrast regarding the adoption of innovations with disappointing value. Imitating innovations can result in unsuccessful results either due to the product or service innovation itself or a failed implementation of the imitation. Greve's (2012) study highlighted the uncertainty confronted by decision makers regardless of embracing an innovative or imitative strategy.

The subject of ordering maritime ships was used in the Greve (2012) study wherein the dependent variable was the first-time order of fast ferries. The predictor or independent variable was the multiyear time-lagged purchasing process. Therein, the information diffusion process reveals the final outcome as to whether the firm ultimately purchased a fast ferry. Data was tested using the log-likelihood ratio test with the fast ferry contrasted with the baseline ferry model. Greve (2012) explained that this study evaluated how an adopter or imitator of innovation valued the innovation after using it. Thus, the research evaluated how imitators reacted in terms of modifying their decision/order as information from prior imitators began diffusing across the industry. Although generalizability is limited given the specifics of the maritime shipping focus, this study is unique in the extant literature as it provided insights into imitators' response to disappointing innovation results.

Of import to this study is that the extant literature confirms imitation innovation as a potential innovation strategy to be selected by firms within different industries to achieve competitive advantage. This imitative, reuse, or recombination of preexisting innovative product and/or service features gained by observing their competitors, may provide late market entrants a competitive advantage. That is, using knowledge gained from in-house experience as well as observing competitors, imitators may be able to supplant or mitigate the advantages of pioneer innovators and/or early market entrants (Yolles, 2009; Yoo, Reed, Shin, & Lemak, 2009).

Innovation Strategy

Regardless of the innovation types pursued, research suggests that firms must develop innovation strategies that generate competitive advantage while being demonstrably flexible in meeting the current and future needs of customers. That is, the innovation strategy, be it radical, incremental, or imitative, should address the front-end of the business to shape markets, shorten conceptual design timelines, and deliver innovative and affordable products and services (Cooper & Edgett, 2010; Naranjo-Valencia, Sanz-Valle, & Jiménez-Jiménez, 2010; Porter, 2008). Studies have shown that effective innovation strategies can foster an operational rhythm whereby aggressive targets for innovation become the norm; thus, enabling growth by challenging the organization to deliver innovative, performance-enabling results (Artz, Norman, Hatfield, & Cardinal, 2010; Mazzucato & Tancioni, 2012; Peeters & van Pottelsberghe de la Potterie, 2006).

To help explain the relationship of new product innovation and firm performance, Harmancioglu, Droge, and Calantone (2009) conducted a survey-based study of managers from the chemical, biochemical, and pharmaceutical industries. Given a 51% response rate that yielded 306 usable surveys, the researchers conducted a partial least square analysis to test their hypotheses. Harmancioglu et al.'s (2009) questionnaire gathered information from managers regarding each firm's new product innovation strategy from a resource perspective. It is interesting to note that multiple innovation types were employed by these sampled companies as a function of resource capabilities. Results from the study revealed that by executing innovation/technological fit approaches, consistent with customer needs and the firm's resource portfolio, there was a

positive relationship between technological fit and profitability. The study also indicated a positive relationship between marketing fit and profitability.

The work of Harmancioglu, Droge, and Calantone's (2009) was relevant to this study because it provides an understanding of how innovation types can play a role in creating value when executed in concert with a viable innovation strategy. Notwithstanding, gathering information from managers in lieu of process and customer participants did limit the generalizability of the study. However, Harmancioglu, Droge, and Calantone's (2009) study is supportive of this study given that different innovation types were used by the firms in the study to maintain competitive advantage, meet market demands, and generate profits for stakeholders. Implicit in the study's results are the ongoing decisions made by managers regarding the allocation and execution of resources, which played a significant role in attaining value-generating results from the innovation strategies deployed.

A longitudinal study of innovation and firm performance by Artz, Norman, Hatfield, and Cardinal (2010) indicated that a firm's innovation strategy must support and apply integrated enterprise strategies, that both protect the market space, and ensure technology is ready when needed. Without specifically addressing the innovation types, Artz et al.'s (2010) study spanned 19 years and sampled 272 firms from 35 different industries to test the benefits of innovation. Results indicated a positive relationship was found between new product announcements and performance, indicating the importance of strategy effecting a continuous innovation stream. The recognition that a continuous stream of innovation is an important contributor to a firm's profitability is relevant to this study in that it provides legitimacy for the hypotheses related to year-over-year patent

generation and firm performance. In addition, the study revealed that companies valued innovative forms of protecting competitive advantage by the use of strategic patenting measures. Artz et al. (2010) acknowledged that patenting innovation to seek competitive protection was not an original intent of patents. Although not a focus of the study, Artz et al. (2010) noted that using patents to execute defensive practices for competitive advantage should be a consideration by management in developing innovation strategies.

Goetzke, Rave, and Triebswetter (2012) used the annual patent counts of companies in different countries as an indicator of innovation to evaluate innovation strategies in response to environmental regulations. Although all patent activity was tested, the researchers also evaluated a form of imitative innovation using patent citation analysis to consider the effects of technology spillover, or re-use, within the glass processing industry. By creating an extensive database and applying binomial regression analysis, this study revealed that citation flow coefficients indicating industry knowledge spillover, or imitative innovation flows, has the strongest relationship within a country. Interestingly, the study noted that the citation intensity measure for the United States in this study revealed the highest of all with a .418 coefficient.

Although the findings from the Goetzke, Rave, and Triebswetter (2012) study are not relevant to this study, the approach to evaluating innovation strategy is helpful. That is, using year-over-year patent counts as a construct of innovation is foundational in testing this study's hypotheses. It was also helpful in planning this study's method of reference citation analysis in connection with regression and log-likelihood techniques. Even though the issues with the study's data did not allow for this level of analysis to be performed. Hence, the comprehensive approach taken by Goetzke, Rave and

Triebswetter (2012) to include all innovation types when evaluating innovation strategy is consistent with the aforementioned hypotheses being evaluated.

In support of helping managers implement an effective strategy, Moorthy, and Polley's (2010) study evaluated the development of technological knowledge and its impact on performance. The researchers purposed to use patent and citation count data to determine how well the depth and breadth of a firm's technological knowledge predicted financial performance. The study's sample consisted of 73 firms representing 14 different 2-digit Standard Industrial Classifications (SIC) with some firms' technical portfolio encompassing 120 different technologies.

Using hierarchical multivariate regression methods to test their hypotheses, the researchers found that a firm's depth and breadth of technological knowledge is well suited for predicting the financial performance variables used in this study. Results revealed that the model explained 48, 29, and 55%of the dependent variables: return on invested capital, sales growth, and Tobin's q respectively. Although generalizability is limited given the small sample size, the findings from Moorthy, and Polley's (2010) research are supportive the current study's hypotheses regarding innovation strategy's influence on financial performance.

Summary

One area that is of critical importance and presents a challenging management dilemma is the creation of a competitively advantageous approach to innovation strategy. To that end, the aforementioned studies within the extant literature have found that all three innovation types can lead to improved performance. However, implicit in the

literature is a lack of agreement among researchers as to which type should constitute the thrust of a firm's innovation strategy. Ongoing research and development efforts significantly drive up cost and place increased pressures on existing economically profitable programs and services to generate sufficient returns that satisfy investor demands and investments for the future. In addition, maintaining current operational excellence while spending non-recurring research dollars can easily exceed operating profits and limit ongoing execution capabilities. These realities require managers to balance reductions in research, overhead, capital, and other expenses in order to a maintain competitive advantage while enabling affordable designs for the next generation of products and services (Nicholas, Ledwith, & Bessant, 2013).

Building on the findings, framework, and research expertise observed in two supporting studies (Artz, Norman, Hatfield, & Cardinal, 2010; Moorthy & Polley, 2010), the researcher was in a unique position to conduct a technically low-risk high-value study to achieve the goals described earlier in the purpose of the study. Key to this study is the random selection of publicly traded firms with year-over-year demonstrated patent generation and corresponding annual financial reports. Constructs from the two studies provided insights to help navigate a successful execution of the current study. The researcher's use of secondary data from publicly available sources provided significant and relevant information to perform data analysis and synthesize the results for findings that led to new and meaningful contributions to the body of knowledge.

The literature review has provided the researcher with a heightened appreciation for the proper framing of the problem statement with respect to the design process. More specifically, while innovation strategy has been operationalized within other studies to

emphasize a particular innovation type or innovation in general, patent counts have played a prominent role either directly or indirectly in these studies. Likewise, this study followed a similar approach that operationalized innovation strategy; that is, a firm's propensity to innovate, as documented by year-over-year patent generations. In addition, a cross-industry approach for defining the study's population coupled with random sampling methods served to increase generalizability of associated findings.

Clearly, this study purposed to operationalize the innovation strategy variable using patents without regard to innovation type. Using this broad approach to innovation strategy is intended to aid in increasing the understanding of the relationship between innovation strategy and firm performance. Thus, this research study was designed to respond to the aforementioned research questions and accompanying hypotheses while bringing focus on the following three objectives:

1. Provide managers with increased insight and understanding when allocating resources for innovative endeavors.
2. Increase understanding of the value of ongoing innovation efforts.
3. Increase understanding of the relationship between on-going innovation generation and firm performance.

To address these three research objectives, the researcher leveraged the lessons learned and key results from those studies analyzed during the literature review that identified significant relationships from an innovation strategy and performance perspective. The proper level of data review and investigative fidelity was performed on the secondary dataset that was created from USPTO records based on the firms' in the

sample. More information regarding the variable constructs used in the study will be provided in Chapter 3.

CHAPTER 3. METHODOLOGY

As inferred in the literature review, a wide variety of methods have been employed by researchers to evaluate the relationship between innovation constructs and firm performance. As these methods can be quite complicated and vary significantly, it can be difficult to assess the suitability of a method for a given focus of inquiry. Each method has its specific advantages, disadvantages and limitations. While a few methods have found wider use within specific industries, others are considered more as specialist methods generally limited to specific research inquiries (Creswell, 2009). The purpose of this chapter is to enable the reader to understand the methodology used in this study, why it is deemed suitable for this inquiry, and to provide sufficient insight such that the study can be replicated. On the basis of this information, it should be possible for future researchers to choose whether a replication should be performed or an alternate methodology should be developed.

The objective of this study is to provide a cross-sectional, multi industry assessment of the relationship between financial performance and innovation strategy, as operationalized by year-over-year patent generation. In addition, the research questions for this study evaluates the role of firm size as a function of market capitalization, and its effect on performance with respect to innovation strategy. To investigate these relationships, firms traded on U.S. exchanges from multiple industries were targeted for this study. A detailed discussion is presented here of the research design's methodology including population characteristics, sampling procedures, sources of secondary data, data collection, variables, and analytical procedures.

Research Design

Applying for and being granted patents implies that a firm places value on intellectual property. Firms that engage in the patent process provides an indicator of the strategic direction for innovation. Although patent data does not represent all innovations within a firm, prior research has investigated patent generation as part of innovation strategy and as a method of obtaining intellectual property using patent counts as a measure (Artz, Norman, Hatfield, & Cardinal, 2010). Following previous research with the goal of evaluating the relationship of innovation strategy on firm performance, the study's design called for the aggregation of assignee patents issued in a given year using the accounting year's financial performance as the criterion or dependent variable while controlling for the size of the firm.

The study employed secondary data analysis using a non-experimental quantitative design to evaluate the study's research questions, and corresponding hypotheses statements. Thus, the data was structured such that each data point reflects any specific firm's multi- year innovation strategy as a function of assignee patents issued in a calendar year. Data collection focused on a seven-year time period from 2004 through 2010 inclusive. The period was established based on the end-point of 2010 to allow sufficient time for adjustments (i.e., errors and corrections or restatements due to changes in accounting principles) to be reflected on financial statements. The collection, processing, and storage of the explanatory and criterion variables as well as other ancillary data from the secondary datasets were accomplished through the development and tailoring of Excel-based, Visual Basic for Applications (VBA).

The basic issue to be addressed in formulating a relationship model when evaluating innovation strategy relative to firm performance, is how to analyze the relationship in mathematical terms. In theory, an infinite quantity of data from the targeted population is needed to describe fully the relationship of all variables in a system. Clearly, some degree of simplification is required if a useful mathematical analysis is to be established; specifically, the relationship must be expressed in terms of a finite number of variables.

Consequently, identification of such variables allow the researcher to determine the feasibility of adopting statistical processes such as regression analysis, to estimate the relationships among identified variables. Linear and multiple regression models are without a doubt the most widely used analysis techniques found in quantitative research involving both experimental and non-experimental studies. This method is based on using changes in the predictor variables to describe the affects upon the criterion or the dependent variable (Chang & Chang, 2010; Payne & Wansink, 2011).

Theoretical Framework

Managers seek innovation strategies that influence innovative processes, products, and/or services with the purpose to disrupt routine economic patterns in order to create a competitive and/or economic advantage. Management's motivation to focus on innovation strategy with expectations of improving financial performance is underpinned by Schumpeter's (1934) economic value theory. From a management dilemma perspective, firms may benefit in the understanding of the relationship between a sustained innovation strategy and financial performance indicators. A longitudinal study

by Artz, Norman, Hatfield, and Cardinal (2010), and an empirical investigation on predicting firm performance using patent data by Moorthy and Polley (2010) and others (Cromer, Dibrell, & Craig, 2011; Malewicki & Sivakumar, 2004; Nissing, 2005; Reed & Storrud-Barnes, 2011; Wang, 2008) has established the importance of a firm's innovation strategy on firm performance.

Existing literature (Wang, 2008) has established that the management of intellectual capital, as measured by multiple innovation constructs, is a strong mechanism in shaping markets and maintaining competitive advantage (Reed & Storrud-Barnes, 2011). Literature has also established that innovation strategy is of great importance across selected industrial sectors, and as previously noted, management's motivation to predict firm performance as a function of innovation strategy is recognized as a cost effective approach in creating sustained economic advantage (Cromer, Dibrell, & Craig, 2011). This study investigated the relationship between innovation strategy and firm performance from a multi-industry perspective. In this regard, there is a paucity of research and associated findings in the current literature associated with multi-industry studies. Extant literature on innovation also does not differentiate between mid- and large-capitalized firms relative to innovation and its relationship with firm performance.

Thus, the premise of this quantitative non-experimental study is to extend previous research with purpose to address the following research questions.

Research Question 1

To what degree does innovation and a company's financial performance correlate across different industries?

Research Question 2

To what degree does innovation strategy for publicly traded mid-capitalized firms and a company's financial performance correlate across different industries?

Research Question 3

To what degree does innovation strategy for publicly traded large-capitalized firms and a company's financial performance correlate across different industries?

Research Hypotheses

Given the previously discussed purpose, and the quantitative, non-experimental design of the study, hypotheses statements have been derived from the extant literature in response to the study's research questions. More specifically, the following hypotheses address the study's three research questions:

Hypothesis 1

$H1_0$: There will be no correlation between innovation strategy and a firm's financial performance across different industries.

$H1_A$: There will be a positive correlation between innovation strategy and a firm's financial performance across different industries.

Hypothesis 2

$H2_0$: There will be no correlation between innovation strategy for mid-capitalized publicly traded firms and a firm's financial performance across different industries.

$H2_A$: There will be a positive correlation between innovation strategy for mid-capitalized publicly traded firms and a firm's financial performance across different industries.

Hypothesis 3

$H3_0$: There will be no correlation between innovation strategy for large-capitalized publicly traded firms and a firm's financial performance across different industries.

$H3_A$: There will be a positive correlation between innovation strategy for large-capitalized publicly traded firms and a firm's financial performance across different industries

Population and Sampling

Population

The relevant population examined in this study was defined by firms with a propensity to innovate within the communications, healthcare, manufacturing, and energy industries and that were also traded on U.S. stock exchanges. In addition, the hypotheses and research questions require that firms in the population have a minimum market capitalization of one billion U.S. dollars. This definition led to a target population of 1007 firms available for the random sampling procedure.

Results from each firm-level analysis process was organized by company name affiliation and stored as documents using Excel and .txt files. All results from non-firm specific analysis was organized and stored using categorical variables to identify market capitalization within a hierarchical framework. That is, the categorical variable along with associated attributes were used to designate files and/or tabs within Excel documents to include supporting analysis as applicable.

Sample

The sampling plan procedure called for each firm to be randomly selected from the previously defined population. As such, a complete list of all 1007 firms was created with a number assigned to each firm. A computer-based random number generator was then employed to draw a set of random numbers that were used to select members from the population. Sampling without replacement was also employed, which allowed for repeat random numbers to be rejected; thus, each firm in the population was only sampled once. In addition, firms were evaluated and accepted or rejected for use in the study predicated on a demonstrated propensity to patent, and the existence of annual EDGAR's documented financials, during the period of performance from 2004 through 2010 inclusive.

A multi-industry population such as the one being used in this study faces different exigencies and is therefore not considered highly homogenous. Thus, a standard power analysis was used with a relatively small effect size of 0.15 in determining the sample size (Faul, Erdfelder, Buchner, & Lang, 2009). Consequently, using a confidence level of 95%the required sample size was calculated at 374. However, a final sample size of 275 firms was used in the study due to the sampling evaluation process. That is, using random sampling techniques and the evaluation criteria for the propensity to patent and firm performance, the entire population of 1007 firms was exhausted resulting in a final sample size of 275 firms.

Given the research's design focus on evaluating the relationship between a firm's long-term innovation strategy and a company's financial performance, only firms with a demonstrated propensity to patent were selected. Research has shown that firms vary in

their propensity to patent, however, the industries selected for this study have demonstrated a propensity to patent over time (Lévêque, 2007; Moorthy & Polley, 2010; Rickne, 2006). Thus, firm level evaluation criteria for selecting companies to be included in the sample required that the firms have a demonstrative track record of patenting their discoveries.

More specifically, for each company identified by the random sampling process, the USPTO database was subsequently queried to determine the count and average number of assignee patents from January 01, 2004 through December 31, 2010. Only companies with an average of six patents per years were included in the study. The study‘s evaluative criteria requiring an average of six patents per year to determine a firm’s propensity to patent was based on studies conducting similar research. Previous studies emphasized the importance of including propensity to patent threshold criteria for including companies in research examining innovation’s relationships to firm performance, technology spillovers, and/or affects on industry collaboration. Prior research threshold criteria for determining propensity to patent criteria has ranged from 0 to 50 patents per year, and/or combined criteria to include removing companies that have had zero assignee patents over a specified consecutive number of years (Cattani, 2005; Kerr & Fu, 2008; Oettl & Agrawal, 2008; Wilhelmsson, 2009). Correspondingly, a study by Rickne (2006) of science-based firms determined that the high performing bio-technology firms were those with an average of six patents per year. Thus, leveraging off previous research, this study has established a research threshold criteria of six patents per year on average, and corresponding documented financials as reported in EDGAR’s during the corresponding seven-year period. Thus, both of these evaluative criteria were

exercised in determing the acceptability of randomly identified firms from the population to be included in the sample.

Data Collection

Data for the study was obtained from the United States Patent and Trade Office (USPTO), the Electronic Data Gathering, Analysis, and Retrieval (EDGAR) online system, Finance.yahoo.com, and Morningstar.com financial services. The volume of data required by the study and available in each patent, along with the number of patents assigned to the firms in the population necessitated the use of software-based macro utilities. A macro is a series of sequential operations that are initiated upon demand. For purposes of this study, macros were created and used in applications such as Excel as well as in the disk operating system (DOS) environments. The macros enhanced both the collection and reliability of the data by minimizing errors from manual keystrokes and mouse clicks. That is, incorporating macros into the data collection and analysis process allowed for the automation of repetitive tasks to leverage high speed processing and increased reliability.

Prior to writing the macro code, a data collection plan was developed providing an overview of the data collection process, as well as data attributes and data processing requirements. Multiple macros were required for the study resulting in over 2000 lines of code. Although simple tasks such as copying files were frequently automated, more complex processing tasks were also incorporated. For example, tasks included querying, copying, sorting, and testing over 269,000 USPTO patents for key data elements, using the research's design requirements. Thus, the incorporation of research-specific macros allowed for data verification and validation prior to data analysis.

Variables

Criterion Variables

In this study, Earnings before Interest, Taxes, Depreciation and Amortization (EBITDA) is used as the criterion variable. Similar to the dependent variable in experimental studies, the criterion variable represents the presumed effect in a non-experimental study. The values of the criterion or dependent variable explained by other variable(s) referred to as the independent variable (Creswell, 2009). According to research conducted by Anderson, Bey, and Weaver (2008), EBITDA was found to provide the highest indicator of a firm's market value added (MVA). That is, EBITDA was found to have a strong relationship to analysis seeking to quantify the capital claims against a firm and the accompanying market value of the firm's debt and equity.

In addition to EBITDA, three other criterion variables were evaluated in the study as measures of firm performance. These included Revenue (REV), Return on Assets (ROA), and Return on Equity (ROE). Both ROE and ROA have been included in similar research (Cromer, Dibrell, & Craig, 2011) given their recognized effectiveness as indicators of business operations from a profitability perspective. ROA is included given its propensity to measure the rate of return on stockholders' cumulative investment in the firm. Likewise, ROE provides an indication of firm performance with respect to the profit generated in relation to its overall use of resources.

Predictor Variables

In non-experimental studies, the predictor variable is often used to evaluate, or correlate, the relationship(s) of interest. For this study, annual patent counts were used as

the primary predictor variable as an indication of innovation strategy. In order to gain additional insight into the relationship of innovation strategy on firm performance, two other predictor variables were also planned for use. They were the average number of referenced patents per issued patent per year, and the average number of inventors per issued patent per year. These additional predictor variables were selected to provide additional insight into the resources allocated by management in the execution of the firm's innovation strategy. Table 1 identifies and summarizes the variables used in the study.

Table 1.

Variables in the Study

Variable	Type	Description
EBITDA	Criterion	Annual Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA) values for each firm with optimal Box-Cox transformation applied
REV	Criterion	Annual Revenue (REV) values for each firm with optimal Box-Cox transformation applied
ROA	Criterion	Annual Return on Asset (ROA) values for each firm with optimal Box-Cox transformation applied
ROE	Criterion	Annual Return on Equity (ROE) values for each firm with optimal Box-Cox transformation applied
Pat_Cnt	Predictor	Annual Patent counts for each firm with optimal Box-Cox transformation applied
Cnt_Inv	Predictor	Count of inventors per Patent per year for each firm with optimal Box-Cox transformation applied
REF_Pat	Predictor	Count of referenced Patents per Patent per year for each firm with optimal Box-Cox transformation applied
Mkt_CAP	Categorical	Denotes size of firm based on market capitalization: 1 = Large_CAP, 2 = Mid_CAP

Analysis Methods

Operationalizing the construct of innovation strategy is a complex process due to the nature of its multi-dimensional structure. As such, six variables that previous research has demonstrated can affect the firm's innovation strategy are used in this study to include patent counts, firm size, referenced citations, number of inventors, number of unique US codes (patent attribute data), and industrial sectors (SIC). The first four variables are internal to each firm and are germane to management's decision-making process for the allocation of resources with respect to innovation pursuits (Cromer, Dibrell, & Craig, 2011; Reed & Storrud-Barnes, 2011; Wang, 2008).

Descriptive statistics are used as an analysis method to characterize the sample of firms based on the financial and patent data collected. These data sets are sub-grouped using the categorical variables in order to develop an appreciation of levels and trends within the data set. Given the longitudinal nature of the study, the data was queried to determine the propensity of firms to generate patents within technical classifications. This query encompassed both within and across the industry sectors; the sample and results are described in Chapter 4.

Additionally, diagnostic tests for multicollinearity such as the Durbin-Watson and Variance Inflation Factor (VIF) tests were performed to check for collinearity related problems. Chapter 4 describes steps taken in the study to improve the performance of these tests and to align the data with assumptions required for tests involving linearity.

Finally, the study's analysis used correlation and regression methods to evaluate the relationship between the predictor and criterion variables previously described. Using these methods to test the study's hypotheses, is appropriate given that the predictor values

are precisely known and only the criterion variable is uncertain. That is, if a statistically significant relationship exists, the regression line can be expected to be an unbiased estimator of the criterion value (Chang & Chang, 2010). In this study, three criterion variables are used to evaluate each firm's performance as measured by EBITDA, ROE, and ROA.

Validity

Internal validity is ascribed by maintaining reliable data collection techniques, incorporating predetermined sampling procedures, and bounding of the data collection period. External validity is a focus of the study by increasing generalization using random sampling from a multi-industry population (Leedy & Ormrod, 2010).

Ethical Considerations

Given that the study uses secondary data and does not employ any personally identifying information, informed consent was not required. The study only encompasses data that heretofore existed in government and/or industry databases. Names of inventors were not included in the data retrieved for analysis.

CHAPTER 4. RESULTS

This study was undertaken with purpose to evaluate the degree to which innovation strategy, as a function of year-over-year patent generation, contributes to firm performance. Accordingly, results from this longitudinal, multi-industry, non-experimental, quantitative study are provided in this chapter. As previously stated, the period of interest for the study included the seven-year time period from 2004 through 2010 inclusive.

To be considered in the study's population, the study required firms to be publicly traded on a U.S. exchange and have a minimum capitalization of one billion U.S. dollars as of year ending 2010. These requirements defined a population consisting of 1007 companies. Similar to Moorthy and Polley's (2010) research approach, each firm selected for the sample was researched to ensure ongoing operations had been maintained throughout the period of interest based on the firm's SEC financial filings as well as issuance of annual assignee patents as reported by the USPTO. All financial numbers were adjusted for inflation with 2004 as the baseline year. The aforementioned analysis resulted in a total of 275 firms being selected for the study, which exhausted the relevant population under consideration.

Descriptive Statistics

Given the multi-industry design of this longitudinal study, the resulting sample of 275 firms in the study is unsurprisingly diverse. Using the SIC classification schema, firms in the study represent 24 different two-digit major industry classifications and 101 4-digit sub-classifications. Annual revenues (inflation adjusted to 2004) range from $3.5

million to $52.5 billion with an average of $488.2 million per year. Cumulative patents by firm for the seven-year period ranged from 39 to 27941, for a grand total of 269,121 patents; which encompassed 433 technology disciplines based on the USTPO's US class codes. In support, there was an average of 2.8 inventors per patent, and each patent, on average, referenced 15 prior patents.

A set of descriptive statistics was generated for each of the hypotheses previously presented in the study and will be repeated later in this chapter. Accordingly, Table 2 provides the aggregate descriptive statistics by year for variables associated with all firms in the study; these variables are used in evaluating the first hypothesis statement and overarching research question. Of particular interest in Table 2 are the significant differences between the mean and median statistics.

Table 2.

Descriptive Statistics for All Firms (Yearly)

Variable	N	Mean	StDev	Minimum	Median	Maximum
EBITDA	152	110835	658278	-38776	509	7747704
Revenue	152	488215	2887453	4	3638	52519449
ROA	148	5.307	10.791	-68.707	6.108	74.52
ROE	132	11.645	41.152	-488.745	13.27	740.045
Pat_Cnt	152	139.8	377.18	0	34	5879
Cnt_Inventors	152	389.7	1116.8	0	92	19673
Cnt_REF_Pat	152	2099	5453	0	585	65285

As can be observed from Table 2, the mean statistics are considerably larger in value than the median values; indicating a lack of normality and a resulting right skewness in the accompanying distributions. Similar observations can be made from the descriptive statistics presented later in the chapter for the remaining two hypotheses. Consequently, a Box-Cox analysis (Box & Cox, 1964) and an examination of the

histograms for all criterion and predictor variables used in the study led to the determination that a transformation should be applied to all corresponding data sets.

As is the case in this study, transformations can be useful when considering regression analysis using non-normal distributions in order to improve linearity, stabilize variance (homoscedasticity), and minimize multicollinearity. That is, linearity, homoscedasticity, and the absence of multicollinearity within variables are important assumptions when using linear-based analytical procedures such as regression. Additionally, the transformations were incorporated to render more symmetric and unimodal data that more closely approximate a normal distribution. Thus, the study's regression results are reported using log transformations for all dependent and independent variables using the Box-Cox (1964) optimization approach.

Using the tools suite within Minitab© as the statistical software application, regressions were ran with the outputs flagged to report Durbin-Watson, and Variance Inflation Factor (VIF) values. Durbin-Watson values approaching 2 (scale is 0 to 4) indicates that autocorrelation is not present in the sample. The VIF value is useful as an indicator of the presence or absence of multicollinearity; based on the study by O'Brien (2007), values greater than 10 signal the presence of highly correlated variables.

Data Analysis

Test of Hypothesis 1

Hypothesis $H1_A$ states that there will be a positive correlation between innovation strategy and a firm's financial performance across different industries. This hypothesis statement supports the research question that asks: to what degree does innovation and a

company's financial performance correlate across different industries? Data from all 275 companies in the sample were included in formulating the variables and subsequent tests responding to these constructs of inquiry. As previously stated, Table 1 provides the descriptive statistics for this set of data and related variables.

Also noted earlier, the descriptive statistics and associated histograms for all variables indicated right skewed distributions for all variables in the study. A Box-Cox analysis and optimization was performed resulting in log transformations for all data sets in the study to increase conformity of assumptions related to univariate normal distributions, linearity, and homoscedasticity. Subsequent to these procedures, a series of scatter plots were generated for each of the study's set of variables.

Following a review of the scatter plots, correlations, and regression analysis with their accompanying ANOVAs were performed in testing the first hypothesis. With respect to both EBITDA and REVENUE as a function of patent related variables, the plots generally revealed a positive and steeper slope than did plots for ROA and ROE. That is, plots for ROA and ROE versus patent related variables indicated flat to slightly negative slopes.

Table 3 displays a correlation matrix that presents the unconditional associations between each of the study's variables with all firms included. Unfortunately, the correlations continue to show undesired correlations between the predictor variables after executing the Box-Cox (1964) transformation.

Table 3.

Correlation Matrix: All Firms

	REV	EBITDA	ROA	ROE	Pat_Cnt	Inventors
EBITDA	0.757					
	0.000					
ROA	-0.292	-0.348				
	0.000	0.000				
ROE	-0.331	-0.345	0.735			
	0.000	0.000	0.000			
Pat_Cnt	0.428	0.259	-0.076	-0.076		
	0.000	0.000	0.216	0.227		
Inventors	0.448	0.294	-0.088	-0.112	0.979	
	0.000	0.000	0.148	0.076	0.000	
Cnt_REF	-0.268	-0.145	0.068	0.046	-0.887	-0.874
	0.000	0.016	0.263	0.466	0.000	0.000

Contents: Pearson correlations
P-Value

In testing the hypothesis using regression analysis, the goal is to produce better models. That is, to come up with better predictors or more predictors that will explain more of the variance in the criterion variable. Thus, using the predictor variables for the study, both simple and sequential (also referred to as hierarchical) regressions were originally planned for each of the criterion variables: EBITDA, Revenue, ROA, and ROE.

However, due to the presence of multicollinearity in the predictor variables, testing was limited to simple linear regression using the predictor variable Pat_Cnt as a function of each criterion variable. Given the focus of the study's problem statement, research questions, hypothesis statements, and precedence from past studies, the Pat_Cnt was considered the best predictor variable if multiple regression was not appropriate for testing due to multicollinearity issues.

The intent of the study with respect to the remaining two predictor variables was to conduct sequential or multiple regression analysis to evaluate if their inclusion and/or combinations were additive in explaining criterion variable variance. It is recognized that when two or more predictor variables are highly correlated, they basically convey the same information making some variables statistically insignificant while they should be otherwise. Thus, acknowledging that multicollinearity is present among these predictor variables, results from these multiple regression models are for discussion purposes only and not for testing the hypothesis.

Table 4 summarizes the test results from the linear regression analyses for all firms in the multi-industry sample corresponding to the condition set by $H1_A$. The null hypotheses for both EBITDA and REVENUE as a function of Pat_Cnt was rejected as indicated by the displayed p-values. Conversely, the null hypotheses for ROA and ROE as a function of Pat_Cnt was not rejected. The regression results from the REVNEUE versus Pat_Count model indicate that 18.3%of the criterion variance is explained by the predictor variable and is statistically significant. Although also statistically significant, very little of the criterion variance is explained with the model EBITDA versus Pat_Cnt.

Table 4.

Summary of Regression Analysis: All Firms

Criterion variable	Predictor variable	R-Squared	P-Value	Durbin-Watson	VIF
EBITDA	Pat_Cnt	0.064	0.000	1.990	1.000
REVENUE	Pat_Cnt	0.183	0.000	2.010	1.000
ROA	Pat_Cnt	0.006	0.216	1.780	1.000
ROE	Pat_Cnt	0.006	0.227	1.900	1.000

Test of Hypothesis 2

Hypothesis $H2_A$ states there will be a positive correlation between innovation strategy for mid- capitalized publicly traded firms and a firm's financial performance across different industries. Similarly, the research question asks: to what degree does innovation strategy for publicly traded mid-capitalized firms and a company's financial performance correlate across different industries. A total of 152 companies make up the mid-capitalized (Mid-CAP) sample for the study and the accompanying data that support the variables used to test $H2_A$.

Mid_CAP firms in the study represent 18 different two-digit SIC industry classifications and 69 4-digit sub-classifications as compared to the 275 firms' SIC classifications, which were 24 and 101 respectively. Of the 152 companies, 32 firms (over 21%) are categorized as SIC 3674 entitled, Semiconductor and Related Devices. These 32 firms received 27.4%of the patents issued to this group of Mid_CAP firms during the seven-year period from 2004 – 2010.

Descriptive statistics encompassing the seven-year period for this group of companies can be found in Table 5. Annual revenues (inflation adjusted to 2004) range from $3.5 million to $22.5 billion with an average of $232.3 million per year. This is a substantial difference from the mean of all 275 firms that averaged $488.2 million per year. Cumulative patents per year by firm for the seven-year period ranged from 0 to 2404, for a total of 68,795 assignee patents issued, which is in contrast with the 269,121 patents for all 275 firms. The average number of patents per year by firm was 64.7 patents. During the seven year period, an average of 2.68 inventors worked on each patent with each patent referencing an average of 15.4 prior patents.

Table 5.

Descriptive Statistics for Mid-CAP Firms

Variable	N	Mean	StDev	Minimum	Median	Maximum
EBITDA	152	60633	492117	-38776	169	6264000
Revenue	152	232343	1808061	4	1136	22095960
ROA	148	3.135	12.59	-68.707	4.794	74.52
ROE	132	6.87	51.67	-488.74	9.59	740.05
Pat_Cnt	152	64.66	154.9	0	24	2404
Cnt_Inventors	152	173.7	400.6	0	63	6118
Cnt_REF_Pat	152	998.9	2066.2	0	417.5	25987

Table 6 displays a correlation matrix that presents the unconditional associations between each of the study's variables for Mid-capitalized firms. Similar to the results for all 275 firms, correlations for Mid_CAP firms continue to show undesired correlations between predictor variables after executing the Box-Cox (1964) transformation.

Table 6.

Correlation Matrix: Mid-CAP Firms

	REV	EBITDA	ROA	ROE	Pat_Cnt	Inventors
EBITDA	0.533					
	0.000					
ROA	-0.227	-0.277				
	0.005	0.001				
ROE	-0.232	-0.261	0.771			
	0.007	0.002	0.000			
Pat_Cnt	0.453	0.125	0.044	0.086		
	0.000	0.125	0.598	0.325		
Inventors	0.423	0.126	0.062	0.056	0.969	
	0.000	0.122	0.456	0.521	0.000	
Cnt_REF	-0.288	-0.042	-0.038	-0.124	-0.819	-0.815
	0.000	0.607	0.650	0.157	0.000	0.000

Contents: Pearson correlations
P-Value

As seen in the analysis for $H1_A$, this analysis was also limited to simple linear regression for testing $H2_A$ due to the presence of multicollinearity in the predictor variables. Likewise, results from multiple regression models using these remaining two predictor variables will be referred to for discussion purposes only and not for testing the hypothesis.

Table 7 summarizes the test results from the linear regression analyses for Mid-CAP firms in the multi-industry sample corresponding to the condition set by $H2_A$. The null hypotheses for REVENUE as a function of Pat_Cnt was rejected as indicated by the displayed p-value. All remaining tests failed to reject the null hypotheses for EBITDA, ROA, and ROE as a function of Pat_Cnt. The regression results from the REVENUE versus Pat_Cnt model indicate that 20.5%of the criterion variance is explained by the predictor variable and is statistically significant at $\alpha = 0.05$ level.

Table 7.

Summary of Regression Analysis: Mid-CAP Firms

Criterion variable	Predictor variable	R-Squared	P-Value	Durbin-Watson	VIF
EBITDA	Pat_Cnt	0.016	0.125	2.000	1.000
REVENUE	Pat_Cnt	0.205	0.000	1.920	1.000
ROA	Pat_Cnt	0.002	0.598	1.840	1.000
ROE	Pat_Cnt	0.008	0.325	2.050	1.000

Test of Hypothesis 3

Hypothesis $H3_A$ states that there will be a positive correlation between innovation strategy for large- capitalized (Lg._CAP) publicly traded firms and a firm's financial performance across different industries. Likewise, the corresponding research question asks: to what degree does innovation strategy for publicly traded large-capitalized firms

and a company's financial performance correlate across different industries. The test for $H3_A$ was performed using data from 123 Lg._CAP companies in support of the previously described predictor and criterion variables, and associated constructs.

The group of 123 Lg._CAP firms was comprised of 18 two-digit SIC industry classifications and 60 4-digit sub-classifications as compared to the 275 firms' SIC classifications, which were 24 and 101 respectively. Of the 123 Lg._CAP companies, 22 firms (approximately 17.9%) received 55.1%of all patents issued to this group during the seven-year period. These 22 firms are classified into 4, 4-digit, SIC codes to include 3570 (Computer and Office Equipment), 3674 (Semiconductors and Related Devices), 3600 (Electronic and Other Electrical Equipment-No Computer Equipment), and 7372 (Services – Prepackaged Software).

Descriptive statistics encompassing the seven-year period for this group of Lg._CAP companies can be found in Table 8. Annual revenues (inflation adjusted to 2004) range from $51 million to $52.5 billion with an average of $804 million per year. Cumulative patents per year by firm for the seven-year period ranged from 0 to 5873, for a grand total of 200,326 assignee patents issued during the seven-year period. Patents issued to this group represent 74.4% of the 269,121 patents issued to all 275 firms. The average number of patents per year by the Lg._CAP firm was 64.0, which is close to the mean of 64.7 patents for Mid_CAP firms. Lastly, an average of 2.82 inventors worked on each patent and each patent referenced an average of 14.9 prior patents during the seven-year period.

Table 8.

Descriptive Statistics for Lg.-CAP Firms

Variable	N	Mean	StDev	Minimum	Median	Maximum
EBITDA	123	172873	814330	-4920	2511	7747704
Revenue	123	804416	3798768	51	13822	52519449
ROA	122	7.984	7.192	-41.241	7.786	43.889
ROE	121	17.328	21.756	-249.018	17.158	277.08
Pat_Cnt	123	232.7	522.5	0	64	5879
Cnt_Inventors	123	656.5	1569.4	0	190	19673
Cnt_REF_Pat	123	3459	7609	0	988	65285

Likewise with previous discussions, Table 9 displays a correlation matrix that presents the unconditional associations between each of the study's variables for Lg.-CAP firms. As seen in the results for all 275 firms, correlations for Lg._CAP firms also show undesired correlations between predictor variables after executing the Box-Cox transformation. Thus, analysis used with $H3_A$ was limited to simple linear regression for testing due to the presence of multicollinearity in the predictor variables. As discussed with both $H1_A$ and $H2_A$ testing, results from multiple regression models using the remaining two predictor variables (Cnt_Inv and Cnt_REF) will be referred to for discussion purposes only and not for testing the $H3_A$ hypothesis.

Table 10 summarizes the test results from the linear regression analyses for Lg.-CAP firms in the multi-industry sample corresponding to the condition set by $H3_A$. All test conditions for $H3_A$ failed to reject the null hypotheses. That is, the predictor variable Pat_Cnt was not statistically significant in explaining any of the variance for REVENUE, EBITDA, ROA, and ROE criterion variables at $\alpha = 0.05$ level.

Table 9.

Correlation Matrix: Lg.-CAP Firms

	REV	EBITDA	ROA	ROE	Pat_Cnt	Cnt_Inv
EBITDA	0.955					
	0.000					
ROA	-0.006	-0.185				
	0.947	0.041				
ROE	-0.226	-0.299	0.662			
	0.013	0.001	0.000			
Pat_Cnt	-0.199	-0.190	-0.004	0.067		
	0.028	0.035	0.963	0.462		
Cnt_Inv	-0.230	-0.230	0.026	0.095	0.988	
	0.011	0.011	0.773	0.300	0.000	
Cnt_REF	0.003	0.009	-0.015	0.020	0.933	0.919
	0.978	0.918	0.866	0.826	0.000	0.000

Contents: Pearson correlations
P-Value

Table 10.

Summary of Regression Analysis: Lg.-CAP Firms

Criterion variable	Predictor variable	R-Squared	P-Value	Durbin-Watson	VIF
EBITDA	Pat_Cnt	0.014	0.198	2.090	1.000
REVENUE	Pat_Cnt	0.023	0.092	2.160	1.000
ROA	Pat_Cnt	0.000	0.993	1.890	1.000
ROE	Pat_Cnt	0.004	0.488	1.820	1.000

Summary

The Schumpeterian theory (Schumpeter, 1934) for a strong organizational emphasis on innovation helped to motivate this study's development leading to three areas of inquiry. The first argument stems from a research question wherein

demonstrated innovation strategies of publicly traded firms with market capitalization values exceeding $1 billion influence firm performance (Research Question 1). The second argument segments the first by stating that publicly traded firms, that are sized or classified as mid-capitalized, which demonstrate ongoing innovation will influence firm performance (Research Question 2). The third argument continues the focus of inquiry by positing the same relationship with firm performance for firms classified as large-capitalized and that have demonstrated innovation (Research Question 3). The results from this study indicated limited support for Research Question 1 and some support for Research Question 2. However, results from this study indicate no support for Research Question 3.

In particular, the study also found no significant relationship to exist between firm performance as measured by Return on Assets (ROA) and Return on Equity (ROE) ratios. In particular, the predictor variables framing patent counts (Pat_Cnt) did not provide much support for explaining variance associated with the criterion variable EBITDA that has been helpful to investors when assessing a firm's Market Value Added (MVA). Chapter 5 will discuss the study's key findings, implications and conclusions, limitations, and recommended directions for future research on innovation strategy as a function of generating documented intellectual capital.

CHAPTER 5. DISCUSSION, IMPLICATIONS, RECOMMENDATIONS

The purpose of this study was to investigate the relationship, if any, between innovation and value creation across multiple industries by evaluating changes in firm performance with respect to patent generation. The previous chapter discussed the results obtained from testing the study's hypothesis statements in response to the research questions. This chapter will review the study's results, practical implications, and limitations. Recommendations for future research will be provided at the close of the chapter.

Discussion

This study has introduced a conceptual framework based on Schumpeterian theory to evaluate the relationship between innovation and value creation with respect to firm performance. Schumpeterian theory frames the organization as a profit-motivated entity or system driven by societal and/or competitive impetuses to create new knowledge as manifested in the form of intellectual capital (Cromer, Dibrell, & Craig, 2011; Lepak, Smith, & Taylor, 2007). Consequently, innovation or intellectual capital is expanded based on an organization's effectiveness in allocating limited resources as it leverages the knowledge, skills, and talents of the people within the organization. Depending on the company and the industry, the organization may use one or a variety of approaches such as disruptive, incremental, or imitative innovation to maintain and/or gain competitive advantage (Luo, Sun, & Wang, 2011; Salavou & Avlonitis, 2008). Regardless of the innovation approach(s) deployed, organizational leaders are expected to provide investors with financial gains in return for the use of the firms' invested capital and/or resources.

The degree that an organization follows a specific technology or innovation approach depends in part, not only on how much of the organizations' resources are invested in any one segment of technologies or group of innovations, but also the degree to which an organization is constrained by the amount of resources available for research and development on an annual basis. While maintaining focus on a specific segment of technologies or innovation approaches can result in positive outcomes for organizations whose products and services benefit in a market with demand pull; it can be financially devastating for those organizations with limited alternatives that find themselves overly reliant on products and services from which, the market is shifting away. Consequently, the level of financial health and operational agility enjoyed by a firm is dependent on the success in translating new ideas into future market shaping products and services (Reed & Storrud-Barnes, 2011). Therefore, according to Schumpeterian theory, the source of an organization's competitive advantage is its ability to continuously engage in varying forms of creative market disruption, regardless of innovative approach, as a key to sustained economic growth.

With respect to publicly traded mid- to large-capitalized firms in the U.S., whose mission it is to maximize shareholder wealth, a misalignment between the investor's invested capital in terms of research and development and the firm's financial performance, could result in loss of market share and/or the firm's market value. Thus, a management team's ability to select product development projects, while providing the requisite level and execution of resources for research and development, is essential towards sustaining economic viability and shareholder returns.

Discussion of Results

With regard to the framework just described, this study addressed three questions regarding the nature of the relationship between innovation strategy and financial performance (i.e., value creation). Consequently, innovation strategy was operationalized using a predictor variable as a function of year-over-year assignee patent generation by firms traded on U.S. exchanges. Data for two other predictor variables was also captured with respect to the number of inventors per patent issued, and the number of references cited in support of a new patent's claims. Furthermore, criterion variables were selected as attributes of firm performance to include Earnings before Interest, Taxes, Depreciation, and Amortization (EBITDA), Revenue, Return on Assets (ROA), and Return on Equity (ROE).

The study's first hypothesis ($H1_A$) and related research question posited that there would be some level of positive correlation between innovation strategy and a firm's financial performance, across multiple or different industries. To test the research question and accompanying hypothesis, linear regression was used in lieu of multiple regression using a sequential structure as previously planned. The simple form of regression testing was required due to the presence of multicollinearity among the predictor variables after applying Box-Cox (1964) log transformations. Nonetheless, linear regression provided a means of probative inquiry as to the significance, and degree, that innovation strategy explained the criterion variable as a construct of firm performance.

When testing all firms for $H1_A$, the period of interest from 2004 through 2010, the findings showed that innovation strategy is significant for a firm's performance with

respect to EBITDA and Revenue. In addition, individual regression results were able to explain about 18.3 of the revenue criterion variable Revenue and 6.4%of the variance in the EBITDA criterion variable. Conversely, the findings showed that innovation strategy was not a significant predictor for Return on Assets (ROA) or Return on Equity (ROE) during the same period for all firms. These results are consistent with findings in an event study by Xin, Yeung, & Cheng (2008) with respect to radical innovation involving a sample of 78 U.S. manufacturing firms.

The second hypothesis statement ($H2_A$) and research question was similarly tested using linear regression as opposed to multi regression due to the presence of multicollinearity among the predictor variables after applying Box-Cox (1964) log transformations. This research question focused on mid-capitalized firms traded on U.S. exchanges that also demonstrated an innovation strategy by means of year-over-year patent generation. The results indicate that the predictor variable for innovation strategy is statistically significant and useful in explaining 20.5%of the criterion variable with respect to revenue. However, there was not a significant relationship between the predictor variable and the criterion variables: EBITDA, ROA, or ROE.

The third and final hypothesis statement ($H3_A$) and research question asked, "To what degree does innovation strategy for publicly traded large-capitalized firms and a company's financial performance correlate across different industries." Surprisingly, there was no statistical significance between the predictor variable and any of the criterion variables. A number of possible reasons may well explain these findings. The next section will discuss possible explanations for the above results.

Reasons for Findings

Although not readily apparent, the contrast between the results from all firms, mid-capitalized firms, and large-capitalized firms is consistent with prior research results from industry-specific studies. That is, industry-specific studies probing the relationships between innovation and firm performance have resulted in divergent findings with regards to ratio-based measures of profitability such as assets and invested capital as measured by ROA and ROE respectively. Conversely and consistent with this study, there has been a higher degree of consistency among prior studies with regard to innovation-based predictor variables and their explanatory relationship with revenue or sales as a criterion variable (Artz, Norman, Hatfield, & Cardinal, 2010; Firer & Williams, 2003; Maditinos, Chatzoudes, Tsairidis, & Theriou, 2011; Xin, Yeung, & Cheng, 2008).

For instance, Artz, Norman, Hatfield, & Cardinal (2010) conducted a longitudinal, empirical-based study wherein the researchers operationalized innovation using new product announcements. Findings from Artz et al.'s (2010) study revealed that product announcements were statistically significant in predicting the sales growth of firms in the study. The researchers also found that managers were using patents as mechanisms for protecting competitive position and not necessarily to introduce new products and services; these non-traditional uses of patents may have biased the predictive power of patent generation with regards to profitability performance measures.

It was initially surprising that large-capitalized firms did not test as significant with respect to the criterion variables revenue as did mid-capitalized firms. The lack of significance was even more striking given the difference in average annual revenues between mid- and large-capitalized companies, which clearly distinguishes the revenue

generating capabilities between these two groups. However, one possible explanation may be attributed to the difficulty large firms' encounter when leveraging disruptive innovations or innovation-driven market shifts to execute a repositioning in the marketplace. Denning (2005) advised that large firms have experienced an estimated failure rate of greater than 90%when attempting to use innovation-driven approaches to reposition themselves in the marketplace.

Secondly, this explanation is further supported by Aboulnasr, Narasimhan, Blair, and Chandy's (2008) study on the market's response to new product innovation offerings by large firms. Aboulnasr et al, (2008) found that as large firms introduce disruptive product innovations into the market, a surge in competitive responses often materializes. The researchers further noted that the competitive response was heightened in instances when the large firm's offering was related to a relatively small market. Thus, in a long-term study such as this one, the effects on revenue from competitive surges would be expected to disassociate revenue from innovation.

Consequently, these two mutually supportive explanations lead to a third possible explanation that is implicitly incongruent with the goal of for-profit corporations to maximize wealth for shareholders. More specifically, a bank financing study by Francis, Hasan, Huang, & Sharma, (2012) that, in part, focused on loan returns from innovation was quite revealing. Finding a high degree of uncertainty with respect to R&D spending and subsequent profits from innovation outputs, the researchers found a unique dissimilarity between small and medium sized firms versus large corporations. That is, their findings suggested that the negative relationship between loan spreads and patent outputs was not as pronounced for large firms as others. These results are in line with the

earlier explanations indicating that innovation output has less of an impact on the financial performance of larger firms.

Finally, a plausible but less likely explanation for this lack of significance with regards to large-capitalized firms and financial performance may be the prolific generation of patents without regard to their direct impact on revenues or profits. Thus, with patent generation as a unit of analysis, the patent data was evaluated for Pareto-based characteristics. Pareto adds a depth to the study's analysis by giving an indication of the concentration of patent-generation among firms during the period of interest.

Pareto analysis of the seven years of patent data revealed, with regard to all firms, that 80%of the patents were issued to approximately 20%of the companies in the study. More specifically, 80.3%of the 269,121 patents were issued to 21.5%of the companies. Further, of the 59 firms comprising the 21.5%, 73.3%or 44 firms were large-capitalized firms. If low returns on scarce resources, in the form of mediocre returns on issued patents, is seen as competing with other value-added or profit-generating resources, it may well be argued that these resources may be better re-allocated to provide higher returns for company shareholders of large firms.

Although statistically significant, the multi regression model results were not reported in Chapter 4 due to the presence of multicollinearity issues, it is interesting to note that with reference patents included, the model indicated an R^2 of 34.7%. As alluded to in Chapter 4, the multi regression was performed for discussion purposes only. More specifically, there may be an opportunity for future research to develop a set of ratio-based predictor variables that include patent counts, number of inventors, referenced patents, patent processing or cycle time, U.S. classification codes, etc. As noted in the

section below on future research, a non-traditional approach to developing innovation measures using attributes from the patent filing may provide useful and explanatory variables with respect to a firm's financial performance.

Theoretical Implications

This study's findings have important implications for the study of innovation strategy and its subsequent impact on a firm's financial outcomes. One of the theoretical implications brought out in this study is the importance of innovation generating, publicly traded firms, in positioning themselves to be effective actors in shaping markets (Cromer, Dibrell, & Craig, 2011; Lepak, Smith, & Taylor, 2007). By doing this, managers responsible for allocating a firm's scarce resources can be better positioned to negotiate in challenging budgetary environments that enables them to articulate a mutually beneficial R&D strategy without being exploited, or having the needs of researchers and/or new product development staffs' marginalized. The results presented in this study indicate that innovation strategy, as operationalized by year-over-year patents generated, does relate to firm performance measures for mid-capitalized multi-industry firms. Moreover, when one considers the study's findings as well as the reality of an investor-driven accountability environment as characterized by persistent calls for performance-based returns, there is a need for increased collaboration among researchers and industry managers alike. This collaboration is important to United States' firms in order to remain competitive in the global marketplace. That is, competitive in terms of developing a compelling argument that communicates the value proposition for sustaining and/or appropriating increases in innovation-enabling investments, across a vast array of academic-, industry- and government-based entities. These tactics are necessary to not

only remain viable in a highly competitive global environment wherein other governments and consortiums are committing untold resources, but also to attain a sustainable legitimacy with investors who, more than ever, have ready access to global markets that promise high returns for the use of their investment capital (Al-Mubaraki, Sharp, & Busler, 2013; Amara, Landry, & Halilem, 2013; Chiang-Ping, Hu, & Yang, 2011; Davé, Warden, Ganguli, Hohenshell, Lindefjeld, Thappeta, . . . Murphy, 2013; Mowery, 2011).

Currently, there exists a gap in the literature as it pertains to multi-industry studies of innovation strategies and its impact on firm performance and the macro-economy. The literature that does exist on innovation activity and financial performance focuses primarily on industry specific firms (Artz, Norman, Hatfield, & Cardinal, 2010; Cromer, Dibrell, & Craig, 2011; Malewicki & Sivakumar, 2004; Nissing, 2005; Reed & Storrud-Barnes, 2011; Wang, 2008). Pulling on the literature of Schumpeterian theory to inform us about the relationships between firm innovation and the assurances that it facilitates economic shifts in the market, has continued to stimulate the conversation about the appropriateness and need for ongoing investments in R&D. Nonetheless, the story of how resources dedicated to process, product, and service innovation can impact financial performance has yet to be sufficiently explained. Thus, encouraging researchers to consider issues of R&D resource allocations and how they may be related to financial performance, and ultimately macroeconomics as an important topic for future research.

Empirical and Practical Contributions

Qualitative studies focusing on the necessity of innovation have time and again confirmed the widely held perception among company leaders that innovation is essential

to remain competitive. Yet, the recurring need to justify and resource innovation activities remains a management dilemma. Industry leaders have found it challenging when answering questions related to quantifying the financial performance benefits of ongoing investments in innovation. Thus, many leaders have approached this issue by addressing what influences successful innovations. Responses often focus on maintaining an innovative culture, customer knowledge, competitiveness, and discussing research investments that delivered improved product and service offerings through either imitative, incremental, or radical innovations (Arnold, Fang, & Palmatier, 2011; Grawe, Chen, & Daugherty, 2009; O'Cass & Ngo, 2007). In other words, leaders tend to describe the innovation-linked 'what' as being stressed in order to drive and realize innovation-enabled successes. However, this approach may be more reactionary than is needed to ensure that investors have confidence in the steps being taken by resource allocation managers to ensure innovation activities are appropriately funded. Regardless of the type of funding source, equity or debt, invested funds come with expectations of accountability and risk-adjusted, fair-market-based returns for investors.

Therefore, this research is practically significant because it highlights and extends the body of knowledge to include a multi-industry perspective on innovation strategy and its relationship to firm performance. More specifically, this research confirms and extends findings from industry-specific studies that innovation strategy as operationalized by year-over-year patent generation, are statistically significant in predicting and explaining some performance measures. Thus, intellectual capital as manifested by artifacts such as assignee patents, should be given consideration in management conversations when establishing innovation strategy and subsequent

targeting of processes, products, services, and/or technologies for improvement. As a result of this multi-industry focus, this research holds the promise of aiding managers, responsible for allocating resources to more confidently plan R&D expenditures and related outcomes. One such outcome would be to consider the finance department as an integral part of innovation planning and decision making, with purpose to help create achievable technology performance measures with regards to R&D activities that can be directly or indirectly correlated with firm-specific financial indices. Finally, this research implicitly conveys a need for managers of innovation endeavors to ensure that organizational learning is leveraged as a systematic and coherent outcome of these innovation undertakings.

Recommendations for Future Research

Although far from an exhaustive investigation, the Schumpeterian theoretical framework applied and presented within the context of this study broadens the theoretical base that previous industry-specific studies have explored. That is, this study purposed to extend the extant body of knowledge with regards to the relationship between innovation strategy and firm performance from a multi-industry perspective. Additional broadening of the body of knowledge will require that we better understand how the various contributors such as the marketplace, economic realities, industry participants (including organizational culture), various institutional innovation efforts, and the policy environment all converge to influence different investment sources in focusing and allocating innovation-enabling resources. Accordingly, future investigators need to gather detailed information from these contributing components for the formulation of

innovation constructs. Likewise, future researchers need to consider appropriate predictor variables of financial performance measures to design more complex and thorough explanatory models. As discussed earlier, future research may benefit from the development of predictor variables using a combination of data attributes from patent filings. For example, the development of index-based predictor variables derived from patent data attributes may be useful in avoiding multicollinearity issues. Thereby, enabling the formulation of more complex multi regression models to possibly explain the relationship between innovation strategy and a firm's financial performance.

Similar to the multi-industry approach, future researches should continue with the line of inquiry that captures the diversity of environments that innovation arises and its relationship to value-proposition constructs. In order to accomplish this, a mixed-methods study should be contemplated to capture undocumented innovation activities as well as innovation efforts from non-public and small business enterprises. It is also important that more is learned about individual innovation methods and outcomes that are more necessity-driven activities wherein funding is particularly limited.

In addition, the literature also stands to gain considerably from studying a diverse set of non-profit organizations (NPO) and their inherent innovation strategy. More specifically, the research should investigate the NPO's innovation strategy's relationship, if any, to benefactor contributions. With regard to leveraging innovations across different non-profit organizations, future researchers may also investigate the innovative approaches that NPO's seek to align themselves with different organizations.

Limitations

When working with databases as large as USPTO and EDGARs, it is not uncommon for the attributes of some firms to not match up when cross-referencing data files. Therefore, by the very nature of these data sources with the additional challenges of a multi-year, multi-industry study, the researcher is faced with an inherent limitation of a reduction in power and efficiency due to the reduction in sample size that occurs when firms are removed due to the inability to match a firm's data across disparate data types such as address and name changes. This limitation was addressed by using other data sources, such as Yahoo Finance and Morningstar, to correct data issues and thereby mitigate the impact of these cross-reference issues.

In addition, this analysis is limited by the fact that only firms listed and traded on U.S. stock exchanges were analyzed. No private firms, not-for-profit organizations, government, academic (public or private), or individual year-over-year patent generating entities were analyzed. Moreover, no publicly traded consumer goods or financial services type industries were included in this study as well. Consequently, these results cannot be generalized to the all-inclusive universe of innovation producing, or year-over-year patent-generating entities within the United States. In addition, although some may have been included provided that the firm was publicly listed and traded on U.S. stock exchanges, no entities outside the United States were intentionally targeted for analysis in this study. Therefore, these findings cannot be generalized to industries and/or entities outside of the United States, even though they may generate year-over-year patents and file them using the USPTO process.

Furthermore, this study was limited by time-based constraints. That is, this study was conducted over a seven-year period, including the years 2004 through 2010, it does not examine subsequent or prior years. Therefore, this study is not generalizable to subsequent or prior years. Similarly, this study does not address any time intervals that may exist between the recording of any financial data and subsequent adjustments due to company-related disclosures such as taxes, or other modifications to financial statements, annual reports, patent challenges, or other analysis-related documentation.

Another limitation of this model is the fact that some large, patent-generating firms merged, went private, or went public during the seven-year period of the study. Thus, data for these firms was not complete for the seven-year period and they were not included in the analysis. Lastly, in working with large data sets such as EDGARs, occasionally, specific data values were not published by the firm. In these cases, standard Minitab functions for handling missing data were enabled.

REFERENCES

Abel, I. (2008). From technology imitation to market dominance: The case of iPod. *Competitiveness Review, 18*(3), 257-274. doi:10.1108/10595420810906028

Aboulnasr, K., Narasimhan, O., Blair, E., & Chandy, R. (2008). Competitive response to radical product innovations. *Journal of Marketing, 72*(3), 94-110. doi:10.1509/jmkg.72.3.94

Acs, Z. J., Anselin, L., & Varga, A. (2002). Patents and innovation counts as measures of regional production of new knowledge. *Research Policy, 31*(7), 1069-1085. doi:10.1016/S0048-7333(01)00184-6

Al-Mubaraki, H. M., Sharp, J., & Busler, M. (2013). Incubator: Innovation and technological transfer. *Journal of American Academy of Business, Cambridge, 19*(1), 209-215.

Almeida, P., Hohberger, J., & Parada, P. (2011). Individual scientific collaborations and firm-level innovation. *Industrial & Corporate Change, 20*(6), 1571-1599.

Amara, N., Landry, R., & Halilem, N. (2013). Faculty consulting in natural sciences and engineering: Between formal and informal knowledge transfer. *Higher Education, 65*(3), 359-384. doi: 10.1007/s10734-012-9549-9

Andersén, J. (2007). How and what to imitate? A sequential model for the imitation of competitive advantages. *Strategic Change, 16*(6), 271-279. doi:10.1002/jsc.793

Anderson, A. M., Bey, R. P., & Weaver, S. C. (2008). Measures of income and firm valuation. *Corporate Finance Review, 12*(5), 10-15

Armstrong, J. S., & Green, K. C. (2007). Competitor-oriented objectives: The myth of market share. *International Journal of Business, 12*(1), 117-117-136.

Arnold, T. J., Fang, E., & Palmatier, R. W. (2011). The effects of customer acquisition and retention orientations on a firm's radical and incremental innovation performance. *Academy of Marketing Science Journal, 39*(2), 234-251. doi: 10.1007/s11747-010-0203-8

Artz, K. W., Norman, P. M., Hatfield, D. E., & Cardinal, L. B. (2010). A longitudinal study of the impact of R&D, patents, and product innovation on firm performance. *Wiley-Blackwell*. doi:10.1111/j.1540-5885.2010.00747.x

Baba, Y. (2012). Adopting a specific innovation type versus composition of different innovation types. *The International Journal of Bank Marketing, 30*(3), 218-240. doi: 10.1108/02652321211222568

Balasubramanian, N., & Lee, J. (2008). Firm age and innovation. *Industrial & Corporate Change, 17*(5), 1019-1047.

Bessen, J., & Maskin, E. (2009). Sequential innovation, patents, and imitation. The Rand *Journal of Economics, 40*(4), 611-635.

Boldrin, M., & Levine, D. K. (2006). Globalization, intellectual property, and economic prosperity. Spanish Economic Review, 8(1), 23-34. doi:10.1007/s10108-005-0100-3

Borshell, N., & Dawkes, A. (2010). Pharmaceutical royalties in licensing deals: No place for the 25 per cent rule of thumb. *Journal of Commercial Biotechnology, 16*(1), 8-16. doi: 10.1057/jcb.2009.13

Box, G. E. P & Cox, D. R. (1964). An analysis of transformations. *Journal of the Royal Statistical Society, 26*, 211–52.

Cattani, G. (2005). Preadaptation, firm heterogeneity, and technological performance: A study on the evolution of fiber optics, 1970-1995. *Organization Science, 16*(6), 563-580.

Chang, H., & Chang, W. (2010). A better way to increase the credibility in quantitative research. The Business Review, Cambridge, 16(2), 134-141. Retrieved from http://search.proquest.com/docview/818338617?accountid=27965

Chiang, C. C. (2006). Innovation efficiency and the market valuation of R&D. *The Business Review, Cambridge, 5*(1), 93-97.

Chiang-Ping, C., Hu, J., & Yang, C. (2011). An international comparison of R&D efficiency of multiple innovative outputs: The role of the national innovation system. Innovation: Management, *Policy & Practice, 13*(3), 341-360.

Cooper, R. G., & Edgett, S. J. (2010). Developing a product innovation and technology strategy for your business. *Research Technology Management, 53*(3), 33-40.

Craig, K. C. (2009). Create a culture of innovation. *Design News, 64*(9), 16-16.

Cresswell, J. W. (2009). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (3 ed.). Thousand Oak, California: SAGE Publications, Inc.

Cromer, C. T., Dibrell, C., & Craig, J. B. (2011). A study of schumpeterian (radical) vs. kirznerian (incremental) innovations in knowledge intensive industries. *Journal of Strategic Innovation and Sustainability, 7*(1), 28-42.

Davé, R. S., Warden, P. S., Ganguli, P., Hohenshell, J. J., Lindefjeld, R. O., Thappeta, N., . . . Murphy, B. B. (2013). Nanotechnology innovation strategy and the importance of intellectual property. *Licensing Journal, 33*(1), 7-19.

Denning, S. (2005). Why the best and brightest approaches don't solve the innovation dilemma. *Strategy & Leadership, 33*(1), 4-11.

DiBemardino, F. (2011). The missing link: Measuring and managing financial performance of the human capital investment. *People & Strategy, 34*(2), 44-49.

Dumay, J., Rooney, J., & Marini, L. (2013). An intellectual capital-based differentiation theory of innovation practice. *Journal of Intellectual Capital, 14*(4), 608-633. doi: 10.1108/JIC-02-2013-0024

Faems, D., de Visser, M., Andries, P., & van Looy, B. (2010). Technology alliance portfolios and financial performance: Value-enhancing and cost-increasing effects of open innovation. *Journal of Product Innovation Management, 27*(6), 785-796. doi:10.1111/j.1540-5885.2010.00752.x

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*, 1149-1160.

Firer, S., & Williams, M. S. (2003). Intellectual capital and traditional measures of corporate performance. *Journal of Intellectual Capital, 4*(3), 348-360.

Francis, B., Hasan, I., Huang, Y., & Sharma, Z. (2012). Do banks value innovation? Evidence from US firms. *Financial Management (Wiley-Blackwell), 41*(1), 159-185. doi:10.1111/j.1755-053X.2012.01181.x

Freedman, M. (2003). The genius is in the implementation. *The Journal of Business Strategy, 24*(2), 26-26-31.

Grawe, S. J., Chen, H., & Daugherty, P. J. (2009). The relationship between strategic orientation, service innovation, and performance. *International Journal of Physical Distribution & Logistics Management, 39*(4), 282-300. doi: 10.1108/09600030910962249

Gerpott, T. J., Thomas, S. E., & Hoffmann, A. P. (2008). Intangible asset disclosure in the telecommunications industry. *Journal of Intellectual Capital, 9*(1), 37-61. doi: 10.1108/14691930810845795

Ghosh, D., & Wu, A. (2007). Intellectual capital and capital markets: Additional evidence. *Journal of Intellectual Capital, 8*(2), 216. doi: 10.1108/14691930710742817

Goetzke, F., Rave, T., & Triebswetter, U. (2012). Diffusion of environmental technologies: A patent citation analysis of glass melting and glass burners. *Environmental Economics and Policy Studies, 14*(2), 189-217. doi:http://dx.doi.org.library.capella.edu/10.1007/s10018-012-0028-4

Goktan, A. B., & Miles, G. (2011). Innovation speed and radicalness: Are they inversely related? *Management Decision, 49*(4), 533-547. doi: 10.1108/00251741111126477

Golder, P. N., Shacham, R., & Mitra, D. (2009). Innovations' origins: When, by whom, and how are radical innovations developed? *Marketing Science, 28*(1), 166-179.

Grahovac, J., & Miller, D. J. (2009). Competitive advantage and performance: The impact of value creation and costliness of imitation. *Strategic Management Journal, 30*(11), 1192-1212.

Greve, H. R. (2009). Bigger and safer: The diffusion of competitive advantage. *Strategic Management Journal, 30*(1), 1-23.

Gummesson, E. (2005). Qualitative research in marketing: Road-map for a wilderness of complexity and unpredictability. *European Journal of Marketing, 39*(3), 309-327.

Gupta, S., Woodside, A., Dubelaar, C., & Bradmore, D. (2009). Diffusing knowledge-based core competencies for leveraging innovation strategies: Modelling outsourcing to knowledge process organizations (KPOs) in pharmaceutical networks. *Industrial Marketing Management, 38*(2), 219-227. doi: 10.1016/j.indmarman.2008.12.010

Harmancioglu, N., Droge, C., & Calantone, R. J. (2009). Strategic fit to resources versus NPD execution proficiencies: What are their roles in determining success? *Journal of the Academy of Marketing Science, 37*(3), 266-282. doi:10.1007/s11747-008-0125-x

Heeley, M. B., & Jacobson, R. (2008). The recency of technological inputs and financial performance. *Strategic Management Journal, 29*(7), 723-744.

Heiman, B. A., & Nickerson, J. A. (2004). Empirical evidence regarding the tension between knowledge sharing and knowledge expropriation in collaborations. *Managerial and Decision Economics, 25*(6-7), 401-420.

Herbert, T. T., & Brazeal, D. V. (2004). The corporation of the (near) future: Re-defining traditional structures for innovation, adaptability, and entrepreneurship. *Journal of Business and Entrepreneurship, 16*(2), 115-140.

Hoonsopon, D., & Ruenrom, G. (2012). The impact of organizational capabilities on the development of radical and incremental product innovation and product innovation performance. *Journal of Managerial Issues, 24*(3), 250-276,229.

Inauen, M., & Schenker-Wicki, A. (2012). Fostering radical innovations with open innovation. *European Journal of Innovation Management, 15*(2), 212-231. doi: 10.1108/14601061211220977

Ivica V., & Jasna P. (2008). Innovation in Croatian manufacturing 2004: What do financial results show? *Economic and Business Review for Central and South - Eastern Europe, 10*(1), 5-19,69.

Kaufmann, H. R., Tsangar, H., & Vrontis, D. (2012). Innovativeness of European SMEs: Mission not yet accomplished1. *Ekonomska Istrazivanja, 25*(2), 333-359.

Kerr, W. R., & Fu, S. (2008). The survey of industrial R&D--patent database link project. *Journal of Technology Transfer, 33*(2), 173-186. doi: 10961-007-9078-3

Kim, S., & Huarng, K. (2011). Winning strategies for innovation and high-technology products management. *Journal of Business Research, 64*(11), 1147-1150. doi: 10.1016/j.jbusres.2011.06.013

Kiron, D., Kruschwitz, N., Haanaes, K., Reeves, M., & Goh, E. (2013). The innovation bottom line. *MIT Sloan Management Review, 54*(3), 1-n/a.

Lee, O. (2012). IT-enabled organizational transformations to achieve business agility. *The Review of Business Information Systems (Online), 16*(2), 43.

Lee, R. P., & Zhou, K. Z. (2012). Is product imitation good for firm performance? An examination of product imitation types and contingency factors. *Journal of International Marketing, 20*(3), 1-16. doi:10.1509/jim.12.0019

Leedy, P. D., & Ormrod, J. E. (2010). *Practical research: Planning and design* (9th ed.). Upper Saddle River, NJ: Prentice-Hall.

Lepak, D. P., Smith, K. G., & Taylor, M. S. (2007). Value creation and value capture: A multilevel perspective. *Academy of Management Review, 32*(1), 180-194.

Lévêque, F. (2007). *Patents and Innovation: Friends or Foes*?. UC Berkeley

Levitt, T. (1966). Innovative imitation. Harvard Business Review, 44(5), 63-70.

Lieberman, M. B., & Asaba, S. (2006). Why do firms imitate each other? *Academy of Management Review, 31*(2), 366-385. doi:10.5465/AMR.2006.20208686

Luo, Y., Sun, J., & Lu Wang, S. (2011). Emerging economy copycats: Capability, environment, and strategy Academy of Management. doi:10.5465/AMP.2011.61020801

Maditinos, D., Chatzoudes, D., Tsairidis, C., & Theriou, G. (2011). The impact of intellectual capital on firms' market value and financial performance. *Journal of Intellectual Capital, 12*(1), 132-151. doi: 10.1108/14691931111097944

Malewicki, D., & Sivakumar, K. (2004). Patents and product development strategies: A model of antecedents and consequences of patent value. *European Journal of Innovation Management, 7*(1), 5-22.

Mazzucato, M., & Tancioni, M. (2012). R&D, patents and stock return volatility. *Journal of Evolutionary Economics, 22*(4), 811-832. doi: 10.1007/s00191-012-0289-x

McDonald, R. E. (2007). An investigation of innovation in nonprofit organizations: The role of organizational mission. *Nonprofit and Voluntary Sector Quarterly, 36*(2), 256-281. doi:10.1177/0899764006295996

Meyer, J. P. (2011). Effects of exploration on the relationship between intellectual capital and the retained technical value of innovation. *International Journal of Innovation Management, 15*(2), 249-277.

Moorthy, S., & Polley, D. E. (2010). Technological knowledge breadth and depth: Performance impacts. *Journal of Knowledge Management, 14*(3), 359-377. doi: 10.1108/13673271011050102

Mowery, D. C. (2011). Nanotechnology and the US national innovation system: Continuity and change. *Journal of Technology Transfer, 36*(6), 697-711. doi: 10.1007/s10961-011-9210-2

Naranjo, J. C., Valle, R.S. & Jiménez, D., (2010). Organizational culture as determinant of product innovation. *European Journal of Innovation Management, 13*(4), 466-480. doi: 10.1108/14601061011086294

Nicholas, J., Ledwith, A., & Bessant, J. (2013). Reframing the search space for radical innovation. *Research Technology Management, 56*(2), 27-35.

Nissing, N. (2005). Strategic inventing. *Research Technology Management, 48*(3), 17-22.

Nybakk, E., & Jenssen, J. I. (2012). Innovation strategy, working climate, and financial performance in traditional manufacturing firms: An empirical analysis. International *Journal of Innovation Management, 16*(2), 1250008-1250001; 1250008-26.

O'Brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality and Quantity, 41*(5), 673-690.

O'Cass, A., & Ngo, L. V. (2007). Market orientation versus innovative culture: Two routes to superior brand performance. *European Journal of Marketing, 41*(7/8), 868-887. doi: 10.1108/03090560710752438

Oettl, A., & Agrawal, A. (2008). International labor mobility and knowledge flow externalities. *Journal of International Business Studies, 39*(8), 1242-1260. doi: 10.1057/palgrave.jibs.8400358

Payne, C. R., & Wansink, B. (2011). Quantitative approaches to consumer field research. *Journal of Marketing Theory and Practice, 19*(4), 377-389.

Peeters, C., & van Pottelsberghe de la Potterie, B., (2006). Innovation strategy and the patenting behavior of firms. *Journal of Evolutionary Economics, 16*(1-2), 109-135. doi: 10.1007/s00191-005-0010-4

Pfeffer, J. (2007). A modest proposal: How we might change the process and product of managerial research. *Academy of Management Journal, 50*(6), 1334-1345. doi:10.5465/AMJ.2007.28166117

Phelps, C. C. (2010). A longitudinal study of the influence of alliance network structure and composition on firm exploratory innovation. *Academy of Management Journal, 53*(4), 890-913. doi:10.5465/AMJ.2010.52814627

Phene, A., & Almeida, P. (2008). Innovation in multinational subsidiaries: The role of knowledge assimilation and subsidiary capabilities. J*ournal of International Business Studies, 39*(5), 901-919. doi: 10.1057/palgrave.jibs.8400383

Porter, M. E. (2008). The five competitive forces that shape strategy. *Harvard Business Review, 86*(1), 78-93.

Powers, J. B., & Campbell, E. G. (2011). Technology commercialization effects on the conduct of research in higher education. *Research in Higher Education, 52*(3), 245-260. doi: 10.1007/s11162-010-9195-y

Quintane, E., Casselman, R. M., Reiche, B. S., & Nylund, P. A. (2011). Innovation as a knowledge-based outcome. *Journal of Knowledge Management, 15*(6), 928-947. doi: 10.1108/13673271111179299

Reed, R., & Storrud-Barnes, S. F. (2011). Patenting as a competitive tactic in multipoint competition. *Journal of Strategy and Management, 4*(4), 365-383. doi: 10.1108/17554251111181016

Rickne, A. (2006). Connectivity and performance of science-based firms. *Small Business Economics, 26*(4), 393-407. doi: 10.1007/s11187-005-4848-5

Sakkab, N. (2011). Our nation needs an innovation strategy. *Research Technology Management, 54*(3), 11-14.

Salavou, H., & Avlonitis, G. (2008). Product innovativeness and performance: A focus on SMEs. *Management Decision, 46*(7), 969-985. doi: 10.1108/00251740810890168

Schulz, N. (2008). Review of the literature on the impact of mergers on innovation. *Journal of Strategic Management Education, 4*(16493877), 19-63.

Schumpeter, J.A. (1934). *The Theory of Economic Development* (trans. Opie, R.), Harvard University Press, Cambridge, MA.

Seidler-de Alwis, R., & Hartmann, E. (2008). The use of tacit knowledge within innovative companies: Knowledge management in innovative enterprises. *Journal of Knowledge Management, 12*(1), 133-147. doi:10.1108/13673270810852449

Singh, J. (2007). Asymmetry of knowledge spillovers between MNCs and host country firms. *Journal of International Business Studies, 38*(5), 764. doi: 10.1057/palgrave.jibs.8400289

Smith, M., Bust, M., Ball, P., & Van der Meer, R, (2008). Factors influencing an organisation's ability to manage innovation: A structured literature review and conceptual model. *International Journal of Innovation Management, 12*(4), 655–676.

Sonnier, B. M., Carson, K. D., & Paula, P. C. (2007). Accounting for intellectual capital: The relationship between profitability and disclosure. *Journal of Applied Management and Entrepreneurship, 12*(2), 3-14.

Stadler, C. (2011). Process innovation and integration in process-oriented settings: The case of the oil industry. *Journal of Product Innovation Management*, 44-62. doi:10.1111/j.1540-5885.2011.00860.x

Story, V., Hart, S., & O'Malley, L. (2009). Relational resources and competences for radical product innovation. *Journal of Marketing Management, 25*(5), 461-481.

Styhre, A., Ollila, S., Roth, J., Williamson, D., & Berg, L. (2008). Heedful interrelating, knowledge sharing, and new drug development. *Journal of Knowledge Management, 12*(3), 127-140. doi:10.1108/13673270810875912

Sull, D. N. (2007). Closing the gap between strategy and execution. *MIT Sloan Management Review, 48*(4), 30-38..

Swanson, R.A., & Holton-III, E.F. (2005). Res*earch in Organizations: Foundations and Methods of Inquiry*. California: BK.

Trott, P., & Hoecht, A. (2007). Product counterfeiting, non-consensual acquisition of technology and new product development. *European Journal of Innovation Management, 10*(1), 126-143. doi: 10.1108/14601060710720582

Tung, J. (2012). A study of product innovation on firm performance. *International Journal of Organizational Innovation (Online), 4*(3), 84-97.

Wanasika, I., & Conner, S. L. (2011). When is imitation the best strategy? *Journal of Strategic Innovation and Sustainability, 7*(2), 79-93.

Wang, J. (2008). Investigating market value and intellectual capital for S&P 500. *Journal of Intellectual Capital, 9*(4), 546-563. doi: 10.1108/14691930810913159

Wang, M. (2011). Measuring intellectual capital and its effect on financial performance: Evidence from the capital market in Taiwan. *Frontiers of Business Research in China, 5*(2), 243-265. doi: 10.1007/s11782-011-0130-7

Wilhelmsson, M. (2009). The spatial distribution of inventor networks. *The Annals of Regional Science, 43*(3), 645-668. doi: 10.1007/s00168-008-0257-4

Withers, M. C., Drnevich, P. L., & Marino, L. (2011). Doing more with less: The disordinal implications of firm age for leveraging capabilities for innovation activity. *Journal of Small Business Management, 49*(4), 515-536.

Xin, J. Y., Yeung, A. C. L., & Cheng, T. C. E. (2008). Radical innovations in new product development and their financial performance implications: An event study of US manufacturing firms. *Operations Management Research, 1*(2), 119-128. doi:10.1007/s12063-009-0017-3

Yolles, M. (2009). Competitive advantage and its conceptual development: An exploration. *Business Information Review, 26*(2), 93-111. doi:10.1177/0266382109104411

Yong, S. L., & Ingham, H. (2012). The impact of different industrial classification schemes on firm performance: An IVs analysis. *International Journal of Business and Social Science, 3*(9), n/a.

Yoo, J. W., Reed, R., Shin, S. J., & Lemak, D. J. (2009). Strategic choice and performance in late movers: Influence of the top management team's external ties. *Journal of Management Studies, 46*(2), 308-335. doi:10.1111/j.1467-6486.2008.00802.x

Zhou, K. Z., Brown, J. R., & Dev, C. S. (2009). Market orientation, competitive advantage, and performance: A demand-based perspective. *Journal of Business Research, 62*(11), 1063-1070. doi:10.1016/j.jbusres.2008.10.001

Ziedonis, R. H. (2004). Don't fence me in: Fragmented markets for technology and the patent acquisition strategies of firms. *Management Science, 50*(6), 804-820.