Financial Narratives of U.S. Biotechnology Companies Before, During, and After the Great Recession

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Financial Narratives of U.S. Biotechnology Companies Before, During, and After the Great Recession

Abstract
The regulatory environment and associated financial disclosures required of U.S. companies have become increasingly complex as a result of dynamic market conditions and the need to assure stakeholders of the integrity of reported financial results. Advances in technology now provide the opportunity for unique investigation into the narratives included in regulated financial disclosures. The purpose of this study was to determine whether regulated financial disclosure narratives of U.S. biotechnology companies change before, during, and after a financial crisis. The research aimed to characterize financial narratives through textual analysis and the use of predetermined semantics. This is a quantitative study of Management Discussion and Analysis narratives for U.S. biotechnology companies before, during, and after the financial crisis of 2008. The study furthers the understanding of how narratives are used in regulated disclosures. This study demonstrated that financial narratives of U.S. biotechnology companies follow patterns based on predetermined language semantics. In addition, the clustering patterns change before, during, and after a financial crisis, evidence of an association between reporting narratives and earnings per share was not observed. Given the advances in analytical data technology, it is recommended that this study serve as proof of concept for public companies, stakeholders, and regulators to adopt a more efficient review of public company financial disclosures. Further research should also be completed of different reporting narratives and industries.

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Financial Narratives of U.S. Biotechnology Companies
Before, During, and After the Great Recession

By

James W. Clark

Submitted in partial fulfillment
of the requirements for the degree
Ed.D. in Executive Leadership

Supervised by
Guillermo Montes, Ph.D.

Committee Member
Peter C. Carpino, Ph.D.

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St. John Fisher College

August 2015
Dedication

Family first. Without the selfless support and love of my wife, Melissa, and our son, Benjamin, the successful completion of this dissertation would not have been possible. I am forever fortunate and grateful. Our twins provided a reminder of how fragile life is and to move forward each day is truly a gift.

During the final stages of this dissertation my father, Woodams Payne Clark, passed. He is now with my mother, Rita Mary Clark. As the last of their nine children, I was privileged to experience, firsthand, the inspiration that only the greatest generation could provide.

And finally, to my Chair, Dr. Guillermo Montes, and committee member, Dr. Peter C. Carpino. Thank you for your leadership by example. Thank you for pointing the way to use our talent to help others who too often do not have a voice for themselves.
Biographical Sketch

James W. Clark is currently the Chief Financial Officer at St. John’s of Rochester. Mr. Clark attended Geneseo State University from 1984 to 1987 and graduated with a Bachelor of Arts degree in Economics in 1987. He attended Clarkson University from 1987 to 1989 and graduated with a Master of Business Administration degree in 1989. He came to St. John Fisher College in the summer of 2013 and began doctoral studies in the Ed.D. Program in Executive Leadership. Mr. Clark pursued his research in financial narratives under the direction of Dr. Guillermo Montes and Dr. Peter C. Carpino, and received the Ed.D. Degree in 2015.
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## Table of Contents

Dedication .......................................................................................................................... iii

Biographical Sketch ........................................................................................................... iv

Abstract ............................................................................................................................... v

Table of Contents ............................................................................................................... vi

List of Tables ..................................................................................................................... ix

List of Figures .................................................................................................................... x

Chapter 1: Introduction ....................................................................................................... 1

- Introduction ..................................................................................................................... 1
- Problem Statement .......................................................................................................... 3
- Theoretical Rationale ...................................................................................................... 4
- Statement of Purpose ..................................................................................................... 10
- Research Questions ..................................................................................................... 11
- Significance of the Study ............................................................................................. 11
- Definition of Terms ..................................................................................................... 11
- Chapter Summary ......................................................................................................... 12

Chapter 2: Review of the Literature .................................................................................. 14

- Introduction and Purpose .............................................................................................. 14
- Literature Search Methodology .................................................................................... 14
- Chapter Organization .................................................................................................... 16
- Identified Research Gaps ............................................................................................. 35
Appendix B ....................................................................................................................... 84
Appendix C ....................................................................................................................... 85
Appendix D ....................................................................................................................... 87
Appendix E ....................................................................................................................... 89
Appendix F ....................................................................................................................... 92
Appendix G ....................................................................................................................... 93
Appendix H ....................................................................................................................... 94
Appendix I ....................................................................................................................... 95
Appendix J ....................................................................................................................... 113
## List of Tables

<table>
<thead>
<tr>
<th>Item</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 4.1</td>
<td>DICTION 7.0 Calculated Variables</td>
<td>49</td>
</tr>
<tr>
<td>Table 4.2</td>
<td>Summary Table of DICTION 7.0 Identified Outliers</td>
<td>50</td>
</tr>
<tr>
<td>Table 4.3</td>
<td>Final Inclusion Criteria for Each Biotechnology Company</td>
<td>54</td>
</tr>
<tr>
<td>Table 4.4</td>
<td>Cluster Membership 2006 Before the Financial Crisis</td>
<td>54</td>
</tr>
<tr>
<td>Table 4.5</td>
<td>Cluster Centers</td>
<td>55</td>
</tr>
<tr>
<td>Table 4.6</td>
<td>Cluster Names</td>
<td>55</td>
</tr>
</tbody>
</table>
List of Figures

<table>
<thead>
<tr>
<th>Item</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 3.1</td>
<td>Three critical components applied to the data analysis</td>
<td>45</td>
</tr>
<tr>
<td>Figure 4.1</td>
<td>Normalized embellishment scores for 2006</td>
<td>51</td>
</tr>
<tr>
<td>Figure 4.2</td>
<td>Normalized complexity scores for 2008</td>
<td>53</td>
</tr>
<tr>
<td>Figure 4.3</td>
<td>Graphical representation of cluster centers</td>
<td>56</td>
</tr>
<tr>
<td>Figure 4.4</td>
<td>Insistence results using DICTION raw score</td>
<td>57</td>
</tr>
<tr>
<td>Figure 4.5</td>
<td>Variety results using DICTION raw score</td>
<td>58</td>
</tr>
<tr>
<td>Figure 4.6</td>
<td>Embellishment results using DICTION raw score</td>
<td>59</td>
</tr>
<tr>
<td>Figure 4.7</td>
<td>Complexity result using DICTION raw score</td>
<td>60</td>
</tr>
<tr>
<td>Figure 4.8</td>
<td>Graphical representation of cluster centers for insistence</td>
<td>61</td>
</tr>
<tr>
<td>Figure 4.9</td>
<td>Graphical representation of cluster centers for embellishment</td>
<td>62</td>
</tr>
<tr>
<td>Figure 4.10</td>
<td>Graphical representation of cluster centers for variety</td>
<td>62</td>
</tr>
<tr>
<td>Figure 4.11</td>
<td>Graphical representation of cluster centers for complexity</td>
<td>63</td>
</tr>
</tbody>
</table>
Chapter 1: Introduction

Introduction

In the United States, the Securities and Exchange Commission (SEC), under the oversight of the U.S. Congress, is responsible for maintaining and regulating the required accounting and disclosure rules, which public firms that trade securities must follow. In addition to required financial statements, press releases and the Management’s Discussion and Analysis (MD&A) are the means by which managers communicate a firm’s performance in narrative form (Davis & Tama-Sweet, 2012). As the SEC’s regulatory powers have grown in response to the evermore complex and multi-dimensional financial markets, the seemingly straightforward mission of investor protection has become more intricate and multi-dimensional (Atkins & Bondi, 2008).

Background of disclosure reporting. It is helpful to review the background and historical development of disclosure reporting in order to understand the current disclosure environment and how disclosed information is being used. For the purposes of this discussion, “disclosure regulation” is broadly defined as mandatory reporting obligations and the enforcement of those obligations (Bushee & Leuz, 2005). Disclosure requirements are produced by the SEC, itself, and through SEC oversight of private standards-setting bodies, such as the Financial Accounting Standards Board (FASB) and the Emerging Issues Task Force (EITF), which in turn, solicit input from business leaders, academic researchers, and regulators around the world (Bushman & Smith, 2003). The abundance of disclosure information generated in a regulated environment
provides a means to review public disclosure narratives under a common and guided method of reporting. The information that is required for proper disclosure is meant to be comprehensive (Appendix A) and is broken into 12 topic areas. Topic area seven (Appendix B) offers guidance for the Management’s Discussion and Analysis, the purpose of which is to provide a narrative explanation of the financial statements and other statistical data that enhance a reader’s understanding of the company’s financial condition, changes in financial condition, and results of operation (Securities and Exchange Commission, 2013).

Historically, the SEC’s mission has focused on investor protection (Securities and Exchange Commission, 2013). Recent accounting discrepancies have resulted in a great deal of new research regarding the efficacy of disclosure reporting. After the well-publicized investigations into management indiscretions of large corporations, including Enron and WorldCom, Congress reacted in the same way it did in response to the insider trading scandals of the 1980s—it increased the SEC’s authority to enforce new and existing laws. The Sarbanes-Oxley Act of 2002, for example, imposed significant, additional requirements on corporations and their officers and directors, and it greatly expanded the SEC’s enforcement powers and the criminal penalties for violating federal securities law (Zhang, 2007).

The laws that govern the securities industry continue to evolve and, to date, include eight major bodies of legislation (Appendix C). Market instability, as a result of corporate misinformation, has compounded the need to detect asymmetrical indicators that are implicit in the disclosure statements (Hobson, Mayew, & Venkatachalam, 2012).
Moreover, the research around disclosure requirements and the associated cost remains an active debate despite the additional legislation imposed (Healy & Palepu, 2001a).

**Disclosure strategies.** In developing an overall disclosure strategy, managers have multiple outlets to communicate results and financial expectations. Mayhew (2012) defined a corporate disclosure outlet as any medium of expression or publication through which a firm describes its economic condition. This broad definition encompasses quantitative disclosure, qualitative written disclosure, and verbal disclosure. The MD&A statement falls within this definition and allows a narrative format to complement the typical financial statement disclosures. Moreover, the MD&A in Form 10-K and 10-Q filings is particularly useful, because it is less prescriptive than typical accounting measures as corporations are increasingly developing strategies on how and what to disclose, while adhering to disclosure-imposed regulation (Davis & Tama-Sweet, 2012).

**Problem Statement**

As organizations navigate the growing complexity of the global business environment, strategies for how best to meet disclosure requirements suggest that multiple approaches will continue to be employed. Furthermore, different companies may view their approach to disclosing benefits and costs differently. Firms voluntarily disclose information that is not required by the SEC in an effort to shape the perceptions of market participants and other stakeholders and, ultimately, to benefit from improved terms of exchange with these parties (Healy & Palepu, 2001b). Other firms limit their voluntary disclosures out of concern for adverse implications, including setting a disclosure precedent that may be difficult to maintain in the future (Graham, Harvey, & Rajgopal, 2005).
The research examines the least-prescriptive, but still required, part of public company disclosures, namely, the MD&A and the context of the MD&A provided by management. The analysis reviews MD&A narratives before, during, and after a financial crisis to determine the extent to which the MD&A changed as the crisis was managed by an organization.

**Theoretical Rationale**

Recently, research has mapped corporate disclosure theories as an approach to demonstrate the complex relationship between different notions of the financial disclosure phenomenon (Larissa von, Hutaibat, & Al-Htaybat, 2012). For the purposes of this study, two theoretical frameworks were employed. Signaling theory is applied as the basis of understanding from the point of view of the firm, while public interest theory is applied to capture the perspective of the regulatory body—in this case, the SEC.

**Signaling theory.** Signaling theory was originally applied to imperfect information in the labor market. In his 1973 seminal article, Michael Spence suggested that the level of education of a potential job applicant sends a signal to a potential employer of the applicant’s ability relative to the market. In turn, the employer offers wages based on the level of education which, in turn, causes future or potential job applicants to invest in higher levels of education (Spence, 1973).

When applied to information economics (Akerlof, 1970; Spence, 1973; Stiglitz, 1976), signaling theory suggests that in the sharing of information between a company’s insiders and outsiders, the company’s managers “signal” value to its stakeholders (Magness, 2010). The implicit assumption is that incomplete information exists in the marketplace since one party has more or better information than the other, thereby
creating “information asymmetry” (Spence, 2002). Because imperfect markets need a mechanism to mitigate information asymmetry, signaling theory contends that signals are sent to carry information to maintain equilibrium from sellers to buyers (Spence, 2002).

Maintaining equilibrium through signaling theory is further explained through the idea of “pooling.” This phenomenon occurs when a group of providers of public information allow themselves to be undifferentiated or pooled (Spence, 2002). They do this because there is a cost to gathering and distributing the information. The cost, and the expected benefit of differentiating oneself is not greater (Spence, 2002). The alternative to pooling is when a group expects the benefit from differentiation to be greater than the cost. Instead of pooling, the company distinguishes itself through “separation” by accepting the extra cost to signal differentiating information. From a societal point of view signaling is inefficient because resources are used to generate signals. Assuming the size of the groups is comparable, inefficient information signaling can be reduced through the use of a tax or an added cost on signaling activity (Spence, 2002).

Signaling theory is also referenced in the literature associated with disclosure requirements, and it is applied to help explain disclosure strategies and, more specifically, why managers may disclose more information than what is generally required (Haniffa & Cooke, 2002). It is assumed that investors have difficulty unscrambling accounting measures of performance from real economic achievement, hence this situation is marked by strong information asymmetry (Verrecchia, 2001). The increasing SEC requirements since 1933, in terms of detail and extent of information required, have grown and will likely continue to grow in response to the need for more-informed stakeholder
evaluations of public companies. Therefore, the problem of asymmetric information continues to be a concern worthy of further investigation.

In order to understand the motivation behind signaling, it is important to consider public companies’ incentives. Stock-based compensation plans can encourage managers to provide certain voluntary disclosures. Managers also may use voluntary disclosures to add context to poor performance (Beyer, Cohen, Lys, &Walther, 2010). Moreover, there is evidence of higher stock sales by the company’s managers after good news. Since managers behave differently based on the release of public information, there is support for further investigating the value of the information disclosed (Noe, 1999). A recent study indicated that a public information environment would likely provide benefits for firms whose stakeholders desired more transparent information (Barron & Hong, 2014).

With regard to financial narratives and in particular a firm’s MD&A, there are costs associated with varying degrees of disclosure and the construction of well-nuanced financial narratives. A public company has limited time and resources to meet the regulatory filing requirements of quarterly and annual financial disclosures. As a result, each firm must decide how much time and resources it is willing to dedicate to this task. The additional cost of signaling appears to provide a framework that ties together contrasting social phenomena between information requirements of the firm and the firm’s stakeholders (Bird & Smith, 2005). As a result, the firm’s stakeholders are challenged to review the firm’s performance through multiple perspectives. Without a fully informed assessment of performance, investors and other stakeholders may not price the firm correctly in the market, which could potentially lead to market failure (Beyer et al., 2010).
A strict interpretation of an efficient market characterized by the free market theory discounts the need for signaling between regulated firms and their stakeholders. Simply put, the stakeholder or user of the information will demand the financial information, the corporation will supply the information, and the market will adjust accordingly. At its core, free market theory argues that information is available to everyone at the same cost. Financial information is viewed as a public good, and capital markets function under ideal conditions (Cooper & Kein, 1983). The question is whether financial markets are truly as efficient as the theory implies. However, signaling theory offers further explanation of the perceived value of greater information. This is demonstrated as signaling theory addresses the market participants who are willing to distinguish or separate from the pooling participants who accept increased costs, including time and activity, to produce differentiating information.

**Public interest theory.** Public interest in political affairs is represented in the works of Plato, Aristotle, Hobbes, and Rousseau, among others (Hantke-Domas, 2003). Public interest theory often has been coupled with welfare economics and social responsibility and has been covered extensively in the political, social, economic, and legal literature. The political implications of public interest theory are excluded from the central theme of this study in order to focus on economic considerations from the perspective of the regulatory body (the SEC) and the firms (publically traded companies).

Public interest theory assumes that markets are not always efficient, and regulation occurs as a response to public demand to improve market inefficiencies (Pigou, 1960). Public interest theory suggests that imperfect information leads to increased regulations as a means to improve decision making. Without the assumption of
inefficient and asymmetrical information, exchange regulators would have little rationale to influence regulatory outcomes (Laffont & Tirole, 1991).

In order to further understand public interest theory, it is important to recognize the key assumptions behind the theory. First, there is an assumption free markets are fragile institutions and need to be regulated to keep them free (Posner, 1974). As a result, regulation exists in support of the public interest. The second assumption is that regulation is assumed to operate effectively (Posner).

Public interest theory also supports the mission of a regulatory body, like the SEC, whose stated mission is to protect investors; maintain fair, orderly, and efficient markets; and facilitate capital formation (Securities Exchange Act of 1934). The SEC’s mission statement directly asserts an intention to maintain fair and efficient markets. One method of supporting fair and efficient markets is to ensure equal access to publicly traded company information through regulation. From the regulated firm’s standpoint, regulation is compulsory even though, in some cases it is considered onerous and costly (Stigler, 1971).

Applying public interest theory to financial disclosure also must account for the cost of regulation for both the regulators and the public firms responding to regulation. In formulating policy, public officials have to consider the costs and benefits of regulation, while sponsors have to consider the costs and benefits of influencing the government to act in their favor (Levine & Forrence, 1990). In the case of financial disclosures by public companies, the SEC has the ultimate responsibility for the public interest including the setting of standards for acceptable disclosure content. The challenge faced by the SEC is to provide consistent information without making its
disclosure policy so onerous and cumbersome that the public company stakeholders incur a greater cost than benefit from the information obtained. The SEC is faced with the difficult task of how best to provide for the public interest. Recent empirical work indicates that both mandatory and voluntary disclosure are inherent with asymmetrical information flow (Bertomeu & Magee, 2014).

**Related theories.** Accountability is also a common theme in disclosure literature, and it takes into consideration the public corporation as well as the regulatory agency. (Hanke & Stark, 2009) defined accountability as the “improvement of image and reputation when dealing with outside interfaces” (p. 6). The role of a firm has significant implications if the image of the firm toward corporate social responsibility is compromised. An interesting implication of corporate social responsibility is a shift of the responsibility to reduce information asymmetry to the firm. Providing clear, concise information that reputes social responsibility is viewed as a benefit to the firm versus a cost, with an implication that firms could benefit from improved articulation of their strategy.

Normative stakeholder theory has reemerged recently as a topic to answer the question of where stakeholders should focus their efforts. Normative stakeholder theory holds that managers have a moral responsibility with regard to the interests of certain corporate constituent groups, including shareholders (Jones & Felps, 2013). The recent scholarly work on stakeholder theory is an interesting evolution, which affords a scrutinized view of wealth maximization; however, this study focuses on the regulatory-body implications of public interest theory.
Evidence supporting the application of signaling theory and public interest theory. Signaling and public interest theories are complementary because signaling theory can be applied to the user in the market of the information and public interest theory can be applied to the regulator’s stated mission. In essence, signaling theory is a response to the regulatory body’s effort to further its mission and, in doing so, it is a response to public interest. Recent research has been advanced as a result of the public’s reaction to perceived imperfect market information. Disclosure regulations provide valuable and relevant information to market users to reduce information asymmetry between informed and uninformed people (Healy & Palepu, 2001b).

Perhaps the most significant evidence that signaling theory and public interest theory provide value is their broad use across disciplines. Signaling theory is a means to understand the unpredictability of a firm’s market. Public interest theory offers insight into the regulator’s role. Over time, signaling theory and public interest theory have been applied to multiple situations of complexity and where information asymmetry is present.

Statement of Purpose

The purpose of this study is to determine whether regulated financial disclosure narratives of U.S. biotechnology companies change before, during, and after a financial crisis. The research aim is to advance the ability to understand and characterize financial narratives in a unique approach through textual analysis. The resulting conclusion informs both stakeholders and regulators of the characteristics of U.S. biotechnology companies’ financial narratives. Moreover, this study advances the use of textual analysis as a means to better understand potential asymmetries in the exchange of financial information.
Research Questions

This research sought to gain understanding on the message and tone of regulated financial reporting narratives of U.S. biotechnology companies before, during, and after a financial crisis. The research questions asked were:

- Based on predetermined semantics, do the words used before, during, and after a financial crisis follow a pattern?
- Do the message and tone of regulated financial reporting narratives change before, during, and after a financial crisis?
- Are the words used in the reporting narratives of U.S. biotechnology companies predictive of future financial performance?

Significance of the Study

The MD&A portion of annual reports of public companies is a way for managers to communicate performance in a narrative form. The biotechnology industry comprises approximately 20% of the value of the health care sector, with the pharmaceutical industry leading the sector at approximately 43% (Appendix D). The completed analysis furthers the emerging field of varied applications of financial text analysis. Moreover, through the use of the MD&A, a regulated population was evaluated under the specific disclosure requirements of MD&A reporting as governed by the Securities and Exchange Commission. Finally, with the use of statistical analysis of disclosure statement text, insight is gained into the signaled changes during and after a global economic crisis.

Definition of Terms

Acronyms and abbreviated terms often are applied in disclosure reporting and corporate finance literature. Definitions are provided in Appendix E to improve the
understanding of the key concepts in this research. These definitions have been adapted from the Securities and Exchange Commission and the Financial Accounting and Standards Board websites (Appendix E).

**Chapter Summary**

As the SEC’s regulatory powers have been increasingly deployed since its establishing legislation in 1934, significant research has been applied to the efficacy of regulation from the standpoint of both public companies and their respective stakeholders. Financial and performance-related information is required to be made public on specific time intervals through strict guidelines assigned by the SEC. Public companies invest significant time and expense to ensure the information provided to stakeholders meets SEC requirements. Moreover, public companies have inherent opportunities to convey the required and regulated information in a context demonstrating sound management of their organizations against their stated missions. SEC submission criteria affords these public companies with an MD&A narrative where they can expound on activities that occurred in their businesses relating to past performance, the impact of external operating environments, and potential implications on future performance.

Using the theoretical framework of signaling theory (from the firm’s perspective) and public interest theory (from the SEC’s perspective), a unique approach to the analysis of the narratives was employed. Prior empirical research in finance literature often has centered on traditional financial statement analysis as a predictor of public company characteristics and performance. As textual analysis software has recently advanced in
the ability to analyze larger amounts of data, it is increasingly possible to gather additional understanding of the narratives of financial statements.

To further inform the analysis of narratives, financial data from 2006, 2008, and 2013 were analyzed to capture time periods before, during, and after, the financial crisis. More specifically, U.S. biotechnology companies that trade securities provided the participant data on a basis that created an additional control of the analysis of the respective narratives. Insight with regard to how organizations use narratives to manage their respective messaging during and after a crisis further informs stakeholders’ need for meaningful information regarding expected performance. In addition, the companies that supply the information may also gain insight into their own messaging-as-reporting requirements to the SEC are fulfilled.

Chapter 2 provides the rationale for investigating the research questions and a relevant literature review. Chapter 3 outlines the research approach, specifies the research participants, data collection instruments, and data analysis procedures. Chapter 4 presents participant-company data collected and a quantitative analysis of the findings. Chapter 5 provides a discussion on the findings, specifies the implications of the findings, identifies the study’s limitations, and concludes with recommendations for researchers, regulators, public corporations, and their respective stakeholders.
Chapter 2: Review of the Literature

Introduction and Purpose

The majority of financial disclosure research is associated with the predictive nature of financial statement analysis. However, advances in information technology also have afforded an analysis of the narrative and language characteristics associated with financial disclosures. Financial narratives are produced by organizations in different forms, including footnotes in financial statements, president or CEO letters in annual reports, quarterly earnings announcements, and the MD&A, which is required in Form 10-K filings. Of the narratives listed, the MD&A receives the most regulatory-imposed rigor. The Securities and Exchange Commission has specific requirements to be addressed in the MD&A, and it has stated explicitly that, “We believe that management’s most important responsibilities include communicating with investors in a clear and straightforward manner” (SEC, 2013, p. 1). The MD&A is a critical component of that communication.

Literature Search Methodology

Financial disclosure reporting spans multiple disciplines including economics, accounting, finance, information management, business ethics, and corporate governance. The focus of this study includes an underlying component of information asymmetry and the resulting actions of regulatory bodies and the countering activities of U.S. publicly traded firms. Empirical studies were identified and prioritized if the subject matter of the
study included a linkage between stakeholders, regulators, public companies, and consideration of the impact of asymmetrical information.

As a result, inclusion criteria for the literature review were peer-reviewed articles from scholarly journals with subject matter containing economics, finance, government regulation, ethics, corporate accounting, linguistics, and information management. As expected, the scholarly work considered articles from business, accounting, and economics. In addition, empirical articles from information technology journals were also reviewed in order to capture the text-mining aspect inherent to the topic.

Inclusion criteria were applied to online research libraries including ProQuest, Web of Science, JSTOR, and Science Direct. The topic or subject criteria applied were corporate financial disclosures, financial narrative, U.S. public companies, text mining, and information asymmetry. To ensure contemporaneous scholarly information, the following additional inclusion criteria were applied: peer-reviewed articles, academic journals, and dissertations with a published date of the year 2000 or later. The result of each search was recorded using EndNote citation software as a repository for the resulting 89 articles captured.

Finally, exclusion criteria also were applied by eliminating any double entries not previously identified with a remaining 82 articles. At this point, a review of each article subject line and abstract eliminated an additional 37 journals with the majority of the eliminations due to the technical accounting nature of the topic being too narrow. Examples of these limited articles included executive compensations, accrual accounting methodologies, and information asymmetry from hedging activities. The remaining articles that were eliminated contained a predominance of research that applied to a
specific geography, leaving 45 research articles for further consideration. Twelve more articles were eliminated after they were reviewed in their entirety because they represented studies that were weak in empirical methods or completely excluded empirical findings. After these articles were removed, 33 articles remained as a basis for the review. Finally, three previously researched non-empirical articles were retained in support of introductory information or as a means to introduce a new topic.

**Chapter Organization**

The following literature review is organized into three key topic areas and it is followed by a discussion of research gaps and a chapter conclusion. The three topic areas are organized to reflect a sequence of information flow, with the ultimate consumer of the information being the perceived stakeholder who would benefit from the information.

The first topic is the empirical research associated with the Management’s Discussion and Analysis portion of firms’ regulated submissions, the second topic area is the role of asymmetrical information, and the third topic is the strategies employed to reduce information asymmetry. The information flow begins with the MD&A, which is affected by the inherent nature of asymmetrical information that is managed by the strategies of the regulatory agency and a firm. The role of the regulatory agency is to reduce information asymmetry. The role of a firm is to apply effective information strategies to send the firm’s intended information signal to the ultimate stakeholders of the information.

**Financial narratives including management’s discussion and analysis.** The Management’s Discussion and Analysis provides a narrative explanation of the financial statements and other statistical data that the registrant believes will enhance a reader’s
understanding of the company’s financial condition, changes in financial condition, and results of operation (Securities and Exchange Commission, 2013). The abundance of disclosure information generated in a regulated environment offers a means to garner insight in a controlled context.

Using public company MD&A narratives provides a unique opportunity to scrutinize a portion of the regulated disclosure that is intended to be less prescriptive but still governed by the overall financial disclosure requirements. Instructions provided by the SEC (2013) specifically state that the MD&A is intended to improve understanding of a company’s performance: “The registrant’s discussion and analysis shall be of the financial statements and other statistical data that the registrant believes will enhance a reader’s understanding of its financial condition, changes in financial condition, and results of operations” (p. 368). Therefore, the MD&A is a regulated disclosure requiring a firm to provide information that is both financial in nature but also effective in providing added information with regard to the actual financial condition of the firm.

Researchers have recognized the potential of the MD&A as a means to evaluate characteristics of public companies from both a current perspective and as a predictor. While the analysis of the MD&A is not considered a new research area, it continues to receive attention from scholarly researchers. A study that fell under the time scope exclusion criteria for this research, Bryan (1997), was the first to examine whether the type of information found in quality MD&As was associated with analysts’ efficacy for forecasting firms’ earnings.

Another early study, albeit exploratory in nature, supported a future stream of research into the language characteristics of the MD&A and tested the hypothesis that a
firm expecting negative earnings would use the MD&A as more strategic than communicative (Yuthas, Rogers, & Dillard, 2002). The hypothesis was based on the expectation that firms would attempt to offer further explanatory language when a negative earnings surprise was expected.

To test this hypothesis, Yuthas et al. (2002) examined only Standard & Poor’s (S&P) 1000 firms with a 2001 first-quarter earnings change of at least 20% less than the average earnings forecast. All Standard Industrial Classification (SIC) codes (Appendix B) were considered, with the exclusion of 7000 codes for the technology industry because this industry was considered to have volatile earnings due to the rapidly changing information technology environment. The measure of an earnings change of 20% or greater applied a paired approach of firms with a 20% positive earnings change against firms with a 20% negative earnings change. A weakness of the study, also identified by the authors Yuthas et al. (2002), was that, after filtering the companies, only seven paired companies met the criteria to be evaluated against the industry average as defined by all of the S&P 1000 excluding SIC code 7000.

However, understanding the limitations of the small sample size, the study did further the use of two important methods. The first was the use of a norms analysis tool for communicative action (Habermas, 1987). This approach required communicators to be comprehensive, truthful, sincere, and legitimate (Yuthas et al., 2002). The second method this study advanced was the use of computer-aided, text-analysis software. In this particular study, the software package applied was DICTION 5.0, which had not been applied previously to annual reports but instead to social disclosures on politics and communications (Yuthas et al., 2002). The DICTION software uses a series of
dictionaries to identify four calculated semantic features—Insistence, Embellishment, Variety, and Complexity—as well as 35 sub features. DICTION uses predefined dictionaries and can use up to 30 custom dictionaries that are built with words that the user defines, such as topical or negative words, for particular research needs (Appendix F).

The descriptive statistics applied to this study were limited through the use of simple averages as the comparative of the industry pairs against an industry average. Four attributes were measured using DICTION software: Insistence, Embellishment, Variety, and Complexity. Using the text analysis software, 37 characteristics were assigned to the five attributes. The negative-earnings companies were compared to the positive-earnings-paired companies and, finally, a comparison to the industry norm was considered. The results were presented in a simple tabular format. The table highlighted that firms with positive earnings used optimism-related terms 3% more than the industry average, while firm’s with negative performance used optimism terms equal to the industry average (Yuthas et al., 2002).

The reliability of the study was limited by its sample size and level of sophistication of descriptive statistics (Yuthas et al., 2002). At a minimum, standard deviations would have further supported the statistical analysis. However, the concept of using the Habermas’s norms was introduced as well as the advancement of text mining software (Habermas, 1987). In the Habermas’s study, the text mining software used built-in dictionaries to identify common characteristics in the narratives.

Other studies applied less emphasis on the MD&A but still focused on the narrative section of financial submissions. Keusch, Bollen, and Hassink (2012)
conducted an empirical analysis regarding the use of narratives in annual reports. Similar to Yuthas et al. (2002), the study focused on narrative text and not on the traditional financial statements. Differing from Yuthas et al., a letter to the shareholders was analyzed instead of the MD&A. More specifically, the analysis was based on whether the use of defensive language attributions differed in a crisis setting versus a non-crisis situation. The population sample comprised the Standard & Poor’s Europe 350® index, which included some of the largest companies in Europe as measured by their market capitalization. High capitalization companies were included because these companies were expected to be followed closely by analysts, investors, and regulators. The year 2008 was used to represent period of time of external crisis, as it was characterized by a severe Gross Domestic Product (GDP) contraction in most developed countries. The year 2006 was chosen as the benchmark, non-crisis year. In total, 125 companies were included in the sample, with one sample for the crisis year and one sample for the non-crisis year, resulting in 250 observations. When industry categorizations were applied, the Standard Industrial Classification system was used.

The use of paired samples was appropriate to measure the same companies before, and after the event that, given its global nature, impacted multiple organizations. In this case, the event was the 2008 market crisis, which afforded potential research on the change to organizations’ narratives. The question of how firms react is of interest to the analysis of asymmetrical information. Specifically, do firms provide narrative language that is supportive to help guide the market through the event, or do the firms take a defensive posture?
Two, one-sample *t*-tests on acclaiming (non-defensive) and defensive attributions were conducted. The results indicated the use of acclaiming attributions was high in both 2006 and 2008 with *t* scores of *t* = 5.5 and *t* = 4.2, respectively, (*p* < 0.001). The results indicated that the outcomes were predominantly credited to company actions in both years. This outcome was based on a manually coded analysis of the statements by year.

As corporations continue to be held to the reliability of their own statements through disclosure-imposed regulations, strategies on how and what to disclose have developed. Managers choose the degree of detail that is reported about a particular data item or event as well as the words to describe it (Davis & Tama-Sweet, 2012). Within the prescriptive disclosure context, company leaders have discretion with regard to the language they use to support their respective financial results. Although accounting-statement disclosures are generally prescriptive in nature, the requirements of other non-accounting activities are open further to the organization’s public communication strategy. Specifically, (Davis & Tama-Sweet, 2012) tested the hypothesis that pessimistic language in press releases, relative to the same firms’ MD&A, was negatively correlated.

Using a sample size of 11,826 financial statements, 12 financial variables, including cash flow and net income, were compared to 20 language variables using DICTION 5.0 to determine the use of optimistic versus pessimistic language. Disclosure information and earnings press release data were compiled using COMPUSTAT, an earnings announcement repository, as the retrieval software for quarterly industry filings.

Using mean, median, and standard deviation as descriptive statistics, the press release and the MD&A were both analyzed using the DICTION 5.0 built-in dictionaries
similar to the study. The mean for the use of pessimistic language for the press release was 0.5, and the MD&A was 1.0, indicating MD&A disclosures as pessimistic. The use of optimistic language for the press release and the MD&A were 1.3 and 1.1, respectively, and they were statistically different. These findings showed a greater use of pessimistic language as a statistically significant difference in the MD&A versus the press release. However, the study did not discuss if or how to discover if this was strategic and/or intentional.

The study completed by (Davis & Tama-Sweet, 2012) contained a pragmatic use of language analysis specifically exploring the use of pessimistic language. Using the text mining approach across multiple narratives in the same study would have likely strengthened the methodological approach. However, this often-cited study has value in its approach as it used a language-analysis approach to further analyze and potentially discover shifts in managers’ reporting strategies under different economic conditions.

The role of asymmetrical information. The transfer of information from the inside of a firm to outside stakeholders includes the potential for asymmetrical information marginalizing the efficacy of the regulation as well as the firm’s ability to communicate consistently with the intended message.

The fundamental premise of asymmetrical information is that one group or organization has more information than another. As a result, many behavioral implications arise, including an attempt to level the information exchange by a regulator, attempts to strategize how the information is extended by the reporting group, and attempts to better understand the information by the stakeholder. In all cases, the
identification and implications of asymmetrical information become important to driving subsequent behaviors.

An examination of information asymmetry and the awareness of its impact, both internally and externally, will better inform a firm’s strategy to meet its intended mission as well as the intended stakeholder’s perception of how well the mission is being executed. Moreover, it has been argued that a non-empirical study of information asymmetry reduction, as a vehicle to integrate the efficiency of disclosure choice, is appropriate (Verrecchia, 2001).

In a large-scale, data-rich study, (Tetlock, 2010) used 29 years of data on all publicly traded U.S. firms in the Dow Jones News Archive to examine how firms’ information environments changed during an initial observation set of more than 2.2 million news events. The study modeled firms’ stock prices in which a public news story eliminated information asymmetry between two groups of traders. The primary source of information was the Dow Jones News Archive, which contains all Dow Jones News Service and all Wall Street Journal stories from 1979 to 2007. Only active stocks were considered where a news story was available. After imposing these requirements, 13,842 unique firms appeared, at some point, in the 29-year sample. Of these firms, 9,452 had news stories on at least one trading day.

The hypothesis tested was that the correlation between absolute returns and trading volume should decline after additional negative news earnings were revealed. News stories in connection with the same earnings releases were observed on the same day of the release and the next day after the release. Using negative words as the independent variable and the firms’ next-day news as the dependent variable, the post-
news differences were analyzed by applying a correlation analysis. The coefficients on negative words the first day was $-8.6 \ (t = -11.2)$, and the next day it was $-1.6 \ (t = -2.4)$, which supported the hypothesis that the market can react to negative language differently over a 24-hour period.

In a similar study, Clatworthy and Jones (2003) conducted an empirical analysis of 50 of the UK’s top and bottom performing firms, using their chairmen’s announcement as the financial narrative since the firms’ last annual report publication. Using a sample size of 100 annual reports, the financial narratives of the top 50 firms and bottom 50 firms were compared. Using a two-tailed t-test, the improving firms’ scores versus declining firms’ scores for the total mean words used were 41.20 and 37.00, respectively ($p < 0.001$). Positive and negative mean words used were also compared between the high-performing and low-performing firms. Again, a two-tailed t-test was conducted and indicated that the highly performing firms used a mean of 37.80 positive words versus 25.40 ($p < 0.001$) positive words used by the low-performing firms. The results are indicative of a pattern where companies with improving performance use more words in total and more positive words when compared to declining companies. These results support the notion that managers strategically use narratives differently during different financial performance outcomes.

A corporate disclosure outlet has been broadly described as any medium of expression or publication through which a firm describes its economic condition. This broad definition encompasses quantitative disclosure, qualitative written disclosure, and verbal disclosure (Mayhew, 2012). Hail (2011) explored the role of unregulated disclosure and concluded that there was little evidence available to show that unregulated
disclosure arrangements turn into a practice which then shapes corporate transparency and, ultimately, affects investors and other market participants (Hail, 2011).

(Francis, Schipper, & Vincent, 2002) studied the market’s reaction to earnings announcements, and they had unexpected findings concerning the relation between investors’ reactions to analysts’ reports and investors’ reactions to subsequent quarterly earnings announcements. Building off the work of (Verrecchia, 2001), absolute abnormal returns were measured over time for both annual reports and analyst reports. The hypothesis tested whether one signal—the annual report—had an influence on a subsequent market signal—the analyst report.

The firms tested were required to have a least one filing with COMPUSTAT, an earnings announcement repository, and Zacks, an analyst report repository, during the years 1986 through 1995. The average number of firm observations per year was 2,202. Aggregate abnormal returns were computed where N was the total number of analyst report dates in year \( t \) compared with the time period for earnings announcements and analyst reports. The results indicated a 16% aggregate of absolute reactions (range 14-20%) to earnings announcements and an 81% aggregate of absolute reactions to analyst reports (range 64-91%) (Francis et al., 2002).

The more pronounced reaction to analyst reports over earnings announcements represented an area for further inquiry. In addition, both earnings announcements and analyst reports had a narrative component (albeit less regulated, which is similar to the MD&A) that would likely allow for further study. Although the study had a large sample size and was completed in 2002, the data now is dated as it was before the financial crisis of 2008.
Other studies have expounded on the insider concept inherent to potential asymmetrical information exchange. Specifically, the focus was on senior officers’ stock sales when they had an information advantage over other insiders. (Anastasia, Bong Soo, & Kerstin) (2014) used the differences in timing of trades by senior officers and other insiders (e.g., directors or large shareholders) to infer asymmetric information.

To test for possible information asymmetry, a population of 348 observations was derived from communicated earnings forecasts and later from actual reported earnings per share (EPS) during the period of 1996 through 2010. The observations consisted of sales by senior officers during the time period between the forecast and the final EPS submission. In the study, the data was reported by corporate insiders to the SEC (Anastasia et al., p. 100).

Using insider trades sales and purchases as dependent variables required splitting the sample into net sales and purchases. The results were analyzed using a non-sales month and a sales month that occurred after the earnings announcement. Descriptive statistics demonstrated that senior officers’ salaries increased when future returns were higher. Using an econometric model to analyze the information asymmetry, the analysis showed that senior officers used private information about future returns when they planned to sell their stocks in anticipation of future lower returns (Anastasia et al.).

**Disclosure strategies of a firm.** In developing an overall disclosure strategy, managers have multiple means to communicate results and financial expectations. An analysis of the MD&A in Form 10-K and 10-Q filings has been expected to prove to be particularly useful, because the MD&A is less prescriptive than typical accounting measures. In addition to the analysis, private corporations frequently extend their
disclosures on a voluntary basis by weighing the marginal costs against the marginal benefits going beyond regulatory requirements (Healy & Palepu, 2001b).

Accrual accounting is required by the U.S. “generally accepted accounting principles” (GAAP) as a method that measures the performance and position of a company by recognizing economic events, regardless of when cash transactions occur. This method allows the current cash inflows/outflows to be combined with future expected cash inflows/outflows to give a more accurate picture of a company’s current financial condition (Investopedia, 2014). However, accruals are open to some degree of discretion, which supports an ongoing debate found in the accounting literature, that managers use discretionary accounting choices as an opportunistic strategy to smooth earnings reports during difficult times or to meet specific performance targets (Bowen, Rajgopal, & Venkatachalam, 2008). It is important to identify this possibility as a further analysis of a firm’s regulated narratives, which may help to expose the use of opportunistic and discretionary accounting practices.

A hypothesis tested by Bowen et al. (2008) identified abnormal accruals by using the absolute value of abnormal accruals after controlling for change in normal cash flows. Using a Spearman correlation, abnormal accruals, as a key discretionary choice, were compared to economic outcomes, including sales growth and returns on assets over a three-year period, with a population size of 3,154 observations. Although the measure for abnormal accrual activity was reported as statistically significant, the differences were minimal for the return on assets and a greater correlation was observed for sales change. When correlated against sales change and return on assets, abnormal accruals were −0.20 and 0.04, respectively (p < 0.05).
Bowen, Rajgopal, and Venkatachalam (2008) added to the accounting literature by an empirical analysis of the determinants and use of discretionary accounting under the guidelines allowed by the GAAP. Tangentially, the study also demonstrated the complexity and difficulty of capturing potential strategies a firm might employ that would lead to a greater asymmetrical information exchange. The study further illuminated the need to consider new approaches to understanding information content between public companies (insiders) and stakeholders (outsiders).

**Methods to reduce asymmetrical information exchange.** Historically, the SEC’s mission has focused on investor protection (Securities and Exchange Commission, 2013). Recent accounting discrepancies have resulted in a great deal of new research with regard to the efficacy of disclosure reporting. After the well-publicized investigations into management indiscretions of large corporations, including Enron and WorldCom, The SEC was subsequently provided with additional authority by congress to develop and enforce new laws.

The Sarbanes-Oxley Act of 2002 imposed significant additional requirements on corporations and their officers and directors. Measuring the economic consequences of the added disclosure specific to the Sarbanes-Oxley Act has been a topic of research and it affords an opportunity to examine the role of the regulator. Using a comparison of U.S. firms impacted by the Sarbanes Oxley regulation versus non-U.S., non-impacted firms, (Zhang, 2007) attempted to identify significant negative abnormal returns associated with the events leading to the imposed regulation. Computed abnormal returns (CAR) are defined as the sum of the differences between the values of equally weighted returns versus the expected value of equally weighted returns. The entire U.S. market returns for
the day before an event, and the day after an event, were used for the analysis. T-statistics were computed using the standard deviation of the raw returns during the event period. The results indicated that the most significant market reaction occurred on July 9, 2002, when President Bush gave a speech that emphasized the need for government-managed reforms. The abnormal returns were: $-1.55 \ (t = -1.07, \ p = 0.04)$ and $-3.1 \ (t = -1.80, \ p < 0.001)$. The results supported that qualitative events, such as a speech by a President, are correlated with market changes.

The role of the SEC as a regulator includes the regulation of how information is presented. The MD&A guidance, alone, has nine subsections (Appendix B). Given the SEC mission of providing meaningful information, it is important to understand the determinants of corporate transparency. A study that reviewed disclosure characteristics, including intensity and timeliness, defined corporate transparency as the widespread availability of information concerning publicly listed firms (Bushman, Piotroski, & Smith, 2004). Intensity was defined as the amount of information in the disclosures, including research and development, capital expenditures, and product data. Timeliness was defined as the frequency of reporting. The number of financial analysts gathering information on the firm measured information acquisition.

Pearson correlation statistics revealed a positive correlation between the quality of the disclosure data and the number of financial analysts reviewing each disclosure. With a sample size of 46 analysts following a firm, this correlated the disclosure with Pearson scores of 0.57 ($p < 0.001$) and 0.53 ($p < 0.001$) for intensity and time, respectively. This result provided further evidence that the content of disclosure reports is an important variable that is managed by the disclosure regulation imposed by the SEC.
The hypothesis was that MD&A modifications, year over year, are indicative of a company’s intention to use the MD&A as the SEC has prescribed, namely, that the MD&A be informative and captures the changes in operating activities and results of the firm. A unique approach to this analysis was employed by (Brown & Tucker, 2011). The use of a Vector Space Model (VSM) was developed to compare the frequency of MD&A words of a firm’s current year with its previous year. Hoberg and Phillips (2010) used a similar approach when reviewing whether similarities in product descriptions in Form 10-K filings were associated with merger and acquisition decisions.

For the years 1997 through 2006, more than 2,500 observations were analyzed by pairing firms in similar industries. Each firm’s MD&A was compared to the previous year using the VSM and developing a VSM raw score. Each of the scores was plotted by industry, allowing for a simple trend analysis. Next, a Spearman correlation analysis was completed with the VSM score compared to a change in EPS and liquidity ratios as a measure of cash on hand.

EPS results were positively correlated with the change in the MD&A as measured by the raw score derived from the VSM (p = 0.11). This suggested that managers with large economic changes reflected all or some part of the change in their respective MD&As. Liquidity, p = 0.01, was significantly higher than the coefficient for an EPS of 0.003.

The results of this study supported the hypothesis that managers do change their respective MD&As based on changes impacting results. However, it is difficult to discern if the changes made were simply to comply with SEC requirements or to provide greater decision-making information to the outside stakeholders. In either case, the
implication was that managers have the ability to choose whether to disclose more or less information.

Very few studies with regard to the MD&A narrative research are of an experimental nature where an intervention is used to gain information with regard to the ability of the narrative to effectively transfer information. One exception is a study completed in 2012 by Rennekamp that focused on an experiment providing information of a more readable nature.

The study was designed to test the hypothesis that more readable information would result in the study participant’s ability to rely on the information and subsequently revise his or her valuation judgments of the firm. A company background was provided to 233 study participants. Each participant was asked to provide his or her opinion of the company’s financial performance after reading the company’s background information. Next, they were given a narrative with regard to the financial performance of the company. The study participants were asked to evaluate their perception of the readability of the narrative and if the narrative contained good or bad information. The readability of the narratives was broken into two groups. One of the narratives was less readable and violated some of the readability and formatting suggestions published in the SEC’s Plain English Handbook (SEC, 1998).

The less readable information was given to 113 subjects; the more readable information was provided to 120 subjects. An ANOVA was completed and plotted with good news/less readable information plotted along with good news/more readable information values of 18.15 and 23.50, respectively. Bad news/less readable information was plotted with bad news/more readable information values of −10.26 and −14.43,
respectively. These results suggested that readability does influence knowledge transfer and the outcome of how the stakeholder may view the firm.

**The role of a firm with regard to information asymmetry.** As firms develop and advance their respective corporate identity, the role of publicly disclosed information and language analysis becomes increasingly relevant. Bravo, Matute, and Pina (2012) analyzed the language used by 82 Spanish banking-institution websites to determine whether the banks were using language to advance corporate social responsibility. The study advanced concepts that were relative in light of the recent banking failures and economic crises that had been experienced in Europe. Despite the extensive amount of research on corporate social responsibility, this study found a novel means to review a specific industry using a public-information language analysis.

One aspect of the study compared savings banks to institutional banks. These two groups were identified under the assumption that savings banks were more community based and more inclined to promote social responsibility, while financial institutions were less inclined to strategically promote corporate social responsibility. Each entity was reviewed by two judges, independently, and inter-judge agreement coefficients in the categories were 90% or above. The judges compared the criteria based on frequency against total word count. The t-values for customer, employee, environmental, supplier, and community corporate social responsibility, indicated that savings banks issued more information regarding corporate social responsibility than the financial institutions in all categories except for suppliers. The largest value difference was reflected in the customer category with an institutional bank score of 0.38 and a savings bank score of
0.67 (p < 0.001). These results supported the hypothesis that financial institutions were less inclined to strategically promote corporate social responsibility.

Information that is not required by the SEC is at times disclosed by companies in order to convey information the firm assumes will be perceived as a stakeholder benefit (Healy & Palepu, 2001b). Other firms limit their voluntary disclosures out of concern for adverse implications, a predominant reason identified for limiting information is out of concern that the managers of the firm may set a precedent that may not be obtainable in future disclosures (Graham et al., 2005).

There is evidence that more regulation may not always lead to improved firm governance. Excess accounting discretion does not necessarily imply weak governance, as illustrated by a factor analysis of predetermined governance variables, with a finding that the correlation between the governance factor score and predicted excess accounting discretion was only −0.060 (Bowen et al., 2008). When a substitute for the governance factor score for the extent of accounting discretion was explained by governance, the resulting coefficient on the governance factor score was not statistically significant (Bowen et al., 2008).

**Advancements in information technology.** As information technology advances, text-mining techniques have become increasingly refined and able to handle larger volumes of free-form text. From a financial disclosure standpoint, text mining has been used to identify sentiments of investors, such as negative or positive opinions, from business newspapers and financial websites (Lee, Song, & Kim, 2010).

Recently, the SEC mandated the use of eXtensible Business Reporting Language (XBRL) as a means to further standardize and make efficient the transfer of financial
information from publicly traded firms to the SEC (Henderson, Sheetz, & Trinkle, 2011). XBRL facilitated the automatic and reliable transfer of financial data across different technology platforms (Troshani & Lymer, 2010). XBRL has been referenced as a means to not only improve efficient transfer of information but to include seamless transfer of financial data across different information technologies and to overcome lingual and national barriers (Deshmukh, 2004).

Although a recent study was limited to large firms in one country, Korea, the study did support the conclusion that XBRL adoption reduces the information asymmetry of the Korean stock market (Yoon, Zo, & Ciganek, 2011). T-tests and multiple-regression analysis were used to analyze the impact of XBRL on information asymmetry. Referencing the work of (Healy & Palepu, 2001a), Yoon et al. (2011) identified the reduction of information asymmetry as a potential benefit of the advancement of XBRL usage. The hypothesis tested was whether XBRL advanced the search capabilities of stakeholders and further reduced information asymmetry.

The method applied was to use the public companies reported in the Korean stock market and measure volatility as defined by the bid-ask spread and trading volume. Trading volume is defined as the number of securities exchanged in a given time interval. Volatility was measured during the XBRL pre-adoptions and post-adoptions periods for 550 Korean firms. An analysis of the correlation among variables, including firm size and stock price, was completed. The resulting regression coefficient for XBRL adoption was −0.05 and was significantly related to the bid-ask spread.

The implications of the Yoon et al. (2011) study are important because the benefit of XBRL technology was shown to have an impact on information asymmetry.
Unfortunately, the study was limited in size and geography. Conversely, the study added to the research that technological advances can be applied to further understand methods and practices that may lead to less information asymmetry. Although this study was fairly recent (2011), it is still four years behind current technological advances.

A recent study that had applied the practical use of textual-analysis software has advanced this approach from a large-sample analysis. As stated by the study, “This is an important methodological advantage, because prior studies required the construction of qualitative disclosure measures using manual coding methods” (Davis, Piger, & Sedor, 2012, p 863).

**Identified Research Gaps**

Disclosure of financial information includes a firm’s approach to meeting regulatory requirements while advancing the mission and goals inherent to the organization. As a result of recent market disruptions and associated regulatory changes, coupled with the need for more efficacious and nonsymmetrical information, there is be a research gap understanding how firms’ narratives have changed. The research gap will be addressed by bringing together the varied components of previous work including an analysis of narratives, text mining, and the associated identification of changes in language usage over a period of time when a financial market disruption is identifiable. The research will advance the work in language analysis and identify if managers of companies have attempted to change market perceptions through signaling different financial priorities of their respective firms.

A comparison of industry types also should be considered as a research gap when applied to a particular characteristic the researcher seeks to uncover. An example might
include whether the banking industry responded faster to the perceived benefit of corporate social responsibility than other organizations that had endured the financial crisis of 2008.

A number of studies used the DICTION software to support the researchers’ text mining and taxonomy methods; however, there is an option to further detail dictionaries for specific insights that the research could uncover. DICTION is now in its 7.0 version and includes the ability to customize dictionaries. In addition, custom dictionaries also have the potential to identify inconsistencies between firms whose reporting emphases internal activities and firms that are guided more by changes in their respective marketplace.

Finally, MD&A research, in general, is of a non-experimental nature because the traits of firms or stakeholders are being measured without attempting an intervention. However, the reduction of information asymmetry may be further supported by experimental interventions. An example of this type of study was evident when processing fluency was analyzed by (Rennekamp, 2012). The intervention, in this case, came in the form of two different disclosure formats where one was considered more readable than the other.

**Chapter Summary**

The literature with regard to MD&A narratives is plentiful and often centers on the predictive ability of inferences made in the MD&A narrative. As computing power and efficiency advance, coupled with the sophistication of text mining software, the MD&A narrative is taking on a more meaningful role for the stakeholders of financial reporting. A noticeable shift in the literature is the pairing of text mining to narrative
analytics. Additional research will help fill the knowledge gaps previously outlined and may, in fact, allow for new applications in text mining and analytics.

As stated by Verrecchia (2001) in a non-empirical study:

One issue that deserves greater attention in the accounting literature, both theory-based and empirical, is the relation between disclosure and information asymmetry reduction . . . . The link between disclosures to efficiency supports the economic rationale for the utility of financial reporting demonstrating the link empirically has proved elusive. (p. 175)

The preceding statement was made without the benefit of knowing the impending vast and rapid changes in technological innovation. In today’s technological environment, the use of narrative analysis has significant potential to reduce information asymmetry.

Improvement of the financial information exchange, as regulated by the SEC and passed between the firms and stakeholders, may come from technological advances previously not considered. Text mining is meant to be complementary to financial statements. However, it is possible that text mining of financial narratives may validate, or even discredit, financial assertions. At a minimum, through the application of new and evolving technology, information asymmetry may be mitigated and supportive of improved decision making.

As stakeholders of financial information grow in sophistication and the ability to process large amounts of data, it is likely that new insights will be found through the analysis of financial disclosures. An area that requires significant processing speed and efficiency is the analysis of the narrative portion of financial disclosures. The MD&A is
a required element of a complete financial disclosure. As data analytics increase,
specifically regarding narratives or text analysis, firms will likely act or react to
stakeholders’ interpretations, which are garnered from these analytics. Of equal interest
and intrigue will be the reaction of the SEC that has already required firms to stay up-to-
date with technological advances through the submission requirement using XBLR in
2008.
Chapter 3: Research Design Methodology

Introduction

The analysis of financial narratives of biotechnology companies before, during, and after a financial crisis affords a unique approach to garner insight into how organizations contextualize information in a regulated environment. As organizations navigate the growing complexity of the global business environment, strategies for how best to meet disclosure requirements suggest that multiple approaches will continue to be employed. Furthermore, different companies may view their approach to disclosing benefits and costs differently. Firms voluntarily disclose information that is not required by the SEC in an effort to shape the perceptions of market participants and other stakeholders and, ultimately, to benefit from improved terms of exchange with these parties (Healy & Palepu, 2001b). Other firms limit their voluntary disclosures out of concern for adverse implications, including setting a disclosure precedent that may be difficult to maintain in the future (Graham et al., 2005).

The proposed research examined the least-prescriptive, but still required, part of the public company disclosures, namely the MD&A and the context of the MD&A provided by management. The analysis reviewed MD&A narratives before, during, and after a financial crisis to determine the extent to which the MD&A had changed as the crisis was managed by the organization.
Method

The following summarizes the methodology for a quantitative study of Management’s Discussion and Analysis narratives for U.S. biotechnology companies before, during, and after the financial crisis of 2008 and includes a description of the participant public companies, procedures used, instruments of measurement, and the resulting data analysis. Through the use of the MD&A, a regulated population was evaluated under the specific disclosure requirements of MD&A reporting as governed by the Securities and Exchange Commission. Textual analysis scores for the predetermined semantics of insistence, embellishment, variety, and complexity were generated (Appendix G). Finally, the statistical analysis of these disclosure statement scores allowed insight into the signaled changes during and after a global economic crisis. As a result, this research will further the emerging field of varied applications of financial text analysis.

Research Context

Comparison data was generated and applied using public biotechnology companies that belong to the specific Global Industry Classification Standard Codes for Health Care (Appendix D). All data retrieved was from public filings of companies that report full-year results on a calendar basis of January through December. Data analyzed was from before, during and after the 2008 financial crisis. The data set representing the period before the financial crisis were full-year financial results from 2006, which were reported by companies in early 2007; full-year financial results during the crisis in 2008, which were reported by companies in early 2009; and, finally, the full-year, post-crisis financial results from 2013, which were reported by companies in early 2014. The
comparison data sets included full-year financial results reported on an annual calendar year basis from January 1 to December 31. Companies that had interim or mid-year financial calendars were excluded in order to ensure a comparable time basis for each data set.

Using these three time intervals affords an analysis before, during, and after a significant financial crisis. The National Bureau of Economic Research (NBER) (2014) stated that the great recession began in December 2007, with the cycle reaching its bottom in June 2009. The NBER’s peaks and troughs of a recession are determined by its Business Cycle Dating Committee (BCDC). A recession is often defined as two consecutive quarters of decline in the GDP. The NBER uses a variety of indicators, but it is accepted that a recession represents a significant decline in economic activity (NBER, 2014).

Research Participants

Comparison data was generated and applied using public biotechnology companies that belong to the specific Global Industry Classification Standard Codes for Health Care (Appendix D). The GICS system, which was jointly developed by S&P and Morgan Stanley Capital International (MSCI), is widely accepted, particularly among financial practitioners (Bhojraj, Lee, & Oler, 2003). The GICS structure consists of 10 sectors, 24 industry groups, 67 industries, and 156 sub-industries. The biotechnology industry comprises approximately 20% of the value of the health care sector, which is led by the pharmaceutical industry at approximately 43% (Appendix D). The GICS codes for biotechnology organizations exclude large pharmaceutical companies. Paugh and Lafrance (1997) defined Biotechnology companies’ normal business activities as follows:
“Biotechnology is a set of enabling technologies used by a broad array of companies in their research and development and manufacturing activities” (p.7). The GICS codes exclude companies that manufacture products using biotechnology but without a health care application (Appendix D). Biotechnology was selected because it was likely to include organizations that have products that require explanatory text on novel products and in process formulations.

Data Collection and Analysis

Data collection was facilitated through public information regarding each biotechnology company’s performance, as required by its respective and regulated annual 10-K disclosures. All data retrieved was from public filings of companies that report full year results on a calendar basis of January through December. Historical data by company is available through Morningstar (2014). In addition, Morningstar offers data export functionality to Microsoft Excel. Key financial ratios, capitalization rates, and financial statements were available through the Morningstar data repository (Appendix H). Moreover, Morningstar included sorting capability to export financial data on a restated basis, allowing for the exclusion of currency impact and accounting adjustments that may have occurred from 2006 to 2013.

Morningstar also provides a repository for Form 10-K filings including each company’s required MD&A disclosure. The text from each company’s entire MD&A was exported and assembled into text files by company by year. Data exports available through Morningstar for biotechnology industry groups included 718 companies. The exclusion criteria was further applied to U.S.-based companies with market capitalization of $10 billion or greater. The resulting data allowed for the exclusion of any company
inconsistent with ongoing biotechnology activities. MD&A textual analysis did not begin until a complete and statistically representative data set was obtained.

The textual analysis was completed with the aid of DICTION 7.0 software (2014). “DICTION 7.0 is a computer-aided text analysis program for determining the tone of a verbal message. The program searches a passage for five general features, as well as 35 sub-features” (DICTION 7.0, 2014, p. 1). It can process a variety of English-language texts using a 10,000 word corpus and calculated values for Insistence, Embellishment, Variety, and Complexity (Appendix G).

**Instruments**

Organizational performance was measured through the use of earnings per share (EPS) in order to assess organizational performance versus the broader measure of organizational effectiveness. In addition to organizational performance, organizational effectiveness also captures internal performance metrics typically associated with operational efficiency (Richard, Devinney, Yip, & Johnson, 2009). EPS is an indicator of a company’s profitability, which is calculated by net income or dividends on preferred stock divided by the company’s average outstanding shares (Investopedia, 2014). EPS is considered a traditional measure of firm value (Richard et al., 2009).

Prior to any measurement of the MD&A text, the collection and validation of data was exported from Morningstar (2014) and formatted for input into DICTION 7.0 (2014). The preparatory work completed before the textual analysis ensured the integrity of the statistical analysis. The textual analysis reviewed the text-rich portion of each company’s MD&A that is found within its annual report in section 7 and 7a. MD&As are regulated in terms of content, but they also provide managers with a means to provide supporting
context for their respective results. In addition to required financial statements, press releases and the MD&A are outlets by which managers communicate a firm’s performance in narrative form (Davis & Tama-Sweet, 2012). Among other things, the MD&A provides an overview of the previous year’s operations and how the company fared in that time period. See Appendix I for an example excerpt of the 2013 MD&A from the biotechnology company, Anika Therapeutics.

**Data Analysis**

The data analysis was based on financial information that was disclosed in a regulated and consistent context. Before the information was uploaded into the text analysis software, it was analyzed to ensure comparability of the variants. Comparable data was filtered by U.S. public companies, the health care sector, the biotechnology industry, market capitalization, and profitability as defined by EPS. The introduction of textual analysis of the companies’ MD&A was considered after the screening process was complete. Based on the design, three critical components were applied to the data analysis. The components were a repository of regulated and consistently reported financial data, a review of the data using an advanced technology in the form of DICTION 7.0 (2014) software, and a statistical description of the data set using a SPSS version 21 analysis.

In order to determine the extent to which the MD&A had changed as the crisis was managed by the organization, a non-parametric analysis was applied using 2006 EPS as the basis, and the variables of insistence, embellishment, variety, and complexity, were used.
A K-means cluster approach was applied by year to the calculated semantic scores derived from DICTION 7.0. This approach is commonly used to gain insight into the similarity of large amounts of data (MacQueen, 1967). The SPSS version 21 functionality allowed for a constraint of three desired clusters. For this study, a cluster analysis of the 2006 financial narratives was initially applied to all four of the calculated variables of insistence, embellishment, variety, and complexity. These four variables were selected as each variable is calculated using the predetermined formula used by the DICTION 7.0 software. This resulted in the ability to analyze which cluster memberships had the strongest statistical relationship on a comparable basis. Moreover, statistical outliers were easily identified and researched using the MD&A as source data. Figure 3.1 shows the number of clusters that were chosen based on different characteristics between clusters and the size of the cluster membership.

Figure 3.1. Three critical components applied to the data analysis.

Chapter Summary

MD&A reporting for U.S. public biotechnology companies, as governed by the Securities and Exchange Commission, provides textual data, which is subject to regulation in terms of content and reporting intervals. Text analysis software allowed for
statistical analysis to provide information and insight on a company’s communication of results before, during, and after, one of the most significant economic crises in recent history. The resulting non-parametric and cluster analysis subsequently allowed a comparison of narrative data of biotechnology companies before, during, and after the 2008 recession. The resulting analysis of the text affords insight on how companies managed through the economic crisis. Specifically, the use of language reflecting insistence, embellishment, variety, and complexity added to the literature to show what ways companies signal their intent during difficult economic challenges.
Chapter 4: Results

Research Questions

This research sought to gain understanding on the message and tone of regulated financial reporting narratives of U.S. biotechnology companies before, during, and after a financial crisis. The research questions asked were:

- Based on predetermined semantics, do financial narratives of U.S. biotechnology companies follow a pattern?
- Do the message and tone of regulated financial narratives change before, during, and after a financial crisis?
- Are the words used in the reporting narratives of U.S. biotechnology companies predictive of future financial performance?

Data Analysis

Selection criteria. To ensure each company was comparable based on industry, geographic location, and size, the built-in filtering criteria of the Morningstar financial repository was used. The first level of inclusion criteria was biotechnology, as the industry type identified by the GICS code of 35201010 (Appendix D). Second, non-U.S.-based organizations were eliminated by selecting domestic companies only. The final two selection criteria were organizations with a market capitalization of higher than or equal to $10 billion and revenue in the base year of 2006 higher than or equal to $1 million. The result of this initial screening yielded a net result of 55 eligible companies.
After a review of the annual Form 10-K financial submission of each company, eight more companies were eliminated because their reporting period was not on a calendar year basis and included mid-year annual submissions. The exclusion of these companies ensured an analysis of narratives based on the same reporting time period. In addition, three more companies were eliminated because their financial results were interrupted due to structural changes in operations which ceased trading during the 2006-2013 time period. Finally, one company was eliminated because it was held by an investment firm and the financial narrative was investment based and inconsistent with the biotechnology narratives.

**Isolating each financial narrative.** All included companies’ financial narratives were isolated for analysis by separating the entire MD&A section from each company’s Form 10-K filing before, during, and after the financial crisis. The result provided 129 financial narratives for analysis using the three time periods for each of the 43 companies. DICTION 7.0 functionality included a mass upload of all 129 narratives and subsequent textual analysis. Four calculated variables were applied to the analysis: insistence, embellishment, variety, and complexity, as described in Table 4.1. These four variables were selected as each variable is calculated based on a predetermined formula used by the DICTION 7.0 software. Moreover, there was supporting previous research and measurement criteria applied for each of the calculated values, which also is noted in Table 4.1. These predetermined semantic measures allowed a consistent analysis of the MD&A narratives across companies and reporting years.
Table 4.1

**DICTION 7.0 Calculated Variables**

<table>
<thead>
<tr>
<th>Calculated Variable</th>
<th>Source</th>
<th>Assumptions</th>
<th>Measurement</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insistence</td>
<td>DICTION 7.0, 2014</td>
<td>Repetition of key terms indicates a preference for a limited, ordered world.</td>
<td>A measure of code-restriction. All words occurring three or more times that function as nouns or noun-derived adjectives are identified (either cybernetically or with your assistance)</td>
<td>[ \text{Number of Eligible Words} \times \text{Sum of their Occurrences} \div 10. ]</td>
</tr>
<tr>
<td>Embellishment</td>
<td>Boder, 1940</td>
<td>Heavy modification slows down a verbal passage by de-emphasizing human and material action.</td>
<td>A selective ratio of adjectives to verbs.</td>
<td>Embellishment is calculated according to the following formula: [ \frac{\text{Praise} + \text{Blame} + 1}{\text{Present Concern} + \text{Past Concern} + 1} ].</td>
</tr>
<tr>
<td>Variety</td>
<td>Johnson, 1946</td>
<td>A high score indicates a speaker’s avoidance of overstatement and a preference for precise, molecular statements.</td>
<td>The ratio of descriptive to functional words</td>
<td>Measure divides the number of different words in a passage by the passage’s total words.</td>
</tr>
<tr>
<td>Complexity</td>
<td>Flesch, 1951</td>
<td>Convoluted phrasings make a text’s ideas abstract and its implications.</td>
<td>Word size</td>
<td>Average number of characters-per-word in a given input file.</td>
</tr>
</tbody>
</table>

*Note.* Retrieved from http://www.dictionsoftware.com/

The output of the DICTION 7.0 software provided raw scores for each of the calculated variables. These scores then were loaded into the SPSS for further statistical analysis. The raw scores for insistence, embellishment, variety, and complexity were standardized into z-scores.

**Identification of outliers.** (Paugh & Lafrance, 1997) defined biotechnology companies’ normal business activities as follows: “Biotechnology is a set of enabling technologies used by a broad array of companies in their research and development and manufacturing activities” (p. 7). Outliers were identified using the DICTION 7.0 raw
scores. The company raw scores that were out significantly above or below the standard deviation for each measured attribute were researched to identify activities that were outside of normal business activities. In each case the outliers included abnormal activities which included pending litigation, multiple acquisitions and/or divestitures in the same year, and research and development investment predominately dedicated to one product.

An analysis of means revealed three 2006 (Before) embellishment scores that were outliers for the companies assigned the symbols: AMGN, BMRN, and OGXI. In addition, the Complexity score for company CBM in 2008 resulted in a z-score well below the overall population mean. The scores for these four companies were influenced by factors outside of their regular business activities. Table 4.2, followed by the detailed narrative analysis, supports the exclusion of these four companies.

Table 4.2

Summary Table of DICTION 7.0 Identified Outliers

<table>
<thead>
<tr>
<th>Company Symbol</th>
<th>Exclusion Year</th>
<th>Reason</th>
<th>Diction Result (z-score)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMGN</td>
<td>2006</td>
<td>Multiple acquisitions, refinancing and pending litigation</td>
<td>4.84 (Embellishment)</td>
</tr>
<tr>
<td>BMRN</td>
<td>2006</td>
<td>Multiple and complex third party transactions, investment focus and product revenue on a limited number of compounds</td>
<td>3.18 (Embellishment)</td>
</tr>
<tr>
<td>OGXI</td>
<td>2006</td>
<td>Deficit spending limited to a small number of product development activities</td>
<td>1.69 (Embellishment)</td>
</tr>
<tr>
<td>CBM</td>
<td>2008</td>
<td>Significant divestiture leaving a less complex core business structure</td>
<td>–5.62 (Complexity)</td>
</tr>
</tbody>
</table>
As indicated in Figure 4.1, the textual analysis for Amgen Inc. (AMGN) embellishment in 2006 resulted in a z-score of 4.84 above the overall population mean. Amgen completed a $5 billion stock repurchase program: the purchase of Avida, a privately held biotechnology company, for $290 million, along with multiple litigation activities regarding the efficacy of the company’s cancer drugs as well as a patent infringement judgment against Roche Pharmaceuticals. It also should be noted that Amgen pled guilty in 2012 and agreed to pay $150 million in criminal penalty and $612 million to resolve 11 related whistleblower complaints. Federal prosecutors accused the company of pursuing profits while putting patients at risk (Amgen-10-K, 2006). As a result of these activities outside of the normal course of biotechnology, Amgen was eliminated from further analysis.

The textual analysis for BioMarin Pharmaceutical (BMRN) embellishment in 2006 resulted in a z-score of 3.18 above the overall population mean. BioMarin Pharmaceutical activities outside normal business transactions included a March 2006 agreement with a third party for the continued sale and commercialization of the Orapred
product line. As a result of final regulatory approvals in January 2006, a net revenue from Naglazyme, a new product used to treat a particular metabolic disorder, increased 756% from $6.1 million in 2005 to $46.5 million in 2006. In addition, Aldurazyme was approved for marketing in the US, EU, Japan, and other countries. Aldurazyme was developed through a joint venture with Genzyme. BioMarin net revenue recorded from that joint venture for 2006 totaled $96.3 million, compared to $76.4 million for 2005. Through the sublicense agreement, the third party acquired exclusive rights to market these products in North America (BioMarin-10-k, 2006). As a result, these complicated transactions were considered outside of the normal course of biotechnology, and BioMarin Pharmaceutical was eliminated from further analysis.

The textual analysis for OncoGenex Pharmaceuticals (OGXI) embellishment in 2006 resulted in a z-score of 1.69 above the overall population mean. Additional review of OncoGenex Pharmaceuticals’s 2006 MD&A filing revealed an accumulated deficit of approximately $111.7 million. Substantially all of the working capital in recent years resulted from equity financings and payments under corporate partnership agreements. The ability to achieve a consistent, profitable level of operation was largely dependent upon obtaining regulatory approval for TOCOSOL Paclitaxel, a breast cancer drug (OncoGenex-10-k, 2006). As a result the company’s discovery bias and dependency on equity financing, biotechnology OncoGenex Pharmaceuticals was eliminated.

Finally, as indicated in Figure 4.2, the textual analysis for Cambrex Pharmaceuticals (CBM) complexity in 2008 resulted in a z-score of –5.62 below the overall population mean. An analysis of the 2008 MD&A narrative for Cambrex Pharmaceuticals identified a divestiture because Cambrex decided to focus on its core
competencies and sell its biologics business to the Lonza Group. The 2008 financial
narrative reflected an abbreviated and less complex narrative, which excluded its
previously owned biologics business (Cambrex-10K, 2008). As a result Cambrex
Pharmaceuticals was eliminated from further analysis.

Figure 4.2. Normalized complexity scores for 2008.

**Research question 1: Identification of patterns in financial narratives.** After
the application of the inclusion criteria, an analysis of the remaining financial narratives,
using predetermined semantics, was completed to identify potential patterns. The first
empirical finding of this study is that outlier scores in for embellishment and complexity
scores indicate conditions that merit close regulatory oversight. Comparable analysis was
made possible by the identification and removal of four companies with data anomalies
not consistent with ongoing operations. As a result, 39 companies and 117 financial
narratives were analyzed (Table 4.3). First, the analysis tested if a pattern was observed
using the predetermined semantics of insistence, embellishment, variety, and complexity.
A K-means clustering analysis resulted in three clusters. As indicated in Table 4.4,
cluster membership resulted in four (10.3%) companies in cluster 1, 22 (56.4%)
companies in cluster 2, and 13 (33.3%) in cluster 3.
Table 4.3

*Final Inclusion Criteria for Each Biotechnology Company*

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Eliminations</th>
<th>Net Remaining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Biotechnology</td>
<td>n/a</td>
<td>718</td>
</tr>
<tr>
<td>US based</td>
<td>247</td>
<td>417</td>
</tr>
<tr>
<td>Market capitalization &gt; $1B</td>
<td>119</td>
<td>352</td>
</tr>
<tr>
<td>2006 Revenue &gt; $1M</td>
<td>297</td>
<td>55</td>
</tr>
<tr>
<td>Use of midyear reporting</td>
<td>8</td>
<td>47</td>
</tr>
<tr>
<td>Interruption of trading</td>
<td>3</td>
<td>44</td>
</tr>
<tr>
<td>Non-biotech investment firm</td>
<td>1</td>
<td>43</td>
</tr>
</tbody>
</table>

**Net number of companies loaded into Diction 7.0**

<table>
<thead>
<tr>
<th>elimination</th>
<th>Number</th>
<th>Net Remaining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquisition and litigation</td>
<td>1</td>
<td>42</td>
</tr>
<tr>
<td>Multiple &amp; complex licensing activity</td>
<td>1</td>
<td>41</td>
</tr>
<tr>
<td>Assumed loss through equity financing</td>
<td>1</td>
<td>40</td>
</tr>
<tr>
<td>Sold off core business – 2008</td>
<td>1</td>
<td>39</td>
</tr>
</tbody>
</table>

**Net data set used for statistical analysis**

39

Table 4.4

*Cluster Membership 2006 Before the Financial Crisis*

<table>
<thead>
<tr>
<th>Cluster Number</th>
<th>Number of Members</th>
<th>Percent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>10.3%</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>56.4%</td>
</tr>
<tr>
<td>3</td>
<td>13</td>
<td>33.3%</td>
</tr>
</tbody>
</table>

**Total**

39 100%

The final cluster centers identified in Table 4.5 indicate that Cluster 1 is characterized by low insistence and high variety and complexity, with an embellishment score slightly below the mean. The results for Cluster 2 indicate all scores at slightly
below the mean for insistence, variety, complexity, and embellishment. Finally, Cluster 3 results include a high positive score for insistence, low scores for embellishment and variety, with a slightly positive score for complexity.

Table 4.5

*Cluster Centers*

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Pundit</th>
<th>Reporter</th>
<th>Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-score (Before_06_Insistence)</td>
<td>−1.17</td>
<td>−0.42</td>
<td>0.77</td>
</tr>
<tr>
<td>Z-score (Before_06_Embellishment)</td>
<td>−0.08</td>
<td>−0.30</td>
<td>−0.20</td>
</tr>
<tr>
<td>Z-score (Before_06_Variety)</td>
<td>1.79</td>
<td>−0.07</td>
<td>−0.40</td>
</tr>
<tr>
<td>Z-score (Before_06_Complexity)</td>
<td>1.57</td>
<td>−0.47</td>
<td>0.22</td>
</tr>
</tbody>
</table>

As a means to characterize each cluster, the names in Table 4.6 were applied and correspond to the definitions listed.

Table 4.6

*Cluster Names*

<table>
<thead>
<tr>
<th>Cluster Number</th>
<th>Names</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pundit</td>
<td>Someone who knows a lot about a particular subject and who expresses ideas and opinions about that subject</td>
</tr>
<tr>
<td>2</td>
<td>Reporter</td>
<td>A person who writes news stories (a just-the-facts approach)</td>
</tr>
<tr>
<td>3</td>
<td>Expert</td>
<td>Having or showing special skill or knowledge</td>
</tr>
</tbody>
</table>
Research question 1: Summary and conclusions. Patterns were identifiable using the z-scores for each of the DICTION 7.0 values calculated. Three cluster groups, as indicated in Figure 4.3, were identified and further characterized by applying named definitions. The three groups included pundits, which typified companies with low insistence scores and near-average scores for embellishment that wrote in complex terms using a great deal of variety. Reporter scores were lower than the mean scores for all four categories of insistence, embellishment, variety, and complexity. However, in each of the four cases, no mean score was less than 1/2 standard deviations below the cluster center. Finally, the experts had high scores for insistence, and they had slightly higher than the cluster center in complexity. Conversely, experts did not reflect a large degree of embellishment or variety as both of these scores were both less than zero from the cluster center.
**Research question 2: Cluster pattern stability by year.** The analysis of narrative change before, during, and after the financial crisis was completed in two steps: First, each cluster pattern was analyzed using the mean score for each year. Second, the calculated DICTION 7.0 raw scores were analyzed using descriptive statistics before, during, and after the financial crisis.

As indicated by Figure 4.4, the use of insistence marked by repeated use of words declined during the 2008 financial crisis and then returned to pre-crisis levels in 2013. This conclusion is further supported by the maximum scores declining from 281.17 to 230.33 from 2006 to 2008 and then increasing to 270.48 in 2013.

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>During</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations</td>
<td>39</td>
<td>39</td>
<td>39</td>
</tr>
<tr>
<td>Minimum</td>
<td>56.56</td>
<td>51.65</td>
<td>60.80</td>
</tr>
<tr>
<td>Maximum</td>
<td>281.27</td>
<td>230.33</td>
<td>270.48</td>
</tr>
<tr>
<td>1st Quartile</td>
<td>85.64</td>
<td>85.59</td>
<td>85.13</td>
</tr>
<tr>
<td>Median</td>
<td>127.70</td>
<td>105.25</td>
<td>111.08</td>
</tr>
<tr>
<td>3rd Quartile</td>
<td>151.23</td>
<td>123.75</td>
<td>150.43</td>
</tr>
<tr>
<td>Mean</td>
<td>127.10</td>
<td>111.15</td>
<td>125.90</td>
</tr>
<tr>
<td>Variance</td>
<td>2,311.80</td>
<td>1,463.85</td>
<td>2,670.75</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>48.08</td>
<td>38.26</td>
<td>51.68</td>
</tr>
</tbody>
</table>

![Box plot](image)

*Figure 4.4. Insistence results using DICTION raw score.*

**Variety.** The measurement of variety was also completed. A high score of variety indicated a speaker’s avoidance of overstatement (Johnson, 1946). An analysis
of all 39 companies for three years (n = 117) was performed. As indicated by Figure 4.5, there was an insignificant change before, during, and after the financial crisis of 2008. The mean score was 0.46 in 2008, compared to mean scores of 0.45 and 0.48 for 2006 and 2013, respectively. In addition, the standard deviation of variety scores during the financial crisis of 2008 resulted in a standard deviation of 0.07 compared to standard deviations of 0.06 and 0.08 for 2006 and 2013, respectively.

![Boxplot of Variety Scores](image)

**Figure 4.5.** Variety results using DICTION raw score.

**Embellishment.** A high embellishment score indicates a speaker’s avoidance of overstatement (Boder, 1940). An analysis of all 39 companies for three years (n = 117) was performed. Similar to variety, the results for embellishment reflected an insignificant change before, during, and after the financial crisis of 2008. The 2008 mean score was 0.34, compared to mean scores of 0.40 and 0.39 for 2006 and 2013,
respectively. In addition, the standard deviation of embellishment scores during the
financial crisis of 2008 resulted in a standard deviation of 0.17, compared to standard
deviations of 0.12 and 0.21 for 2006 and 2013, respectively. As indicated by Figure 4.6,
embellishment was marked by stable statistical descriptors before, during, and after the
great recession.

<table>
<thead>
<tr>
<th>Embellishment</th>
<th>Before</th>
<th>During</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations</td>
<td>39</td>
<td>39</td>
<td>39</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.17</td>
<td>0.19</td>
<td>0.15</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.67</td>
<td>0.99</td>
<td>1.23</td>
</tr>
<tr>
<td>1st Quartile</td>
<td>0.25</td>
<td>0.28</td>
<td>0.24</td>
</tr>
<tr>
<td>Median</td>
<td>0.33</td>
<td>0.37</td>
<td>0.36</td>
</tr>
<tr>
<td>3rd Quartile</td>
<td>0.40</td>
<td>0.52</td>
<td>0.46</td>
</tr>
<tr>
<td>Mean</td>
<td>0.34</td>
<td>0.40</td>
<td>0.39</td>
</tr>
<tr>
<td>Variance</td>
<td>0.01</td>
<td>0.03</td>
<td>0.05</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.12</td>
<td>0.17</td>
<td>0.21</td>
</tr>
</tbody>
</table>

Figure 4.6. Embellishment results using DICTION raw score.

**Complexity.** Finally, the measurement of complexity was completed. A high
complexity score indicates convoluted phrasings that make text ideas abstract and its
implications unclear (Flesch, 1951). Although the mean scores for complexity were
stable across the years, the standard deviation indicated a slight decrease during the
financial crisis of 2008, and then it increased after the great recession in 2013
(Figure 4.7). Means scores for before, during, and after the financial crisis were 5.22,
5.25 and 5.29, respectively. The standard deviation declined during the financial crisis to 0.17 from 0.21 and rose back to 0.23 after the crisis.

<table>
<thead>
<tr>
<th>Complexity</th>
<th>Before</th>
<th>During</th>
<th><em>After</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations</td>
<td>39</td>
<td>39</td>
<td>39</td>
</tr>
<tr>
<td>Minimum</td>
<td>4.73</td>
<td>4.75</td>
<td>4.63</td>
</tr>
<tr>
<td>Maximum</td>
<td>5.99</td>
<td>5.58</td>
<td>6.13</td>
</tr>
<tr>
<td>1st Quartile</td>
<td>5.12</td>
<td>5.15</td>
<td>5.20</td>
</tr>
<tr>
<td>Median</td>
<td>5.20</td>
<td>5.22</td>
<td>5.29</td>
</tr>
<tr>
<td>3rd Quartile</td>
<td>5.32</td>
<td>5.37</td>
<td>5.39</td>
</tr>
<tr>
<td>Mean</td>
<td>5.22</td>
<td>5.25</td>
<td>5.29</td>
</tr>
<tr>
<td>Variance</td>
<td>0.05</td>
<td>0.03</td>
<td>0.06</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.21</td>
<td>0.17</td>
<td>0.23</td>
</tr>
</tbody>
</table>

![Box plot of complexity scores](image)

*Figure 4.7. Complexity result using DICTION raw score.*

**Analysis of cluster patterns.** Using 2006 as the base year, each calculated diction cluster of pundits, reporters, and experts was plotted separately for insistence, embellishment, variety, and complexity using the DICTION output by year. Additional descriptive statistics tables are also available in (Appendix J).

**Insistence.** With the exception of pundits, both reporters’ and experts’ mean score for insistence declined from 2006 to 2008, and it increased in 2013. Pundit scores increased from a mean score of 70.01 to 88.20 from 2006 to 2008, and then they declined again after the financial crisis as reflected in a mean score of 76.70. In 2008, there was a convergence through lower scores for reporters and expert scores during the crisis. The
score for pundits also converged toward the overall mean score of 111.15 by increasing from 70.01 to 88.20. The convergence of scores is representitive of pooling equalibrium. In general, all three scores for pundits, reporters, and experts reflected an equalibrium separation in 2013, back to 2006 prior to the financial crisis (Figure 4.8).

<table>
<thead>
<tr>
<th>Year</th>
<th>Pundits Score</th>
<th>Reporters Score</th>
<th>Experts Score</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>70.01</td>
<td>109.96</td>
<td>173.69</td>
<td>127.10</td>
</tr>
<tr>
<td>2008</td>
<td>88.20</td>
<td>105.61</td>
<td>127.60</td>
<td>111.15</td>
</tr>
<tr>
<td>2013</td>
<td>76.70</td>
<td>116.31</td>
<td>157.26</td>
<td>125.90</td>
</tr>
</tbody>
</table>

*Figure 4.8. Graphical representation of cluster centers for insistence.*

**Embellishment.** Overall embellishment scores remained stable before, during, and after the financial crisis with the exception of pundit scores in 2013. After the recession was considered over, the pundit mean score increased approximately 60.5% from 2008 to 2013 with a raw mean score of increase from 0.43 to 0.51. The overall score remained close to the overall mean with some evidence of equalibrium seperation in 2013 (Figure 4.9).

**Variety.** Pundit scores for variety showed some variability with a decline from 0.57 to 0.49, followed by an increase to 0.56 before, during, and after the crisis, respectively. Scores for variety followed a similar pattern as the scores for insistence with equilibrium pooling and separation in 2008 and 2013, respectively. Moreover,
consistent with the insistence category, 2013 scores returned to patterns similar with the
2006 scores prior to the financial crisis of 2008 (Figure 4.10).

![Graphical representation of cluster centers for embellishment.](image1)

*Figure 4.9. Graphical representation of cluster centers for embellishment. (Pundit outlier for company VRTX identified and removed score of 1.23.)*

![Graphical representation of cluster centers for variety.](image2)

*Figure 4.10. Graphical representation of cluster centers for variety.*

**Complexity.** Mean scores for complexity indicated some change before and after the crisis with an overall reflection of convergent mean scores after the crisis in 2013. Of particular note was the decline for pundits of 5.8% from 2006 to 2008 with scores of 5.56 and 5.24, respectively. An examination for an outlier company was completed and
concluded that no significant outliers were present. The maximum score for the data set was 5.99 with a minimum score of 4.73 with a SD of 0.21 (Appendix J). As a result, in general, pundit scores converged on the mean form 2006 to 2008 and further grouped together after the financial crisis (Figure 4.11).

![Figure 4.11. Graphical representation of cluster centers for complexity.](image)

**Changes of financial narratives before, during, and after a financial crisis.** In addition to the analysis by cluster group, raw scores from the DICTION output were analyzed for 2006, 2008, and 2013. Specifically, each one of the DICTION 7.0 raw scores for the calculated values of insistence, embellishment, variety, and complexity were analyzed by year. This analysis allowed additional insight into changes in the stability of the calculated scores for each time period.
**Insistence.** To measure the level of insistence, which is characterized by the repetition of key terms, an analysis of all 39 observations for three years (n =117) was performed. The results indicated a decline in the use of insistence during the financial crisis of 2008, with a mean score of 111.25, compared to mean scores of 127.10 and 125.90 for 2006 and 2013, respectively. In addition, the standard deviation of insistence scores during the financial crisis of 2008 resulted in a standard deviation of 38.26 compared to standard deviations of 48.08 and 51.68 for 2006 and 2013, respectively.

**Research question 2: Summary and conclusions.** With regard to cluster patterns by pundits, reporters, and experts, general stability pooling equilibrium was observed in 2008, which was the central year of the financial crisis. Pundit complexity was the most unstable characteristic, with a significant decrease in 2008 during the crisis as compared to 2006 before the crisis. In addition, pundit complexity was the only variable that did not reflect separating equilibrium as time progressed after the financial crisis from 2006 to 2013. This finding has particular relevance because the high use of complexity is typified by complex ideas making the message more abstract and unclear (Flesch, 1951).

The aggregate score for insistence also converged in 2008, and then it returned to 2006 levels after the financial crisis. Further evidence of this convergence includes standard deviations of 48.08, 38.26, and 51.68 in 2006, 2008, and 2013 respectively. Given that insistence is a measure of repetition of key terms, it appears that the U.S. biotechnology companies kept their respective narratives to a minimum during a time period characterized by global financial crisis. During the time period of before, during, and after the crisis, total variety results were stable and did not reflect significant
fluctuation during the time periods examined. Variety is a speaker’s avoidance of overstatement (Johnson, 1946).

Different from variety, total embellishment, as an indicator of the level of overstatement followed a general upward pattern from 2006 to 2013. Mean scores were 34, 40, and 39 for before, during, and after the financial crisis. Moreover, standard deviation scores for the same periods were 12.0, 17.0, and 21.0. These scores were not as stable as variety, and they followed a different observation of an upward slope during the observed time periods.

Research question 3: Test for evidence of language used and associated changes in financial outcome. The EPS results for each of the 39 companies’ inflation were adjusted using the Producer Price Index Industry (PPI) adjusted to 2013 prices (United States. Bureau of Labor Statistics.). An independent sample Kruskal-Wallis test found no evidence that cluster groups were associated with EPS in 2006 (H = 2.73, p > 0.5), in 2008 (H = 0.53, p > 0.5) and in 2013 (H = 3.52, P > 0.5). An independent samples median test confirmed these results.

Research question 3: Summary and conclusions. After the completion of the nonparametric testing for cluster groups for 2006 EPS scores, it was concluded that there was no association between cluster groups and the EPS.
Summary of Results

The analysis of financial narratives of biotechnology companies before, during, and after a financial crisis affords a unique approach to gain insight into how organizations contextualize information in a regulated environment. Through a deliberate and consistent application of exclusion criteria, 39 companies provided comparable narratives for 2006, 2008, and 2013 before, during and after the financial crisis respectively. The financial narratives, specifically the MD&A statements were measured against the predetermined and calculated financial scores for insistence, embellishment, variety, and complexity.

The detection of outliers was efficient after an exception based review of the scores generated by DICTION 7.0. Moreover, outlier scores were apparent across years and calculated scores. The cause of the outlier scores was researched back to the publically available MD&A source narratives contained in each 10-k report.

A pattern for the 2006 data was identified using K-means clustering for each of the calculated scores. The final cluster centers identified indicate that cluster 1, Pundits, is characterized by low Insistence and high Variety and Complexity with an Embellishment score slightly below the mean. The results for cluster 2, Reporters, indicate all scores at slightly below the mean for Insistence, Variety, Complexity, and Embellishment. Finally cluster 3, Experts, included a high positive score for insistence and low scores for embellishment and variety with a slightly positive score for complexity.

The analysis indicated that the message and tone of the financial narratives of the calculated scores for insistence, embellishment, variety, and complexity changed over
time. Specifically, there was an observed increase of embellishment in the raw scores
during the crisis. Changes were observed both at the cluster level of pundit, reporter, and
expert but also in aggregate. In general a trend of pooling equilibrium was observed
during the financial crisis and separation equilibrium was observed before the crisis and
after.

A nonparametric independent means test of each cluster compared to financial
outcomes for 2006, 2008, and 2013 conclude no evidence of association between
financial outcomes as measured by the EPS.
Chapter 5: Discussion

Introduction

The regulatory environment and associated financial disclosures required of U.S. companies have become increasingly complex as a result of dynamic market conditions and the need to assure stakeholders of the integrity of reported financial results. The SEC was formed after the great depression and subsequent public demand for greater assurance of the reliability of regulated financial disclosures. This began the historical mission of the SEC to ensure investor and stakeholder protection by attempting to secure a fair marketplace through regulation. The intended environment is one where all public company stakeholders could make decisions with equal access to regulated financial information. Without the assumption of inefficient and asymmetrical information, exchange regulators would have little incentive to influence regulatory outcomes (Laffont & Tirole, 1991). After the latest financial crisis of 2008, Congress was historically consistent by imposing even more prescriptive reporting requirements.

The 2008 financial crisis provided an opportunity for this researcher to analyze textual patterns of U.S.-based biotechnology company financial narratives; to observe changes in message and tone of regulated financial narratives before, during, and after that crisis; and to statistically analyze the ability to predict earnings per share (EPS) based on characterized financial narratives. As a result, this study offers a unique analytical approach that focused on the narratives of public companies rather than on the more common review and analysis of financial statements. In addition, this study has
advanced the use of increasingly sophisticated textual analysis software. DICTION 7.0 was specifically applied to the analysis of MD&A financial disclosures advancing previous textual analysis of annual financial reports (Yuthas et al., 2002)

**Implications of Findings**

**Implications of financial narrative patterns.** After completing the textual analysis of 39 public U.S. biotechnology companies, it was possible to characterize reporting tone and language used into three categories: Pundits, Reporters, and Experts. In addition, textual analysis software provided calculated scores for insistence, embellishment, variety and complexity.

**Cluster group:** Using 2006 as the base year, Pundits typified companies with low insistence scores and a near average score for embellishment, they tended to write in complex terms using a great deal of variety. Reporter scores reflected lower than mean scores for all four categories of insistence, embellishment, variety and complexity. Finally, the Experts had high scores in insistence, and slightly higher scores in complexity. Conversely, Experts did not reflect a large degree of embellishment or variety, as both of these scores were slightly lower than the overall mean results.

In general, Pundits were the least stable group with the highest variability particularly before and during the crisis. Furthermore, all thee cluster groups showed a general trend towards equilibrium pooling in 2008. This is indicative of a crisis pattern of less is better with regard to MD&A narratives. Reasons for this approach may include: greater focus on core business activities and less on reporting, cost and efficiency concerns of financial reporting, and less business activity to discuss and report as each company weathered the storm of the financial crisis. Market instability, has compounded
the need to detect asymmetrical indicators of financial disclosure statements (Hobson, et al., 2012). Of equal interest was the general return of reporting characteristics after the crisis to levels that typified 2006 pre-crisis reporting. This appears to indicate that the U.S. biotechnology companies find some utility of the MD&A as a means to communicate to their stakeholders.

**Calculated scores based on predetermined semantic categories:** An analysis of before, during, and after, financial narratives was also completed in aggregate for total insistence, embellishment, variety, and complexity. Similar to the clustered analysis evidence of equilibrium pooling was observed in 2008. Complexity as an aggregate variable was the most unstable, reflecting a significant decline from 2006 to 2008. The analysis on an aggregate level confirms the observations and potential rationale for changes in narrative behavior observed by cluster. Previous studies have analyzed and concluded changes to MD&A statements occurred over time based on changes impacting results (Hoberg et al., 2010).

The problem of asymmetric information continues to be a concern. Investors and other stakeholders struggle with accounting measures of performance from real economic achievement (Verrecchia, 2001). With the advance of mass information processing capabilities, patterns and change in the tone and language used in financial narratives may provide insight into the signals public companies are sending to the marketplace, either intentionally or inadvertently. Since information exchange is typically asymmetrical or imperfect, the patterns that emerge provide additional information to a very complex information environment, similar to the use of signals to better understand the complex job market (Spence, 2002).
Implications of predictive ability of EPS through financial narratives. The analysis of EPS performance against financial narrative clusters indicated that there was no association for U.S. biotechnology companies. The implication of this finding is that organizations should consider the cost of MD&A development and adopt a strategy that best fits the needs of their respective company. As an example, a strategy intended to simply meet the regulators’ requirements of financial disclosure may enable expense dedicated to financial disclosure preparation be reallocated towards other internal resource requirements.

Financial reporting regulations are not intended as a vehicle for public organizations to incent stakeholders to purchase shares. The intent of the regulated reporting is to provide a common and regulated basis of information available in the same format to all stakeholders. In 1934 and today, the mission of the SEC has focused on investor protection (SEC, 2013).

The inability to find an association between cluster groups and EPS is an indication that the regulated reporting narratives are working as intended. There are numerous other opportunities for organizations to promote their activities and products through marketing, advertising efforts, and retaining key opinion leaders to speak to complex subject matter. The 10-k report and implicit financial narratives are not intended to promote but rather to inform through a consistent context that is regulated and available to all stakeholders. As a result companies should consider how their respective strategy of using the MD&A financial narrative offers additional financial statement clarification as directed by the SEC.
Support for Theoretical Framework

Signaling theory. This study provided another example of the application of signaling theory to a complex and asymmetrical information exchange. Signaling through patterns in financial narratives provides another means to further understand financial information through narrative patterns. As global market complexity increases along with regulatory requirements, a more efficient approach to financial statement analysis is of particular value. Signaling theory allows a means to efficiently identify potential outliers as evidenced in figure 4.1 and 4.2. Resources available to firms and stakeholders will continue to be exceeded by the need for more efficient and meaningful information. The signals provided in financial narratives through patterns and changes in reporting offer a unique means to identify opportunities for further analysis and data based decision making.

As noted, equilibrium pooling is apparent during a financial crisis. However, before and after the financial crisis equilibrium separation was observed. This is justification for further data based analysis. Specifically, game theory scholars and practitioners would likely provide further insight into the predictive ability of financial narratives.

Public interest theory. Congressional reaction often includes regulation requiring additional information. Governmental response is consistent with public interest theory which suggests that imperfect information leads to increased regulation as a means to improve decision making. However, more data is not always better. This study supports a more efficient means to achieve the public interest in a more understandable context. The SEC is clearly attempting to reduce information asymmetry and provide
equal access to financial stakeholders of traded securities. The mission statement of the SEC states “The mission of the U.S. Securities and Exchange Commission is to protect investors, maintain fair, orderly, and efficient markets, and facilitate capital formation” (SEC website p. 1). The mission statement notably mentions efficiency as a priority.

The analysis of patterns in financial narratives affords an efficient and meaningful approach to carry out public interest through the stated SEC mission. This study provides a systematic approach to text analysis supported by the established SEC requirement of a prescribed disclosure format and timeframe for submission. Coupling the rigorous reporting format with advanced textual analysis allows efficient outlier detection and the potential for exception based financial statements review.

**Limitations**

A limitation of this study was the pool of the U.S. biotechnology companies that was available for analysis after the application of exclusion criteria. Given the growth of biotechnology startups the initial pool consisted of more than 700 companies. However, only 39 companies met the inclusion criteria ensuring a comparable basis for analysis.

Although the financial narratives were abstracted uniformly and from a regulated context, it is possible that changes in company leadership and philosophy may have impacted the results from 2006 to 2013.

**Recommendations**

The following are the recommendations of this study:

- This study offers a proof of concept that financial narratives can be analyzed and outliers identified through text analysis software. It is recommended that textual software be applied to other forms of financial reporting. Examples of
potential financial narratives for review include analyst reports, company press releases, and president’s letters commenting on financial performance.

- The use of sophisticated text analysis software could help the SEC advance its mission of investor protection in a more efficient approach. Outliers in this study were quickly identified from a starting population of 43 companies. In the same manner it is recommended regulators adopt a similar approach to quickly identify outliers across industries providing an exception-based approach to further investigation.

- Company stakeholders should begin to demand that narrative information be provided in a clear and more transparent way. An investment decision should be based not only on information available to everyone, but also on information that is presented with the least amount of complexity possible.

- Corporate analysts and fund managers should consider financial narrative analytics when making investment decisions and recommendations. The use of this additional information would provide unique perspective as outliers could be efficiently identified and researched.

- Public companies should rethink the amount of time and effort spent on developing the MD&A, as there is no observed association between EPS and narrative patterns. It may well be in the best interest of the organization to simply meet SEC requirements.

- Given this study demonstrated that patterns in reporting narratives change over time, it is recommended that further research be done on equilibrium pooling and separation. The study may be of particular interest to game
theorists who could apply an extended and focused approach for predictive modeling.

**Conclusion**

As noted by (Akerlof & Shiller, 2010, p. 174), “The recent economic turmoil has brought back to the table many questions that had been considered settled.” This study provides a unique approach to using existing and developing improvements in textual analysis software to more efficiently understand the signals sent from public companies to their respective stakeholders. The exchange of information even in a simple context has traditionally presented a challenge to the provider and receiver; that challenge is magnified when dealing with the complexity of financial narratives. This study suggests a means for interpreting and efficiently gaining insight from the financial narrative portion of regulated financial disclosures.
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http://www.morningstar.com


http://www.morningstar.com


Appendix A

Filing Requirements of Form 10-K for Publicly Traded Companies

(Securities and Exchange Commission, 2013)

(a) Item 1, Business;
(b) Item 1A. Risk Factors;
(c) Item 2, Properties;
(d) Item 3, Legal Proceedings;
(e) Item 4, Submission of Matters to a Vote of Security Holders;
(f) Item 5, Market for Registrant’s Common Equity and Related Stockholder Matters;
(g) Item 6, Selected Financial Data;
(h) Item 7, Management’s Discussion and Analysis of Financial Condition and Results of Operations;
(i) Item 7A, Quantitative and Qualitative Disclosures About Market Risk;
(j) Item 8, Financial Statements and Supplementary Data;
(k) Item 9, Changes in and Disagreements With Accountants on Accounting and Financial Disclosure;
(l) Item 9A, Controls and Procedures;
Appendix B

Filing Requirements Section 7: Management’s Discussion and Analysis

(Securities and Exchange Commission, 2013)

Item 7, “Management’s Discussion and Analysis of Financial Condition and Results of Operations,” gives the company’s perspective on the business results of the past financial year. This section, known as the MD&A for short, allows company management to tell its story in its own words. The MD&A presents:

- The company’s operations and financial results, including information about the company’s liquidity and capital resources and any known trends or uncertainties that could materially affect the company’s results. This section may also discuss management’s views of key business risks and what it is doing to address them.

- Material changes in the company’s results compared to the prior period, as well as off-balance sheet arrangements and the company’s contractual obligations.

- Critical accounting judgments, such as estimates and assumptions. These accounting judgments – and any changes from previous years – can have a significant impact on the numbers in the financial statements, such as assets, costs, and net income.

Item 7A, “Quantitative and Qualitative Disclosures about Market Risk,” requires information about the company’s exposure to market risk, such as interest rate risk, foreign currency exchange risk, commodity price risk or equity price risk. The company may discuss how it manages its market risk exposures.
# Appendix C

## Laws That Govern the Securities Industry

*(Securities and Exchange Commission, 2013)*

<table>
<thead>
<tr>
<th>Act</th>
<th>Intended Purpose</th>
</tr>
</thead>
</table>
| Securities Act of 1933         | Often referred to as the “truth in securities” law, it has two basic objectives:  
• Require that investors receive financial and other significant information concerning securities being offered for public sale; and  
• Prohibit deceit, misrepresentations, and other fraud in the sale of securities.                                                                                                                                                                                                                                                      |
<p>| Securities Exchange Act of 1934 | With this Act, Congress created the Securities and Exchange Commission. The Act empowers the SEC with broad authority over all aspects of the securities industry. This includes the power to register, regulate, and oversee brokerage firms, transfer agents, and clearing agencies as well as the nation’s securities self-regulatory organizations (SROs). The various securities exchanges, such as the New York Stock Exchange, the NASDAQ Stock Market, and the Chicago Board of Options, are SROs. The Financial Industry Regulatory Authority (FINRA) is also an SRO. The Act also identifies and prohibits certain types of conduct in the markets and provides the SEC with disciplinary powers over regulated entities and persons associated with them. The Act also empowers the SEC to require periodic reporting of information by companies with publicly traded securities. |
| Trust Indenture Act of 1939     | This Act applies to debt securities, such as bonds, debentures, and notes, which are offered for public sale. Even though such securities may be registered under the Securities Act, they may not be offered for sale to the public unless a formal agreement between the issuer of bonds and the bondholder, known as the trust indenture, conform to the standards of this Act.                                                                                                                                                                      |
| Investment Company Act of 1940  | Regulates the organization of companies, including mutual funds, that engage primarily in investing, reinvesting, and trading in securities, and whose own securities are offered to the investing public. The regulation is designed to minimize conflicts of interest that arise in these complex operations. The Act requires these companies to disclose their financial condition and investment policies to investors when stock is initially sold and, subsequently, on a regular basis. The focus of this Act is on disclosure to the investing public of information about the fund and its investment objectives, as well as on investment company structure and operations. It is important to remember that the Act does not permit the SEC to directly supervise the investment decisions or activities of these companies or judge the merits of their investments. |</p>
<table>
<thead>
<tr>
<th>Act</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment Advisers Act of 1940</td>
<td>This law regulates investment advisers. With certain exceptions, this Act requires that firms or sole practitioners who are compensated for advising others about securities investments must register with the SEC and conform to regulations designed to protect investors. Since the Act was amended in 1996 and 2010, generally only advisers who have at least $100 million in assets under management or advise a registered investment company must register with the SEC.</td>
</tr>
<tr>
<td>Sarbanes-Oxley Act of 2002</td>
<td>Signed into law by President on July 30, 2003, by President Bush, in which he characterized as “the most far-reaching reform of American business practices since the time of Franklin Delano Roosevelt.” The Act mandated a number of reforms to enhance corporate responsibility and financial disclosures to combat corporate and accounting fraud, and it created the “Public Company Accounting Oversight Board,” also known as the PCAOB, to oversee the activities of the auditing profession.</td>
</tr>
<tr>
<td>Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010</td>
<td>Signed into law on July 21, 2010, by President Barack Obama, the legislation set out to reshape the US regulatory system in a number of areas, including but not limited to, consumer protection, trading restrictions, credit ratings, regulation of financial products, corporate governance and disclosure, and transparency.</td>
</tr>
<tr>
<td>Jumpstart Our Business Startups Act of 2012</td>
<td>The “JOBS Act” was enacted on April 5, 2012. Its aim is to help businesses raise funds in public capital markets by minimizing regulatory requirements.</td>
</tr>
</tbody>
</table>
### Appendix D

**Global Industry Classification Standard Codes for Health Care**

*(Adopted from Morningstar Data Repository Information)*

<table>
<thead>
<tr>
<th>GICS® Industry Group:</th>
<th>Percent of Total Sector as of 2014</th>
<th>GICS® Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Care</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Biotechnology</td>
<td>21.41%</td>
<td>35201010</td>
</tr>
<tr>
<td>Health Care Distributors</td>
<td>3.74%</td>
<td>35102010</td>
</tr>
<tr>
<td>Health Care Equipment</td>
<td>14.91%</td>
<td>35101010</td>
</tr>
<tr>
<td>Health Care Facilities</td>
<td>0.53%</td>
<td>35102020</td>
</tr>
<tr>
<td>Health Care Services</td>
<td>3.47%</td>
<td>35102030</td>
</tr>
<tr>
<td>Health Care Supplies</td>
<td>0.26%</td>
<td>35101020</td>
</tr>
<tr>
<td>Health Care Technology</td>
<td>0.75%</td>
<td>35103010</td>
</tr>
</tbody>
</table>

- **Biotechnology**: Companies primarily engaged in the research, development, manufacturing, and/or marketing of products based on genetic analysis and genetic engineering. Includes companies specializing in protein-based therapeutics to treat human diseases. Excludes companies manufacturing products using biotechnology but without a health care application.
- **Health Care Distributors**: Distributors and wholesalers of health care products not classified elsewhere.
- **Health Care Equipment**: Manufacturers of health care equipment and devices. Includes medical instruments, drug delivery systems, cardiovascular and orthopedic devices, and diagnostic equipment.
- **Health Care Facilities**: Owners and operators of health care facilities, including hospitals, nursing homes, rehabilitation centers, and animal hospitals.
- **Health Care Services**: Providers of patient health care services not classified elsewhere. Includes dialysis centers, lab testing services, and pharmacy management services. Also includes companies providing business support services to health care providers, such as clerical support services, collection agency services, staffing services, and outsourced sales and marketing services.
- **Health Care Supplies**: Manufacturers of health care supplies and medical products not classified elsewhere. Includes eye care products, hospital supplies, and safety needle and syringe devices.
providers. Includes companies providing application, systems and/or data processing software, internet-based tools, and IT consulting services to doctors, hospitals, or businesses operating primarily in the Health Care Sector.

Life Sciences 3.18% 35203010

Companies enabling the drug discovery, development, and production continuum by providing analytical tools, instruments, consumables and supplies, clinical trial services, and contract research services. Includes firms primarily servicing the pharmaceutical and biotechnology industries.

Managed Health Care 7.85% 35102030

Owners and operators of Health Maintenance Organizations (HMOs) and other managed plans.

Pharmaceutical 43.80% 35202010

Companies engaged in the research, development, or production of pharmaceuticals. Includes veterinary drugs.
Appendix E

Definition of Terms

(Adopted from Investopedia Website 2014)

**AICPA – American Institute of Certified Public Accountants.** Founded in 1887, the AICPA established accountancy as a profession distinguished by rigorous educational requirements, high professional standards, a strict code of professional ethics, a licensing status, and a commitment to serving the public interest.

**EITF – Emerging Issues Task Force.** Formed in 1984, the EITF assists the Financial Accounting Standards Board to improve financial reporting through the timely identification, discussion, and resolution of financial accounting issues within the framework of existing authoritative literature.

**FASB – Financial Accounting and Standards Board.** Founded in 1973, FASB’s mission is to establish and improve standards of financial accounting and reporting that foster financial reporting by nongovernmental entities, which provide decision-useful information to investors and other users of financial reports.

**Forms 10-K, 10-Q, and 8-K.** The federal securities laws require publicly traded companies to disclose information on an ongoing basis and on specifically named forms. Form 10-K is used annually by domestic issuers (other than small business issuers); Form 10-Q is used for quarterly reporting; and Form 8-K is used for the current reporting of specific events that require immediate disclosure.

**GAAP – Generally Accepted Accounting Principles.** These principles have a specific meaning for accountants and auditors. The American Institute of Certified Public Accountants Code of Professional Conduct prohibits members from expressing an
opinion or stating affirmatively that financial statements or other financial data “present fairly…in conformity with generally accepted accounting principles,” if such information contains any departures from accounting principles promulgated by a body designated by the AICPA Council to establish such principles

**MD&A – Management’s Discussion and Accounting.** The MD&A is a very important section of an annual report, especially for those analyzing the fundamentals, which include management and management style. It is a section of a company’s annual report in which management discusses numerous aspects of the company, both past and present.

Among other things, the MD&A provides an overview of the previous year of operations and how the company fared in that time period. Management generally also touches on the upcoming year, outlining future goals and approaches to new projects.

Although this section contains useful information, investors should keep in mind that the section is not audited.

**SEC – Securities and Exchange Commission.** Together, the Securities Act of 1933 and the Securities Exchange Act of 1934 created the U.S. Securities and Exchange Commission. The mission of the SEC is to protect investors; maintain fair, orderly, and efficient markets; and facilitate capital formation.

**SIC – Standard Industrial Classification** (SIC) codes are four digit numerical codes assigned by the U.S. government to business establishments to identify the primary business of the establishment. The classification was developed to facilitate the collection, presentation and analysis of data; and to promote uniformity and
comparability in the presentation of statistical data collected by various agencies of the federal government, state agencies and private organizations.
Appendix F

(Securities and Exchange Commission, 2013)

DICTION 7.0 is a computer-aided, text-analysis program for Windows and Mac that uses a series of dictionaries to search a passage for five semantic features—Activity, Optimism, Certainty, Realism, and Commonality—as well as 35 sub-features. Four of DICTION’s scores result from calculations rather than dictionary matches. These include Insistence, Embellishment, Variety, and Complexity.

DICTION writes the results to numeric files for later statistical analysis. Output options include raw totals, standardized scores, word and character counts, and percentages, thereby providing the user with a variety of ways to understand the text being processed.
## Appendix G

### DICTION’S Calculated Variables

(Securities and Exchange Commission, 2013)

<table>
<thead>
<tr>
<th>Calculated Variable</th>
<th>Source</th>
<th>Assumptions</th>
<th>Measurement</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insistence</td>
<td>DICTION 7.0, 2014</td>
<td>Repetition of key terms indicates a preference for a limited, ordered world.</td>
<td>A measure of code-restriction. All words occurring three or more times that function as nouns or noun-derived adjectives are identified (either cybernetically or with your assistance)</td>
<td>[Number of Eligible Words x Sum of their Occurrences] ÷ 10.</td>
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<tr>
<td>Embellishment</td>
<td>Boder, 1940</td>
<td>Heavy modification slows down a verbal passage by de-emphasizing human and material action.</td>
<td>A selective ratio of adjectives to verbs.</td>
<td>Embellishment is calculated according to the following formula: ([\text{Praise} + \text{Blame} + 1] \div [\text{Present Concern} + \text{Past Concern} + 1]).</td>
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<tr>
<td>Variety</td>
<td>Johnson, 1946</td>
<td>A high score indicates a speaker’s avoidance of overstatement and a preference for precise, molecular statements.</td>
<td>The ratio of descriptive to functional words</td>
<td>Measure divides the number of different words in a passage by the passage’s total words.</td>
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<td>Complexity</td>
<td>Flesch, 1951</td>
<td>Convoluted phrasings make a text’s ideas abstract and its implications.</td>
<td>Word size</td>
<td>Average number of characters-per-word in a given input file.</td>
</tr>
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## Appendix H

### Morningstar Data Repository Information

(Gilead 10-K Morningstar 2014)

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<td>Fiscal year ends in December. USD in millions except per share data.</td>
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<td>2028</td>
<td>3026</td>
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<td>Gross profit</td>
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<td>3461</td>
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<td>1073</td>
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<td>Sales, General and administrative</td>
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<td>381</td>
<td>574</td>
<td>706</td>
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<td>977</td>
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<tr>
<td>Total operating expenses</td>
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<td>Income before taxes</td>
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<td>Net income from continuing operations</td>
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<td>814</td>
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<td>1615</td>
<td>1970</td>
<td>2626</td>
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<td>Net income</td>
<td>449</td>
<td>814</td>
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<td>1970</td>
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<td>1615</td>
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<td>Basic EPS</td>
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<td>0.87</td>
<td>1.08</td>
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<td>Basic</td>
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<td>1817</td>
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<td>EBITDA</td>
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ITEM 7. MANAGEMENT’S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

Management Overview

Anika Therapeutics, Inc. ("Anika," and together, with its subsidiaries, the “Company”) develops, manufactures and commercializes therapeutic products for tissue protection, healing, and repair. These products are based on hyaluronic acid (“HA”), a naturally occurring, biocompatible polymer found throughout the body. Due to its unique biophysical and biochemical properties, HA plays an important role in a number of physiological functions such as the protection and lubrication of soft tissues and joints, the maintenance of the structural integrity of tissues, and the transport of molecules to and within cells. Together with our wholly-owned subsidiary, Anika S.r.l., the Company offers therapeutic products in the following areas:

Orthobiologics

Anika’s orthobiologics business contributed 78% to our product revenue for the year ended December 31, 2013. Our orthobiologics products consist of joint health and orthopedic products. Joint health products include ORTHOVISC, ORTHOVISC mini, and MONOVISC. ORTHOVISC is available in the U.S., Canada, and some international markets for the treatment of osteoarthritis of the knee, and in Europe for the treatment of osteoarthritis in all joints. ORTHOVISC mini is available in Europe and is designed for the treatment of osteoarthritis in small joints. MONOVISC is our single injection osteoarthritis treatment indicated for all joints in Europe, and for the knee in the U.S., Turkey and Canada. ORTHOVISC mini, and MONOVISC are two viscosupplementation products which became available in certain international markets during the second quarter of 2008. Our most recent product approval was received in February 2014 for MONOVISC in the U.S. The related commercial introduction is planned for March 2014.

Anika has marketed ORTHOVISC, our product for the treatment of osteoarthritis of the knee, internationally since 1996 through various distribution agreements. International sales of ORTHOVISC contributed 8% of product revenue for the year ended December 31, 2013.

Our strategy is to continue to add new products, to expand the indications for usage of these products, and to add additional countries to our distribution network. The orthobiologics area has been the fastest growing area for the Company, growing from 57% of our product revenue in 2008 to 78% of our product revenue in 2013. We continue to seek new distribution partnerships around the world and we expect total orthobiologics product sales to increase in 2014 compared to 2013, based on sales from existing and new partners.

We currently offer several orthopedic products used in connection with regenerative medicine. The products currently available in Europe include Hyalofast, a biodegradable support for human bone marrow mesenchymal stem cells; Hyalonect, a woven gauze used as a graft wrap; and Hyaloss, HYAFF fibers used to mix blood/bone grafts to form a paste for bone regeneration. We also offer Hyaloglide, an ACP gel used in tenolysis treatment that with additional clinical data may demonstrate potential for flexor tendon adhesion prevention, and in the shoulder for adhesive capsulitis. These products are commercialized through a network of distributors, primarily in Europe, the Middle East, and Korea. Anika believes that the U.S. market offers excellent expansion potential to increase revenue, and this will continue to be a major focus area for the Company.
Dermal

Our dermal products contributed 3% to our product revenue for the year ended December 31, 2013, and consist of advanced wound care products based on the HYAFF technology, and aesthetic dermal fillers. Anika S.r.l. offers products for the treatment of skin wounds ranging from burns to diabetic ulcers. The products cover a variety of wound treatment solutions including debridement agents, advanced therapies and scaffolds used in connection with skin substitutes. Leading products include Hyalomatrix and Hyalofill, for treatment of complex wounds such as burns and ulcers, and Hyalograft 3D and Laserskin scaffolds, for use in connection with the regeneration of skin. Anika S.r.l.’s dermal products are commercialized through a network of distributors, primarily in Europe, Latin America and the Middle East. Several of the products are also approved for sale in the United States including Hyalomatrix, Hyalofill and Hyalogran. Currently, the Company is actively seeking a commercial partner in the United States. In 2012, the Company entered into a distribution agreement for sales of advanced wound care products in nine South American countries, including Argentina, Brazil, Mexico and Chile.

Our initial aesthetic dermatology product is a dermal filler based on our proprietary chemically modified, cross-linked HA, and is approved in Europe, Canada, the U.S., South Korea and certain countries in South America. Internationally, this product is marketed under the ELEVESS trade name. In the U.S., the trade name is HYDRELLE, although the product is not currently marketed in the U.S.

Surgical

Our surgical group consists of products used to prevent surgical adhesions, and to treat ENT disorders. For the year ended December 31, 2013, sales of surgical products contributed 8% of our product revenue. Hyalobarrier is a clinically proven post-operative adhesion barrier for use in the abdomino–pelvic area. The product is currently commercialized in Europe, the Middle East and certain Asian countries through a distribution network, but is not approved in the U.S. INCERT, approved for sale in Europe, Turkey, and Malaysia, is a chemically modified, cross-linked HA product, for the prevention of spinal post-surgical adhesions. There are currently no plans at this time to distribute INCERT in the U.S. Anika co-owns issued U.S. patents covering the use of INCERT for adhesion prevention. See the section captioned “Patent and Proprietary Rights” for additional information.

Anika S.r.l. also offers several products used in connection with the treatment of ENT disorders. The lead products are Merogel, a woven fleece nasal packing, and Merogel Injectable, a thick, viscous hydrogel composed of cross-linked hyaluronic acid, a biocompatible agent that creates a moist wound-healing environment. Anika S.r.l. is partnered with Medtronic for distribution of these products.

In 2011, Merogel Injectable was voluntarily withdrawn from the market due to a labeling error on the product’s packaging. We settled the matter related to this dispute with Medtronic in August, 2012. This labeling error related to conduct that initially occurred prior to our acquisition of Anika S.r.l. from Fidia Farmaceutici S.p.A. (“Fidia”) and, as a result, we made claims against Fidia for indemnification for Anika’s losses related to this issue. Fidia maintained that it did not have liability for this matter, and asserted a counterclaim against Anika for failing to consent to the release of the remaining shares held in escrow upon the closing of the Anika S.r.l. acquisition. The Company reached agreement with Fidia in October 2013 to settle this matter without admission of liability by either party in return for a payment made by Fidia to the Company. As a result of the settlement, the arbitration with Fidia pending before the London Court of International Arbitration has been withdrawn, and shares previously held in escrow have been released.

Ophthalmic

Our ophthalmic business includes HA viscoelastic products used in ophthalmic surgery. For the year ended December 31, 2013, sales of ophthalmic products contributed 6% of our product revenue. Anika previously manufactured the AMVISC product line for Bausch & Lomb under the terms of a supply agreement that expired on December 31, 2010 (the “2004 B&L Agreement”) for viscoelastic products used in ophthalmic surgery. Effective January 1, 2011, the parties entered into a non-exclusive, two year contract
intended to transition the manufacture of AMVISC and AMVISC Plus to an alternative, low-cost supplier formerly affiliated with B&L, and we continued to supply B&L with these products during 2011. Effective January 1, 2012, the parties agreed to a three year contract for Anika to continue to supply these products to B&L as a second supplier with committed annual volumes for 2012, and with lower committed volumes in 2013 and 2014.

B&L accounted for 5% of product revenue for the year ended 2013, and is expected to be lower in 2014 under the current contract. Operating margins under the 2004 B&L Agreement were low and will remain at a similar level under the current contract. See Item 1A. “Risk Factors.”

Veterinary

U.S. sales of HYVISC, our product for the treatment of equine osteoarthritis, contributed 5% to product revenue for the year ended December 31, 2013. We continue to look at other veterinary applications and opportunities to expand geographic territories.

Research and Development

Anika’s research and development efforts primarily consisted of the development of new medical applications for our HA-based technology, the management of clinical trials for certain product candidates, the preparation and processing of applications for regulatory approvals or clearances at all relevant stages of product development, and process development and scale-up manufacturing activities related to our existing and new products. Our development focus includes products for tissue protection, healing and repair. Our investment in R&D has been important over the years, and varies considerably depending on the number and size of clinical trials and studies underway. We anticipate that we will continue to commit significant resources to research and development, including clinical trials, in the future.

In February 2014 we received FDA approval for MONOVISC. MONOVISC is our first FDA approved single-injection treatment of osteoarthritis that uses a non-animal sourced HA. It is also our first osteoarthritis product based on our proprietary cross-linked HA-technology. We received Conformité Européenne (“CE”) Mark approval for the MONOVISC product in October 2007, and began sales in Europe during the second quarter of 2008.

Our second single-injection osteoarthritis product under development is CINGAL, which is based on our hyaluronic acid material with an added active therapeutic molecule designed to provide broad pain relief for a longer period of time. We have completed the formulation and biocompatibility studies of the product. During the second quarter of 2013, we commenced a phase III clinical trial to obtain the needed clinical data for a CE Mark submission and approval, and to support other product registrations including in the United States.

With the acquisition of Anika S.r.l., we have enhanced our research and development capabilities, our technology base, and our pipeline of product candidates. Anika S.r.l. has research and development programs for new products including Hyalofast, an innovative product for cartilage tissue repair, Hyalospine, an adhesion prevention gel for use after spinal surgery, and Hyalobone, a bone tissue filler.

Restructuring Plan

On December 28, 2012 the Company announced the closure of its tissue engineering facility in Abano Terme, Italy due to the inability to meet strict regulatory standards, established by the EMA for Advanced Therapy Medicinal Products, which became effective January 1, 2013. The restructuring plan primarily involved a workforce reduction, the disposal of related supplies and equipment, and the termination of the Hyalograft C autograft in-process R&D project. We recorded restructuring and related impairment charges in the fourth quarter of 2012 of approximately $2.5 million. Of the total restructuring and related impairment charges, approximately $1.6 million was related to the noncash disposal of assets. The remaining $0.9 million related to cash payments anticipated to occur in 2013, primarily for employee
termination costs. The restructuring plan was completed in 2013, with a $286,843 benefit to the statement of operations for the year ended December 31, 2013, based on actual expenses and payment settlements.

Summary of Critical Accounting Policies; Significant Judgments and Estimates

Our discussion and analysis of our financial condition and results of operations are based upon our consolidated financial statements, which have been prepared in accordance with accounting principles generally accepted in the United States of America. The preparation of these consolidated financial statements requires us to make estimates and judgments that affect the reported amounts of assets, liabilities, revenues and expenses, and related disclosure of contingent assets and liabilities. We monitor our estimates on an on-going basis for changes in facts and circumstances, and material changes in these estimates could occur in the future. Changes in estimates are recorded in the period in which they become known. We base our estimates on historical experience and other assumptions that we believe to be reasonable under the circumstances. Actual results may differ from our estimates if past experience or other assumptions do not turn out to be substantially accurate.

We have identified the policies below as critical to our business operations and the understanding of our results of operations. The impact and any associated risks related to these policies on our business operations is discussed throughout “Management’s Discussion and Analysis of Financial Condition and Results of Operations” where such policies affect our reported and expected financial results. For a detailed discussion on the application of these and other accounting policies, see Note 2 in the Notes to the Consolidated Financial Statements of this Annual Report on Form 10-K for the year ended December 31, 2013.

Foreign Currency Translation

The functional currency of our wholly-owned foreign subsidiary is the Euro. Assets and liabilities of the foreign subsidiary are translated using the exchange rate existing on each respective balance sheet date. Revenues and expenses are translated using the monthly average exchange rates prevailing throughout the year. The translation adjustments resulting from this process are included as a component of accumulated currency translation adjustment.

The Company recognized gains from foreign currency transactions of $259,275 and $200,452 during the years ended December 31, 2013, and 2012, respectively and losses from foreign currency transactions of $623,093 in 2011.

Fair Value Measurements

Fair value is defined as the price that would be received from selling an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date. When determining the fair value measurements for assets and liabilities required to be recorded at fair value, we consider the principal or most advantageous market in which we would transact and consider assumptions that market participants would use when pricing the asset or liability, such as inherent risk, transfer restrictions, and risk of nonperformance. The accounting standard establishes a fair value hierarchy that requires an entity to maximize the use of observable inputs and minimize the use of unobservable inputs when measuring fair value.

A financial instrument’s categorization within the fair value hierarchy is based upon the lowest level of input that is significant to the fair value measurement. Three levels of inputs that may be used to measure fair value are:

- Level 1 – Valuation is based upon quoted prices for identical instruments traded in active markets. Level 1 instruments include securities traded on active exchange markets, such as the New York Stock Exchange.
- Level 2 – Valuation is based upon quoted prices for similar instruments in active markets, quoted
prices for identical or similar instruments in markets that are not active and model-based valuation
techniques for which all significant assumptions are observable in the market.

- Level 3 – Valuation is generated from model-based techniques that use significant assumptions
  not observable in the market. These unobservable assumptions reflect our own estimates of
  assumptions market participants would use in pricing the asset or liability.

Allowance for Doubtful Accounts

We maintain allowances for doubtful accounts for estimated losses resulting from the inability of
our customers to make required payments. In determining the adequacy of the allowance for doubtful
accounts, management specifically analyzes individual accounts receivable, historical bad debts, customer
concentrations, customer credit-worthiness, current economic conditions, accounts receivable aging trends
and changes in our customer payment terms.

Inventories

Inventories are stated at the lower of cost or market, with cost being determined using the first-in,
first-out method. Work-in-process and finished goods inventories include materials, labor, and
manufacturing overhead.

The Company’s policy is to write-down inventory when conditions exist that suggests inventory
may be in excess of anticipated demand or is obsolete based upon assumptions about future demand for the
Company’s products and market conditions. The Company regularly evaluates the ability to realize the
value of inventory based on a combination of factors including, but not limited to: historical usage rates,
forecasted sales or usage, product end of life dates, and estimated current or future market values.
Purchasing requirements and alternative usage avenues are explored within these processes to mitigate
inventory exposure.

Revenue Recognition - General

We recognize revenue from product sales when all of the following criteria are met: persuasive
evidence of an arrangement exists; delivery has occurred or services have been rendered; the seller's price
to the buyer is fixed or determinable; and collection from the customer is reasonably assured.

Product Revenue

Revenue from product sales are recognized when title and risk of loss have passed to the customer,
which is typically upon shipment to the customer. Amounts billed or collected prior to recognition of
revenue are classified as deferred revenue. When determining whether risk of loss has transferred to
customers on product sales, or if the sales price is fixed or determinable, the Company evaluates both the
contractual terms and conditions of its distribution and supply agreements as well as its business practices.

Product revenue also includes royalties. Royalty revenue is based on our distributors’ sales and is
recognized in the same period our distributors record their sale of products manufactured by us. On a
quarterly basis we record royalty revenue based upon sales projections provided to us by our distributor
customers. If necessary we adjust our estimates based upon final sales data received prior to issuing our
quarterly unaudited or annual audited financial statements.

Pursuant to the Health Care and Education Reconciliation Act of 2010, in conjunction with the
Patient Protection and Affordable Care Act, a medical device excise tax (“MDET”) became effective on
January 1, 2013 for sales of certain medical devices. Some of our product sales are subject to the provisions
of the MDET. The Company has elected to recognize any amounts related to the MDET under the gross
method as allowed under ASC 605-45. For the period ending December 31, 2013, amounts included in
revenue and cost of goods sold for the MDET were immaterial.
Licensing, Milestone and Contract Revenue

Licensing, milestone, and contract revenue consists of revenue recognized on initial and milestone payments, as well as contractual amounts received from partners. The Company’s business strategy includes entering into collaborative license, development and/or supply agreements with partners for the development and commercialization of the Company’s products.

The terms of the agreements typically include non-refundable license fees, funding of research and development, and payments based upon achievement of certain milestones. The Company adopted Accounting Standards Update (“ASU”) 2009-13, Revenue Recognition, in January 2011, which amends Accounting Standards Codification Subtopic 605-25, Multiple Element Arrangements (“ASC 605-25”) to require the establishment of a selling price hierarchy for determining the allocable selling price of an item. Under ASC 605-25, as amended by ASU 2009-13, in order to account for an element as a separate unit of accounting, the element must have objective and reliable evidence of selling price of the undelivered elements. In general, non-refundable upfront fees and milestone payments that do not relate to other elements are recognized as revenue over the term of the arrangement as the Company completes its performance obligations.

Property and Equipment

Property and equipment are recorded at cost and depreciated using the straight-line method over their estimated useful lives. Computer hardware and software are typically amortized over three to five years, and furniture and fixtures over five to seven years. Leasehold improvements are amortized over the shorter of their useful lives or the remaining terms of the related leases. Property and equipment under capital leases are amortized over the lesser of the lease terms or their estimated useful lives. Maintenance and repairs are charged to expense when incurred, while additions and improvements are capitalized. When an item is sold or retired, the cost and related accumulated depreciation is relieved, and the resulting gain or loss, if any, is recognized in income.

Goodwill and Acquired In-Process Research and Development

Goodwill is the amount by which the purchase price of acquired net assets in a business combination exceeded the fair values of net identifiable assets on the date of acquisition. Acquired IPR&D represents the fair value assigned to research and development assets that we acquire that have not been completed at the date of acquisition or are pending regulatory approval in certain jurisdictions. The value assigned to the acquired IPR&D is determined by estimating the costs to develop the acquired technology into commercially viable products, estimating the resulting revenue from the projects, and discounting the net cash flows to present value.

Goodwill and IPR&D are evaluated for impairment annually or more frequently if events or changes in circumstances indicate that the asset might be impaired. Factors we consider important, on an overall company basis, that could trigger an impairment review include significant underperformance relative to historical or projected future operating results, significant changes in our use of the acquired assets or the strategy for our overall business, significant negative industry or economic trends, a significant decline in our stock price for a sustained period, or a reduction of our market capitalization relative to net book value.

To conduct impairment tests of goodwill, the fair value of the acquired reporting unit is compared to its carrying value. If the reporting unit’s carrying value exceeds its fair value, we record an impairment loss to the extent that the carrying value of goodwill exceeds its implied fair value. We estimate the fair value for reporting units using discounted cash flow valuation models which require the use of significant estimates and assumptions including but not limited to: risk free rate of return on an investment, weighted average cost of capital, future revenue, operating margin, working capital and capital expenditure needs. Our annual assessment for impairment of goodwill as of November 30, 2013 indicated that the fair value of our reporting unit exceeded the carrying value of the reporting unit. Anika S.r.l. is our only acquired
reporting unit and currently holds 100% of the goodwill associated with the 2009 acquisition of that company.

To conduct impairment tests of IPR&D, the fair value of the IPR&D projects is compared to the carrying value. If the carrying value exceeds its fair value, we record an impairment loss to the extent that the carrying value of the IPR&D project exceeds its fair value. We estimate the fair values for IPR&D projects using discounted cash flow valuation models which require the use of significant estimates and assumptions including, but not limited to: estimating the timing of and expected costs to complete the in-process projects, projecting regulatory approvals, estimating future cash flows from product sales resulting from completed projects and in-process projects, and developing appropriate discount rates. Our annual assessment for impairment of IPR&D indicated that the fair value of our IPR&D as of November 30, 2013 exceeded their respective carrying values.

Through December 31, 2013 there have not been any events or changes in circumstances that indicate that the carrying value of goodwill or acquired intangible assets may not be recoverable. The excess of the fair value of the equity of the Anika S.r.l. reporting unit over its carrying value at November 30, 2013 increased from the prior year. The Company continues to monitor and evaluate the financial performance of the Anika S.r.l. business including the impact of general economic conditions, to assess the potential for the fair value of the reporting unit to decline below its book value. There can be no assurance that, at the time future impairment tests are completed, a material impairment charge will not be recorded.

**Long-Lived Assets**

Long-lived assets primarily include property and equipment and intangible assets with finite lives (including purchased software and trade names). Purchased software is amortized over 2 to 10 years and trade names are amortized over 10 years. We review long-lived assets for impairment when events or changes in business circumstances indicate that the carrying amount of the assets may not be fully recoverable or that the useful lives of those assets are no longer appropriate. Each impairment test is based on a comparison of the undiscounted cash flows to the recorded value of the asset. If impairment is indicated, the asset is written down to its estimated fair value based on a discounted cash flow analysis.

**Restructuring and Impairment Charges**

Restructuring charges are primarily comprised of severance costs, activity termination costs and costs of facility closure. Restructuring charges are recorded upon approval of a formal management plan and are included in the operating results of the period in which such plan is approved and the expense becomes estimable. To estimate restructuring charges, management utilizes assumptions such as the number of employees that would be involuntarily terminated and the future costs to operate and eventually terminate the subject activity.

**Research and Development**

Research and development costs consist primarily of salaries and related expenses for personnel and fees paid to outside consultants and outside service providers, including costs associated with licensing, milestone and contract revenue. Research and development costs are expensed as incurred.

**Stock-Based Compensation**

We measure the compensation cost of employee services received in exchange for an award of equity instruments based on the grant-date fair value of the underlying award. That cost is recognized over the period during which an employee is required to provide service in exchange for the award. See Note 10 of the accompanying Consolidated Financial Statements for a description of the types of stock-based awards granted, the compensation expense related to such awards, and detail of equity-based awards outstanding. See Note 14 of the accompanying Consolidated Financial Statements for details relative to the tax benefit recognized in the consolidated statement of operations for stock-based compensation.
Income Taxes

Our income tax expense includes U.S. and international income taxes. Certain items of income and expense are not reported in tax returns and financial statements in the same year. The tax effects of these differences are reported as deferred tax assets and liabilities. Deferred tax assets are recognized for the estimated future tax effects of deductible temporary differences and tax operating loss and credit carry-forwards. Changes in deferred tax assets and liabilities are recorded in the provision for income taxes. We assess the likelihood that our deferred tax assets will be recovered from future taxable income and, to the extent we believe that it is more likely than not that all or a portion of deferred tax assets will not be realized, we establish a valuation allowance. To the extent we establish a valuation allowance or increase this allowance in a period, we include an expense within the tax provision in the consolidated statement of operations.

Comprehensive Income

Comprehensive income consists of net income and other comprehensive income (loss), which includes foreign currency translation adjustments. For the purposes of comprehensive income disclosures, we do not record tax provisions or benefits for the net changes in the foreign currency translation adjustment, as we intend to indefinitely reinvest undistributed earnings of our foreign subsidiary. Accumulated other comprehensive income (loss) is reported as a component of stockholders' equity and, as of December 31, 2013 and 2012, was comprised solely of cumulative translation adjustments.

Segment Information

Operating segments, as defined under U.S. GAAP, are components of an enterprise about which separate financial information is available that is evaluated regularly by the chief operating decision maker, or decision-making group, in deciding how to allocate resources and in assessing performance. The Company’s chief operating decision maker is its Chief Executive Officer. Based on the criteria established by ASC 280, Segment Reporting, the Company has one reportable operating segment, the results of which are disclosed in Note 13 of the accompanying Consolidated Financial Statements.

Results of Operations

Year ended December 31, 2013 compared to year ended December 31, 2012

Statement of Operations Detail

<table>
<thead>
<tr>
<th></th>
<th>Year Ended December 31, 2013</th>
<th>Inc/(Dec)</th>
<th>Inc/(Dec)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2013</td>
<td>2012</td>
<td></td>
</tr>
<tr>
<td>Product revenue</td>
<td>$71,773,730</td>
<td>$68,010,169</td>
<td>3,763,561</td>
</tr>
<tr>
<td>Licensing, milestone and contract revenue</td>
<td>3,307,424</td>
<td>3,348,336</td>
<td>(40,912)</td>
</tr>
<tr>
<td>Total revenue</td>
<td>75,081,154</td>
<td>71,358,505</td>
<td>3,722,649</td>
</tr>
<tr>
<td>Operating expenses:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of product revenue</td>
<td>22,765,404</td>
<td>28,988,621</td>
<td>(6,223,217)</td>
</tr>
<tr>
<td>Research &amp; development</td>
<td>7,059,875</td>
<td>5,388,036</td>
<td>1,671,839</td>
</tr>
<tr>
<td>Selling, general &amp; administrative</td>
<td>12,936,001</td>
<td>14,728,662</td>
<td>(1,792,661)</td>
</tr>
<tr>
<td>Restructuring charges</td>
<td>(286,843)</td>
<td>2,537,988</td>
<td>(2,824,831)</td>
</tr>
<tr>
<td>Total operating expenses</td>
<td>42,474,437</td>
<td>51,643,307</td>
<td>(9,168,870)</td>
</tr>
<tr>
<td>Interest income (expense), net</td>
<td>(127,186)</td>
<td>(187,777)</td>
<td>60,591</td>
</tr>
<tr>
<td>Income before income taxes</td>
<td>32,479,531</td>
<td>19,527,421</td>
<td>12,952,110</td>
</tr>
<tr>
<td>Provision for income taxes</td>
<td>11,905,010</td>
<td>7,769,961</td>
<td>4,135,049</td>
</tr>
<tr>
<td>Net income</td>
<td>$20,574,521</td>
<td>$11,757,460</td>
<td>$ 8,817,061</td>
</tr>
<tr>
<td>Product gross profit</td>
<td>$49,008,326</td>
<td>$39,021,548</td>
<td>$ 9,986,778</td>
</tr>
<tr>
<td>Product gross margin</td>
<td>68%</td>
<td>57%</td>
<td></td>
</tr>
</tbody>
</table>
Total Revenue. Total revenue for the year ended December 31, 2013 increased by $3,722,649 to $75,081,154. The increase in total revenue was primarily due to increased orthobiologics product revenue in 2013 as compared to 2012.

Product revenue by product line. Product revenue for the year ended December 31, 2013 was $71,773,730, an increase of $3,763,561, or 6%, compared to the prior year.

<table>
<thead>
<tr>
<th>Year Ended December 31,</th>
<th>2013</th>
<th>2012</th>
<th>Inc/(Dec)</th>
<th>Inc/(Dec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthobiologics</td>
<td>$55,956,068</td>
<td>$49,954,112</td>
<td>$6,001,956</td>
<td>12%</td>
</tr>
<tr>
<td>Dermal</td>
<td>1,816,602</td>
<td>1,384,403</td>
<td>432,199</td>
<td>31%</td>
</tr>
<tr>
<td>Surgical</td>
<td>5,445,715</td>
<td>5,022,456</td>
<td>423,259</td>
<td>8%</td>
</tr>
<tr>
<td>Ophthalmic</td>
<td>4,656,560</td>
<td>8,784,011</td>
<td>(4,127,451)</td>
<td>(47%)</td>
</tr>
<tr>
<td>Veterinary</td>
<td>3,898,785</td>
<td>2,865,187</td>
<td>1,033,598</td>
<td>36%</td>
</tr>
</tbody>
</table>

$71,773,730 | $68,010,169 | $3,763,561 | 6%

Revenue from orthobiologics increased $6,001,956, or 12%, in 2013 compared to 2012. The improvement in orthobiologics product revenue was due primarily to increases in domestic and international ORTHOVISC sales. Our U.S. ORTHOVISC product revenue for 2013 increased 9% compared to 2012. This increase reflects Mitek’s continued market penetration. International viscosupplementation product revenue in 2013 increased 34% compared to 2012. The increase in international revenue was driven primarily by growth from existing partners, as well as geographic expansion. We expect orthobiologics revenue will continue to increase in 2014, both domestically and internationally.

Dermal revenue increased $432,199, or 31%, in 2013 compared to 2012. The increase was primarily due to Anika S.r.l.’s advanced wound care products revenue which totaled $1,647,396 in 2013, as compared to $976,388 in 2012. This increase was driven by expansion of advanced wound care revenue from existing distributors as well as product launches in South America. We expect advanced wound care revenue to increase in 2014 compared to 2013 primarily due to geographic expansion.

Sales of our surgical products increased $423,259, or 8%, as compared to 2012. This product group consists primarily of Anika S.r.l.’s Hyalobarrier anti-adhesion and ENT products. Our anti-adhesion products include INCERT and Hyalobarrier. Our leading ear, nose and throat care product is Merogel. Anika S.r.l. is partnered with Medtronic for distribution of its ENT products. We expect surgical product revenue to increase in 2014 compared to 2013.

Revenue from ophthalmic products in 2013 decreased $4,127,451, or 47%, compared to revenue for these products in 2012. The decrease was primarily attributable to B&L’s plan to shift manufacturing to an alternative supplier. B&L accounted for 5% of product revenue for the year ended 2013, and is expected to be lower in 2014 due to the lower minimum purchase requirements under the current three year contract. Operating margins under the expired 2004 B&L Agreement were low, and remain at a similar level under the current contract.

Veterinary revenue increased $1,033,598, or 36%, in 2013 as compared to 2012. Sales of HYVISC are made to a single customer under an exclusive agreement which expires December 31, 2014. We expect HYVISC revenue to be at a similar level in 2014 as compared to 2013.

Licensing, milestone and contract revenue. Licensing, milestone and contract revenue for the year ended December 31, 2013 was $3,307,424, compared to $3,348,336 for 2012. Licensing and milestone revenue includes the ratable recognition of the $27,000,000 in up-front and milestone payments related to the JNJ Agreement. These amounts are being recognized in income ratably over the ten-year initial term of the agreement, or $2,700,000 per year. The year 2013 was the last year for the recognition of these milestone payments related to ORTHOVISC under the initial term of the agreement. In November 2012,
Mitek exercised its option and extended the JNJ Agreement for an additional five years through December 2018.

In December 2011, the Company entered into a fifteen-year licensing and supply agreement with Mitek, Inc. to market MONOVISC in the U.S. The Company received an initial payment of $2,500,000 in December 2011, which is also being recognized ratably over the life of the underlying agreement of fifteen years. The Company received FDA PMA approval for MONOVISC in February 2014, and is entitled to receive additional payments from Mitek, following FDA approval and commercial launch of the product, as well as payments related to future regulatory, clinical and sales milestones.

Product gross profit and margin. Product gross profit for the year ended December 31, 2013 was $49,008,326, or 68% of product revenue, compared with $39,021,548, or 57% of product revenue, for the year ended December 31, 2012. The increase in product gross profit was primarily due to the elimination of duplicate manufacturing facility costs for a full year in 2013, improved manufacturing efficiencies, as well as improvements in overall product sales mix, compared to the prior year, with increasing sales of our higher-margin orthobiologics products as a percent of our total product sales being the primary driver.

Research and development. Research and development (“R&D”) expenses for the year ended December 31, 2013 increased by $1,671,839, or 31%, as compared to the prior year, due to the timing of the start of certain clinical trials. R&D as a percentage of revenue was 9% and 8% for the years ended 2013 and 2012, respectively. We expect research and development expenses will increase in 2014 and thereafter compared to 2013 with our continued efforts for CINGAL, the development efforts for tissue regenerative products, line extension products, new products, and early-stage development projects.

Selling, general and administrative. Selling, general and administrative expenses for the year ended December 31, 2013 decreased by $1,792,661, or 12%, as compared to 2012. This decrease was primarily due to a legal dispute settlement payment received in 2013, as well as on-going cost saving initiatives. We expect general and administrative expenses for 2014 will increase reflective of the support required to grow our business both domestically and internationally.

Restructuring charges. On December 28, 2012 the Company announced a strategic shift involving the closure of its tissue engineering facility in Abano Terme, Italy due to the inability to meet strict regulatory standards, established by the EMA, which became effective January 1, 2013. As a result of the plan, the Company recorded restructuring and associated impairment charges in the fourth quarter 2012 of approximately $2.5 million. Of the total restructuring and associated impairment charges, approximately $1.6 million related to the abandonment and noncash impairment of assets. The remaining $0.9 million related to cash payments anticipated to occur in 2013, primarily for employee termination costs. The restructuring plan was completed in 2013, with a $286,843 benefit to the statement of operations for the year ended December 31, 2013, based on actual expenses and payment settlements.

Interest income (expense), net. Net interest expense was $127,186 for the year ended December 31, 2013, as compared to $187,777 in the same period ended 2012. The decrease is the result of the lower balance on our outstanding variable interest rate debt during 2013. On November 29, 2013, the Company terminated the Credit Agreement entered into on January 31, 2008 among the Company, as borrower, Anika Securities, Inc., a wholly owned subsidiary of the Company, as guarantor, each of the lenders from time to time party thereto, and Bank of America, N.A., as administrative agent. In connection with the termination, the Company pre-paid in full its entire outstanding debt under the Agreement plus accrued interest. The outstanding debt balance of $8,400,000 was pre-paid and we did not incur any pre-payment penalties.

Income taxes. Provisions for income taxes were $11,905,010 and $7,769,961 for the years ended December 31, 2013 and 2012, respectively. The decrease in the effective tax rate in 2013 of 3.1%, as compared to 2012, is primarily due to increased R&D tax credits, increased deductible stock option expenses resulting from increased exercise activity, and a favorable foreign tax rate differential.

A reconciliation of the U.S. federal statutory tax rate to the effective tax rate for the periods ending December 31 is as follows:
Year ended December 31, 2013 compared to year ended December 31, 2012

<table>
<thead>
<tr>
<th>Year Ended December 31,</th>
<th>2013</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product revenue</td>
<td>$68,010,169</td>
<td>$61,956,386</td>
</tr>
<tr>
<td>Licensing, milestone and contract revenue</td>
<td>3,348,336</td>
<td>2,822,249</td>
</tr>
<tr>
<td>Total revenue</td>
<td>71,358,505</td>
<td>64,778,635</td>
</tr>
</tbody>
</table>

Operating expenses:

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2011</th>
<th>Inc/(Dec)</th>
<th>Inc/(Dec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of product revenue</td>
<td>28,988,621</td>
<td>26,783,738</td>
<td>2,204,883</td>
<td>8%</td>
</tr>
<tr>
<td>Research &amp; development</td>
<td>5,388,036</td>
<td>6,168,937</td>
<td>(780,901)</td>
<td>(13%)</td>
</tr>
<tr>
<td>Selling, general &amp; administrative</td>
<td>14,728,662</td>
<td>17,858,558</td>
<td>(3,129,896)</td>
<td>(18%)</td>
</tr>
<tr>
<td>Restructuring charges</td>
<td>2,537,988</td>
<td>-</td>
<td>2,537,988</td>
<td>-</td>
</tr>
<tr>
<td>Total operating expenses</td>
<td>51,643,307</td>
<td>50,811,233</td>
<td>832,074</td>
<td>2%</td>
</tr>
<tr>
<td>Income from operations</td>
<td>19,715,198</td>
<td>13,967,402</td>
<td>5,747,796</td>
<td>41%</td>
</tr>
<tr>
<td>Interest income (expense), net</td>
<td>(187,777)</td>
<td>(182,388)</td>
<td>(5,389)</td>
<td>3%</td>
</tr>
<tr>
<td>Income before income taxes</td>
<td>19,527,421</td>
<td>13,785,014</td>
<td>5,742,407</td>
<td>42%</td>
</tr>
<tr>
<td>Provision for income taxes</td>
<td>7,769,961</td>
<td>5,318,334</td>
<td>2,451,627</td>
<td>46%</td>
</tr>
<tr>
<td>Net income</td>
<td>$11,757,460</td>
<td>$8,466,680</td>
<td>$3,290,780</td>
<td>39%</td>
</tr>
<tr>
<td>Product gross profit</td>
<td>$39,021,548</td>
<td>$35,172,648</td>
<td>$3,848,900</td>
<td>11%</td>
</tr>
<tr>
<td>Product gross margin</td>
<td>57%</td>
<td>57%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As of December 31, 2013, the Company had net operating losses ("NOL") for federal income tax purposes in Italy of $9,353,750 with no expiration date.

In connection with the preparation of the financial statements, the Company performed an analysis to ascertain if it was more likely than not that it would be able to utilize, in future periods, the net deferred tax assets associated with its NOL carry-forward. We have concluded that the positive evidence outweighs the negative evidence and, thus, that the deferred tax asset not otherwise subject to a valuation allowance are realizable on a "more likely than not" basis. As such, we have not recorded a valuation allowance at December 31, 2013, and 2012, respectively.

The 2010 through 2013 tax years remain subject to examination by the Internal Revenue Service ("IRS") and other taxing authorities for U.S. federal and state purposes. The 2009 through 2013 tax years remain subject to examination by the applicable governmental authorities in Italy.

Net income. For the year ended December 31, 2013, net income was $20,574,521, or $1.39 per diluted share, compared to $11,757,460, or $0.82 per diluted share, for the same period last year. The primary drivers for this increase in net income were an increase in product gross profit due to improvements in operating efficiencies and streamlining of manufacturing operations with the consolidation into one facility, a more favorable product mix, and lower general and administrative expenses.
Total Revenue. Total revenue for the year ended December 31, 2012 increased by $6,579,870 to $71,358,505. The increase in total revenue was primarily due to increased orthobiologics product revenue in 2012 as compared to 2011.

Product revenue by product line. Product revenue for the year ended December 31, 2012 was $68,010,169, an increase of $6,053,783, or 10%, compared to the prior year.

<table>
<thead>
<tr>
<th>Year Ended December 31,</th>
<th>2012</th>
<th>2011</th>
<th>Inc/(Dec)</th>
<th>Inc/(Dec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthobiologics</td>
<td>$49,954,112</td>
<td>$39,858,139</td>
<td>$10,095,973</td>
<td>25%</td>
</tr>
<tr>
<td>Dermal</td>
<td>1,384,403</td>
<td>3,681,166</td>
<td>(2,296,763)</td>
<td>(62%)</td>
</tr>
<tr>
<td>Surgical</td>
<td>5,022,456</td>
<td>4,976,261</td>
<td>46,195</td>
<td>1%</td>
</tr>
<tr>
<td>Ophthalmic</td>
<td>8,784,011</td>
<td>10,963,822</td>
<td>(2,179,811)</td>
<td>(20%)</td>
</tr>
<tr>
<td>Veterinary</td>
<td>2,865,187</td>
<td>2,476,998</td>
<td>388,189</td>
<td>16%</td>
</tr>
<tr>
<td></td>
<td>$68,010,169</td>
<td>$61,956,386</td>
<td>$6,053,783</td>
<td>10%</td>
</tr>
</tbody>
</table>

Revenue from orthobiologics increased $10,095,973, or 25%, in 2012 compared to 2011. The improvement in orthobiologics product revenue was due primarily an increase in domestic ORTHOVISC sales, offset by decreases in Anika S.r.l.’s orthopedic revenue which was down in all geographic regions. Our U.S. orthobiologics product revenue for 2012 increased 42% compared to 2011. This increase reflected Mitek’s continued market penetration to an estimated market share of 15% in 2012 versus 14% share in 2011. International orthobiologics product revenue in 2012 decreased 21% compared to 2011. The decrease in international revenue was driven primarily by the continued economic stagnation being experienced throughout Europe.

Dermal revenue decreased $2,296,763, or 62%, in 2012 compared to 2011. The decrease was primarily due to Anika S.r.l.’s advanced wound care products revenue which totaled $976,388 in 2012, as compared to $3,331,618 in 2011, due to continued economic challenges faced in the Italian market as well as the impact of changing to a distributor-based sales model in 2012 in Italy, combined with the poor performance of Anika S.r.l.’s distributor in the U.S. territory. Aesthetic dermatology revenue was $408,015 for the year ended December 31, 2012, versus $369,548 for the prior year.

Sales of our surgical products increased $46,195, or 1%, as compared to 2011. This product group consists primarily of Anika S.r.l.’s Hyalobarrier anti-adhesion and ENT products. Our anti-adhesion products include INCERT and Hyalobarrier. Our leading ear, nose and throat care product is Merogel. Anika S.r.l. is partnered with Medtronic for worldwide distribution (except for Italy) of its ENT products.

Revenue from ophthalmic products in 2012 decreased $2,179,811, or 20%, compared to revenue for these products in 2011. The decrease was primarily attributable to B&L’s plan to shift manufacturing to an alternative supplier. B&L accounted for 11% of product revenue for the year ended 2012.

Veterinary revenue increased $388,189, or 16%, in 2012 as compared to 2011. Sales of HYVISC are made to a single customer under an exclusive agreement which expires December 31, 2014.

Licensing, milestone and contract revenue. Licensing, milestone and contract revenue for the year ended December 31, 2012 was $3,348,336, compared to $2,822,249 for 2011. Licensing and milestone revenue includes the ratable recognition of the $27,000,000 in up-front and milestone payments related to the JNJ Agreement. These amounts are being recognized in income ratably over the ten-year initial term of the agreement, or $2,700,000 per year. The year 2013 is the last year for the recognition of these milestone payments. In November 2012, Mitek exercised its option and extended the JNJ Agreement for an additional five years through December 2018.

In December 2011, the Company entered into a fifteen-year licensing and supply agreement with Mitek, Inc. to market MONOVISC in the U.S. The Company received an initial payment of $2,500,000 in
December 2011, which is also being recognized ratably over the life of the underlying agreement of fifteen years. The Company is entitled to receive additional payments from Mitek, following FDA approval and commercial launch of the product, as well as payments related to future regulatory, clinical and sales milestones.

Product gross profit and margin. Product gross profit for the year ended December 31, 2012 was $39,021,548, or 57.4% of product revenue, compared with $35,172,648, or 56.8% of product revenue, for the year ended December 31, 2011. The increase in product gross profit was primarily due to improvements in Anika’s overall product sales mix, as compared to the prior year, with increasing sales of our higher-margin orthobiologics products as a percent of our overall product sales being the primary driver, as well as the realization of operational efficiencies from our new manufacturing facility after consolidation of sites. The positive effect of the improved product sales mix was partially offset by the negative impact of a previously disclosed temporary scale-up issue experienced as we consolidated all of our manufacturing activities into our Bedford facility from our now-closed Woburn facility. Anika S.r.l. outsourced manufacturing of its medical devices to its former parent company, Fidia Farmaceutici, contributing to its then current lower gross margins. The Company continued to make progress on its plan to transfer a significant portion of Anika S.r.l.’s medical device product manufacturing to our Bedford facility and successfully began manufacturing ACP gel products there during the fourth quarter of 2012.

Research and development. R&D expenses for the year ended December 31, 2012 decreased by $780,901, or 13%, as compared to the prior year, due to the timing of the start of certain clinical trials. R&D as a percentage of revenue was 8% and 10% for the years ended 2012 and 2011, respectively.

Selling, general and administrative. Selling, general and administrative expenses for the year ended December 31, 2012 decreased by $3,129,896, or 18%, as compared to 2011. This decrease was primarily due to valuation gains associated with the re-measurement of euro-based assets into U.S. dollars as the Dollar weakened during 2012, as compared to 2011, combined with the placing in service the remainder of the Bedford facility, and lower legal and professional fees, offset by exit costs associated with the closing of our Woburn facility.

Restructuring charges. On December 28, 2012 the Company announced the closure of its tissue engineering facility in Abano Terme, Italy due to the inability to meet strict regulatory standards, established by the EMA, which became effective January 1, 2013. As a result of the plan, the Company recorded restructuring and associated impairment charges in the fourth quarter of approximately $2.5 million. Of the total restructuring and associated impairment charges, approximately $1.6 million related to the abandonment and noncash impairment of assets. The remaining $0.9 million relates to cash payments anticipated to occur in 2013, primarily for employee termination costs.

Interest income (expense), net. Net interest expense was $187,777 for the year ended December 31, 2012, as compared to $182,388 in the same period ended 2011. The modest increase was the result of increased rates on our outstanding variable interest rate debt.

Income taxes. Provisions for income taxes were $7,769,961 and $5,318,334 for the years ended December 31, 2012 and 2011, respectively. The increase in effective tax rate in 2012 of 1.2%, as compared to 2011, was primarily due to an increase in the federal statutory tax rate and the accompanying foreign rate differential, partially offset by increased domestic production deductions all resulting from increased domestic taxable income.

A reconciliation of the U.S. federal statutory tax rate to the effective tax rate for the periods ending December 31 is as follows:
Year ended December 31,

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statutory federal income tax rate</td>
<td>35.0%</td>
<td>34.0%</td>
</tr>
<tr>
<td>State tax expense, net of federal benefit</td>
<td>6.4%</td>
<td>5.7%</td>
</tr>
<tr>
<td>Permanent items, including nondeductible expenses</td>
<td>0.9%</td>
<td>0.9%</td>
</tr>
<tr>
<td>State investment tax credit</td>
<td>(0.2%)</td>
<td>(0.2%)</td>
</tr>
<tr>
<td>Federal, state and foreign research and development credits</td>
<td>(1.2%)</td>
<td>(0.4%)</td>
</tr>
<tr>
<td>Foreign rate differential</td>
<td>2.5%</td>
<td>0.9%</td>
</tr>
<tr>
<td>Domestic production deduction</td>
<td>(3.6%)</td>
<td>(2.3%)</td>
</tr>
<tr>
<td>Effective income tax rate</td>
<td>39.8%</td>
<td>38.6%</td>
</tr>
</tbody>
</table>

As of December 31, 2012, the Company had NOL’s for federal income tax purposes in Italy of $9,144,154 with no expiration date. For Massachusetts state income tax purposes, the Company also had an investment tax credit carry-forward of $298,769 expiring through 2021.

In connection with the preparation of the financial statements, the Company performed an analysis to ascertain if it was more likely than not that it would be able to utilize, in future periods, the net deferred tax assets associated with its NOL carry-forward and its investment tax credit carry-forward. We concluded that the positive evidence outweighs the negative evidence and, thus, that those deferred tax assets not otherwise subject to a valuation allowance are realizable on a “more likely than not” basis. As such, we did not record a valuation allowance at December 31, 2012, and 2011, respectively.

The 2010 through 2012 tax years remain subject to examination by the IRS and other taxing authorities for U.S. federal and state purposes. The 2009 through 2012 tax years remain subject to examination by the applicable governmental authorities in Italy.

Net income. For the year ended December 31, 2012, net income was $11,757,460, or $0.82 per diluted share, compared to $8,466,680, or $0.62 per diluted share, for the same period last year. The primary drivers behind this increase in net income were an increase in product sales with a more favorable product mix, lower clinical spending due to timing of clinical trial efforts, and lower legal and professional fees. These items were partially offset by the fourth quarter 2012 restructuring charge and an increase in our effective tax rate.

Liquidity and Capital Resources

We require cash to fund our operating expenses and to make capital expenditures. We expect that our requirements for cash to fund these uses will increase as our operations expand. Historically we have generated positive cash flow from operations, which, together with our available cash and investments and debt, have met our cash requirements. Cash and cash equivalents totaled $63.3 million and $44.1 million, and working capital totaled approximately $85.3 million and $62.9 million, at December 31, 2013 and December 31, 2012, respectively. The Company believes it has adequate financial resources to support its business for at least the next twelve months.

Cash provided by operating activities was $25,165,001, $10,548,677 and $10,173,134 for 2013, 2012, and 2011, respectively. Cash provided by operating activities increased by $14,616,324 in 2013, as compared to the same period ended 2012. The increase was primarily attributable to increased net income in the current year combined with improvements in accounts receivable collections and the positive effect of deferred income taxes. These were partially offset by the building of inventories to meet anticipated demand.

Cash used in investing activities was $253,155, $1,504,707 and $1,400,348 in 2013, 2012 and 2011, respectively. The decrease in cash used in investing activities in 2013, as compared to the same period in the prior year, is a result of fewer capital purchases associated with our Bedford facility during the current year.
Cash used in financing activities was $5,689,229, $758,854, and $1,165,340 for 2013, 2012, and 2011, respectively. Cash used in financing activities for 2013 of $9.6 million was due to the pre-payment of long-term debt of $8.4 million in November 2013, and quarterly payment of principle of $0.4 million in each of the first three quarters of 2013. This cash decrease is partially offset by $3.1 million of proceeds from exercises of stock options.

Concentration of Risk

A portion of the Company’s accounts receivable arising from product sales within Italy by Anika S.r.l. are due from public hospitals and other government-funded healthcare agencies. As of December 31, 2013, the Company’s accounts receivable from all Italian customers totaled approximately $1.2 million of which public hospital and agency receivables were approximately $0.2 million.

The history with our Italian customers has been such that many of the public healthcare providers funded by the Italian government have been slow to pay with several maintaining outstanding balances over one year past due. The Company continuously evaluates these accounts receivables for potential risks associated with, among other things, governmental funding and reimbursement practices. We have established an allowance against the gross value of these trade receivables based upon specifically identifiable risks and other currently available information. For customers where payment is expected over periods of time longer than one year, revenue and trade receivables have been discounted over the estimated period of time for collection. Allowances for doubtful accounts have been increased for these customers, but have been immaterial to date. The Company will continue to work closely with these customers, monitor the economic situation and take appropriate actions as necessary.

See Note 13, Revenue by Product Group, by Significant Customer and by Geographic region; Geographic Information, in the accompanying Consolidated Financial Statements for information regarding significant customers.

Accounting for Off-Balance Sheet Arrangements

We do not use special purpose entities or other off-balance sheet financing techniques, except for operating leases as disclosed in the contractual obligations table below, that we believe have or are reasonably likely to have a current or future material effect on our financial condition, changes in financial condition, revenues or expenses, results of operations, liquidity or capital resources.

Recent Accounting Pronouncements

In February 2013, the Financial Accounting Standards Board (“FASB”) issued ASU No. 2013-02, Comprehensive Income (Topic 220): Reporting of Amounts Reclassified Out of Accumulated Other Comprehensive Income. The provisions of ASU 2013-02 are effective for annual and interim periods beginning after December 15, 2012. The objective of this update is to improve the reporting of reclassifications out of accumulated other comprehensive income. The amendments in this update seek to attain that objective by requiring an entity to report the effect of significant reclassifications out of accumulated other comprehensive income on the respective line items in net income if the amount being reclassified is required under U.S. generally accepted accounting principles to be reclassified in its entirety to net income. The adoption of this amendment did not have a material impact on our consolidated financial position, results of operations, or cash flows.

In March 2013, the FASB issued ASU No. 2013-05, Foreign Currency Matters (Topic 830): Parent’s Accounting for the Cumulative Translation Adjustment upon Derecognition of Certain Subsidiaries or Groups of Assets within a Foreign Entity or of an Investment in a Foreign Entity. The provisions of ASU 2013-05 are effective for annual and interim periods beginning after December 15, 2013. The objective of the amendments in this update is to resolve the diversity in practice about whether Subtopic 810-10, Consolidation—Overall, or Subtopic 830-30, Foreign Currency Matters—Translation of Financial Statements, applies to the release of the cumulative translation adjustment into net income when a parent either sells a part or all of its investment in a foreign entity or no longer holds a controlling
financial interest in a subsidiary or group of assets that is a nonprofit activity or a business (other than a sale of in substance real estate or conveyance of oil and gas mineral rights) within a foreign entity. The adoption of this amendment will not have a material impact on our consolidated financial position, results of operations, or cash flows.

In July 2013, the FASB issued ASU 2013-11, *Income Taxes (Topic 740) Presentation of an Unrecognized Tax Benefit When a Net Operating Loss Carryforward, a Similar Tax Loss, or a Tax Credit Carryforward Exists*. The provisions of ASU 2013-11 are effective for annual and interim periods beginning after December 15, 2013. The main provisions of ASU 2013-11 require an unrecognized tax benefit, or a portion of an unrecognized tax benefit, to be presented in the financial statements as a reduction to a deferred tax asset for the following; a net operating loss carryforward, a similar tax loss, or a tax credit carryforward, with certain exceptions. The adoption of this amendment will not have a material impact on our consolidated financial position, results of operations, or cash flows.

**Contractual Obligations and Other Commercial Commitments**

We incurred significant capital investments related to the build-out of our new facility in Bedford, Massachusetts, as well as the Anika S.r.l. acquisition. Our future capital requirements and the adequacy of available funds will depend, on numerous factors, including:

- Market acceptance of our existing and future products;
- The success and sales of our products under current and future distribution agreements;
- The successful commercialization of products in development;
- Progress in our product development efforts;
- The magnitude and scope of such efforts;
- Any potential acquisitions of products, technologies or businesses;
- Progress with pre-clinical studies, clinical trials and product approvals and clearances by the FDA and other agencies;
- The cost of maintaining adequate manufacturing capabilities;
- The cost of filing, prosecuting, defending and enforcing patent claims and other intellectual property rights;
- Competing technological and market developments;
- The development of strategic alliances for the marketing of certain of our products;
- The terms of such strategic alliances, including provisions (and our ability to satisfy such provisions) that provide upfront and/or milestone payments to us;
- The cost of maintaining adequate inventory levels to meet current and future product demands; and
- The successful management of Anika S.r.l.

We cannot assure you that we will record profits in future periods. To the extent that funds generated from our operations, together with our existing capital resources are insufficient to meet future requirements, we will be required to obtain additional funds through equity or debt financings, strategic
alliances with corporate partners, or through other sources. No assurance can be given that any additional financing will be made available to us or will be available on acceptable terms should such a need arise. However, we believe that our existing cash and cash equivalents and future cash provided by operating activities will be sufficient to meet our working capital and capital expenditure needs for at least the next 12 months. See Item 1A. “Risk Factors.”

The terms of any future equity financings may be dilutive to our stockholders and the terms of any debt financings may contain restrictive covenants, which could limit our ability to pursue certain courses of action. Our ability to obtain financing is dependent on the status of our future business prospects as well as conditions prevailing in the relevant capital markets. No assurance can be given that any additional financing may be made available to us or may be available on acceptable terms should such a need arise.

The table below summarizes our non-cancelable operating leases and contractual obligations at December 31, 2013:

<table>
<thead>
<tr>
<th>Payments due by period</th>
<th>Total</th>
<th>Less than 1 year</th>
<th>2 - 3 years</th>
<th>4 - 5 years</th>
<th>More than 5 years</th>
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</thead>
<tbody>
<tr>
<td>Operating Leases (1)</td>
<td>$10,505,956</td>
<td>$1,627,388</td>
<td>$3,211,485</td>
<td>$1,943,000</td>
<td>$3,724,083</td>
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<tr>
<td>Purchase Commitments</td>
<td>5,169,047</td>
<td>5,161,476</td>
<td>7,571</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>$15,675,003</td>
<td>$6,788,864</td>
<td>$3,219,056</td>
<td>$1,943,000</td>
<td>$3,724,083</td>
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</tbody>
</table>

(1) Included in this line is a lease we entered into on January 4, 2007, pursuant to which we lease our Corporate Headquarters facility. The Facility consists of approximately 134,000 square feet of general office, R&D and manufacturing space located in Bedford, Massachusetts. The Lease has an initial term of ten and one-half years, and commenced on May 1, 2007. We have an option under the Lease to extend its terms for up to four periods beyond the original expiration date subject to the condition that we notify the landlord that we are exercising each option at least one year prior to the expiration of the original or current term thereof. The first three renewal options each extend the term an additional five years with the final renewal option extending the term six years. Our administrative and R&D personnel began occupying the Bedford facility in November of 2007. The Bedford facility was fully validated and approved by applicable regulatory authorities in 2012. We completed the manufacturing space consolidation and moved all domestic operations into the Bedford facility during the second quarter of 2012. Also included in the table above is the lease entered into in Italy related to Anika S.r.l. The lease for our Italian facility commenced on December 30, 2009 for a period of six years.

ITEM 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

As of December 31, 2013, we did not utilize any derivative financial instruments, market risk sensitive instruments or other financial and commodity instruments for which fair value disclosure would be required under ASC 825, Financial Instruments. Our investments consist of money market funds primarily invested in U.S. Treasury obligations.

Primary Market Risk Exposures

Our primary market risk exposures are in the area of currency exchange rate risk. We have two major supplier contracts denominated in foreign currencies. Unfavorable fluctuations in exchange rates would have a negative impact on our financial statements. The impact of currency exchange rate fluctuation for the two contracts on our financial statements was immaterial in 2013. Currently, we attempt to manage foreign currency risk through the matching of assets and liabilities. In the future, we may undertake to manage foreign currency risk through additional hedging methods. We recognize foreign
currency gains or losses arising from our operations in the period incurred. Our investment portfolio of cash equivalents is subject to interest rate fluctuations, changes in credit quality of the issuer, or otherwise.
Appendix J

Descriptive Statistics 2006 – Before

<table>
<thead>
<tr>
<th>Cluster Name and Variable</th>
<th>2006 Results, 2006 as Basis Year</th>
<th>N</th>
<th>Mean</th>
<th>Median</th>
<th>SD</th>
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Descriptive Statistics 2008 – During

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## Descriptive Statistics 2013 – After

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</tr>
<tr>
<td>Experts</td>
<td>13</td>
<td>5.33</td>
<td>5.36</td>
<td>0.19</td>
</tr>
<tr>
<td>Total Complexity</td>
<td>39</td>
<td>5.29</td>
<td>5.29</td>
<td>0.23</td>
</tr>
</tbody>
</table>

*Outlier identified and removed score of 1.23 company = VRTX