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University of Nevada, Reno

**Business Intelligence:
The Goals and Challenges in Operational Decision-Making**

A thesis submitted in partial fulfillment
of the requirements for the degree of

Bachelor of Science in Finance

by

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prepared under our supervision by

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The Goals and Challenges in Operational Decision-Making**

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Abstract

Business intelligence (BI) is the interpretation and manipulation of data through data analysis technologies to provide decision makers with information that allows them to improve organizational performance. Companies are increasingly using BI technologies to make sense of the vast quantity of data they accumulate from their operational activities. The information they gain from data analysis is then used in decision-making. BI is a powerful and evolving tool giving organizations a competitive advantage. This thesis considers the goals and challenges of using BI to make decisions in operations.

The goals and challenges of using BI are explored through the review of academic and industry literature. Further insight comes from two case studies, which involved interviewing employees at, Microsoft, a large technology corporation and Click Bond, a medium sized aerospace and engineering company. Both companies are increasing their BI efforts.

The literature and case studies indicate BI investment and usage in organizations is generally increasing. However, firms are not reaping the full value of their BI efforts. Common short to mid-term goals are creating a data driven culture through increased management support, analytical talent development, and increasing employees ease of access to data and technical systems. Firms also seek to increase data visualization use and capabilities as well as to increase predictive and prescriptive capabilities. Long-term goals are improved operational efficiency, cost reduction, and competitive advantage. The majority of current BI efforts focus on sectors in which data are readily available. These sectors are finance and supply chain. The goals and challenges of BI vary by

company based on the available data, level of technological capabilities, and the extent BI is incorporated into the organizational culture. Firms need to address these three components to achieve the full value of their BI efforts. Many firms already possess high quality data and sufficient technical systems. Thus, overcoming organizational issues are key to achieving success with BI.

Further research is needed by academic and industry professionals to gain a better understanding of how the goals and challenges of BI evolve over time, how goals and challenges differ among different business sectors, and the outcomes of BI projects and if those projects are successful in achieving their initial goals in the short, medium, and long run.

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Introduction

Companies generate a vast quantity of data about their customers, suppliers, and operations. Data analysis allows companies to gain greater insight into their business practices from relationships with their customers, partners, and internal divisions (Lavalle, Lesser, Shockley, Hopkins, & Kruschwitz, 2011). This data driven insight can then be applied to decision making by business professionals. Using data in the decision making process instead of solely human intuition can lead to more successful outcomes from those decisions. Thus, many companies currently seek to increase the use of data analytics in their operations to create business value by enhancing productivity and offering a competitive advantage (Manyika, Chui, Brown, Bughin, Dobbs, Roxburgh, & Hung, 2011).

Turning data into insight through the use of technical systems is often called business intelligence (BI). In this thesis, BI will be defined as the interpretation and manipulation of data through data analysis technologies to provide decision makers with information that allows them to improve organizational performance. BI emerged as a common term in business and information technology sectors in the 1990s (Chen, Storey, & Chiang, 2012). Businesses are increasingly turning to BI due the decreasing cost of data acquisition and storage (Chaudhuri, Dayal, & Narasayya, 2011). Firms can choose from numerous BI systems and platforms provided by various technology companies. BI platforms aggregate, manipulate, manage, and analyze big data (Manyika et al., 2011). The BI platform market is evolving and growing as more firms look to take advantage of

their available data. The Gartner Group reported the BI platform market was forecasted to be worth \$14.1 billion in 2013 (Sallam, Tapadinhas, Yuen, & Hostmann, 2014).

BI is a recent topic in business and information technology. The majority of research on this topic has been published in the past 10 years (Chen et al., 2012). BI requires three key components: data, technical capabilities, and organizational capabilities. Data refer to the type and acquisition of data by companies. Technical capabilities encompass the computing systems, applications, and software used to process, manipulate, and analyze data. Organizational capabilities refer to the extent companies use BI within their organization. Information technology (IT) and business professionals face challenges in each of the three areas. IT professionals oversee the systems responsible for generating, acquiring, and managing data. Business professionals should be aware of the information technology associated with BI and how to effectively apply BI to organizational practices. Business and IT professionals should assess the overall goals of BI usage in the company and the many challenges they face to ensure they achieve their goals.

As companies place greater emphasis on BI within their organizations, evaluating the goals, challenges, and outcomes of BI are necessary to understand the present and future state of BI. This thesis explores the goals and challenges faced by businesses using BI in operational decision-making.

To consider the goals and challenges of using BI, it is necessary to review academic and industry literature. These sources describe and evaluate the many facets of BI usage in today's businesses through surveys and insight provided by BI professionals. Comparing the results of the different studies provides a unified perspective of the state

of BI and discovers similarities as well as inconsistencies in the findings. Additional insight is gained from two case studies of companies incorporating BI into their organizations. The first study explores the goals and challenges faced by Microsoft, a company that employs BI in a large range of functions. As an intern at Microsoft, I worked on a BI project analyzing different data points for four different types of products. I also interviewed individuals within the organization about their BI efforts. To gain the perspective of a company in the beginning stages of introducing BI technology to the organization, I interviewed a member of the BI team at Click Bond, an aerospace and engineering company. Evaluating the goals and challenges with data, technical capabilities, and organizational capabilities through these sources will present a snapshot of the goals and challenges of current BI efforts for organizations. This paper aims to offer a comprehensive and unique perspective on why firms use BI, if its BI efforts are successful, and the future of the BI industry.

Methodology

To address the goals and challenges of BI, an investigation and analysis of research publications will be conducted. The research publications will come from two main sources: academic articles and industry publications. The research will also focus on using articles published in the past five years to gain the most relevant insight due to the rapid evolution of the technology industry.

In addition to the literature, interviews will be conducted with professionals from Microsoft and Click Bond, two companies implementing BI projects. These interviews will offer a first-hand account of implementation of BI projects. Microsoft was chosen as I was an intern at the company and I completed a data analysis project with the BI team.

Click Bond was chosen due to their emphasis on BI within its organization and proximity to the University of Nevada, Reno. Microsoft offers the perspective of BI from a large technology company, which has many BI projects in place. Click Bond offers the viewpoint of an aerospace and engineering company in the beginning phases of BI implementation. Together these firms provide insight into the conclusions gained from the literature.

The interviews were anonymous and do not identify individual respondents to protect them from liability. The anonymity of the interviews serves to protect the companies from providing sensitive information about its performance and internal practices.

Literature Review

Overview of Reviewed Literature

Academic and industry literature about the topic of business intelligence (BI) has greatly expanded since 2005 (Chen et al., 2012). Due to the rapid evolution of technology, reviewing the most recent research is critical to gaining an accurate picture of the BI industry.

This thesis will also review literature about data analytics and big data to assess BI. These terms are often used in place of or in addition to BI, as BI is dependent on the analysis of data and the large volume of data commonly referred to as “big data.” An article by Chen et al. (2012) assesses the use of these terms in relevant literature and publications. They conclude that the majority of research in this field uses the term business intelligence, with over 60% of the research from 2000 to 2011 using this term compared to 22% using business analytics and 18% using big data.

The reviewed literature is divided between academic and industry sources. Six of these sources conducted surveys asking BI and/or business professionals about the use of BI at the company in which they work. An overview of the scale and scope of the cited surveys are:

- A study by MIT Sloan Management Review surveyed more than 3,000 business executives, managers, and analysts in 108 countries and 30 industries. The results were supplemented with interviews from academic and subject matter experts (Kiron, Shockley, Kruschwitz, Finch, & Haydock, 2011).
- A study by MIT Sloan Management Review with IBM Institute for Business Value surveyed more than 4,500 business executives, managers, and analysts in 120 countries and 30 industries. The results were supplemented with interviews from academic and subject matter experts (Lavalle et al., 2011).
- A whitepaper by Bloomberg Businessweek Research Services (2011) serves to “determine the current state of business analytics in organizations” (p. 2). This paper surveyed 930 respondents worldwide in April and May 2011 and compared to a similar survey in April and May of 2009 (*Current state of business analytics: Where do we go from here?, The*, 2011).
- A research paper by McKinsey Global Institute (MGI) analyzes the state of digital data, how different areas can use big data to create value, the potential value offered to stakeholders, and the implications for business leaders as well as policy makers (Manyika et al., 2011).
- A study by the IBM Institute for Business Value and the Said Business School at the University of Oxford surveyed 1,144 business and IT professionals in 95

countries. The results were also supplemented by interviews with more than 24 academics, subject matter experts, and business executives (Schroeck, Shockley, Smart, Romero-Morales, & Tufano, 2012).

- A dissertation and academic paper by Isik surveyed 116 BI professionals about their satisfaction with BI capabilities (Isik, Jones, & Sidorova, 2011; Isik, 2010).

These studies provide insight into how companies employ BI and the outcome of BI in organizations. The studies vary in length and comprehensiveness. The surveys above are anonymous and do not identify individual businesses or respondents, nor do they categorize businesses by identifiable information such as the amount of revenue or number of employees. The anonymity of the surveys serves to protect the companies from providing sensitive information about its performance and internal practices.

Defining Business Intelligence

Business intelligence (BI) is quickly becoming a key tool for modern businesses to gain a competitive advantage and increase their value (Zeng, Li, & Duan, 2012). BI generally is defined as businesses gaining knowledge from data analysis to make decisions. Table 1 provides different definitions used in the reviewed literature. These definitions have three common elements: the acquisition of data, the use of technical systems to process data, and the use of data analysis to support decision-making. The goals of BI revolve around decision-making to improve operations performance.

Defining Business Intelligence		
Table 1		
Business Intelligence is....	Common Elements in Definition: <i>Data, Technical Influence, Organizational Influence</i>	Source
...“collecting useful information from multiple sources and then presenting it in an easy to understand format.”	Data, Technical Influence	Harding, 2003, p. 49
...“systems that combine data gathering, data storage, and knowledge management with analytical tools to present complex internal and competitive information to planners and decision makers.”	Data, Technical Influence, Organizational Influence	Negash, 2004, p. 178
...“a system comprised of both technical and organizational elements that presents historical information to its users for analysis, to enable effective decision-making and management support, for the overall purpose of increasing organizational performance.”	Technical Influence, Organizational Influence	Isik, 2010, p. 11
...“a collection of decision support technologies for the enterprise aimed at enabling knowledge workers such as executives, managers, and analysts to make better and faster decisions.”	Technical Influence, Organizational Influence	Chaudhuri, Dayal, & Narasayya, 2011, p. 88
...”the process of gathering correct information in the correct format at the correct time; and delivering the results for decision-making purposes, or have a positive impact on business operations, tactics, and strategy in the enterprises.”	Data, Technical Influence, Organizational Influence	Zeng, Li, & Duan, 2012, p. 297
...“the use of systems to interpret the large data warehouses of business event data, much of which is captured by enterprise systems, to support planning and control, decision-making, and organizational performance.”	Technical Influence, Organizational Influence	Elbashir, Collier, Sutton, Davern, & Leech, 2013, p. 88

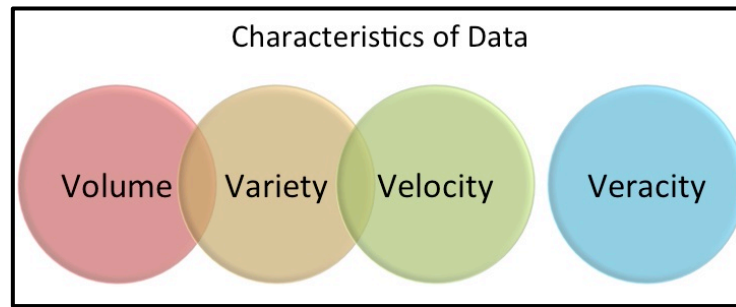
The above definitions describe data, technical influence, and organization influence of BI. Data descriptions identify the collection and type of data. Technical descriptions focus on the technical systems used to make those decisions. Organizational descriptions stress the decision support BI provides for management. In this thesis, BI will be defined as the interpretation and manipulation of data through data analysis technologies to provide decision makers with information that allows them to improve organizational performance. This definition incorporates the different components, which each possess goals and challenges.



Figure 1. Key Components of Business Intelligence.

Data

Data are the foundation of BI. While companies have been collecting data for decades, the digitization of billions of devices and websites allows companies across all industries to collect vast amount of data. Furthermore, advances in BI technical systems and techniques facilitate more detailed data analysis. “Big data” has recently become a commonly used term to describe the greater scale of information as well as the new types of data and analysis available (Isik, 2010; Schroeck et al., 2012). Big data refers to datasets whose size exceeds the capability of typical database software tools to collect,



store, manage, and analyze (Manyika et al., 2011). Data can be characterized by volume, variety, and velocity (Lavallo et al., 2011; Schroeck et al., 2012).

Figure 2. Characteristics of Data.

Volume refers to the large quantity of data organizations employ in decision-making. However, there is not a universal acceptance of a quantifiable measure of “big data.” In the survey by Schroeck et al. (2012), about 50% of business and IT professionals reported big data sets are between one terabyte and one petabyte, and 30 percent reported that they did not have a measure for big data. With the amount of data being collected by firms increasing at an unprecedented rate, the size of datasets that qualify as big data will also increase (Manyika et al., 2011).

Variety describes the different types of data and data sources. With the growth of technology, data are being generated in a plethora of forms including: text, web data, social media comments, audio, video, and more. Data can be structured, semi-structured, or unstructured. Structured data are the easiest to collect and analyze with BI platforms. Baars and Kemper (2008) define structured data as data that is assigned to dedicated fields and can be directly processed with computing equipment. Examples include numeric data like weight or alphabetic data like countries. Unstructured data cannot be easily assigned to fields and directly processed. Examples are emails, audio, and video

content. The largest reported sources of big data in the study by Schroeck et al. (2012) are transactions, log data, events, and emails. These sources are mainly structured data, while unstructured data are part of less than 40% of big data initiatives.

Variety also refers to the source of data. Data originates internally or externally in a firm. Internal data are generated from the organization analyzing the data. External data are given to the organization by another organization or collected from an outside source. Over half of respondents in the Schroeck et al. (2012) study reported their big data analysis efforts target internal data. Internal data are the most mature, well-understood data available to organizations. Isik et al. (2011) found over 75% of respondents in a survey were satisfied with the reliability of internal data collected by their BI system and that the BI system is regularly updated. External data are more difficult for companies to process, as it must be transformed into a format that can be utilized by the BI system. Fewer than 40% of respondents in the study by Lavallo et al. (2011) reported satisfaction with the reliability or accuracy of external data used by BI systems. However, the size and scope of internal data cannot always be managed by traditional BI systems. Sixty percent of business executives reported having more data than their organization is able to use effectively (Lavallo et al., 2011).

Velocity is defined as the rate data are created, processed, and analyzed (Schroeck et al., 2012). Real-time data collection and processing is a rising focus of BI. Organizations increasingly desire to gain immediate insights more quickly from data. Real time data processing will decrease the latency time from when the data are created and when it is accessed. This poses many challenges as data mining and analysis techniques need to be revised to incorporate streaming data. Processing data as it is

acquired causes technical challenges of incorporating continuous data into queries (Chaudhuri et al., 2011).

The article by Schroeck et al. (2012) also promotes a fourth characteristic of data: veracity. **Veracity** is associated with the uncertainty of data. Different data types come with different levels of reliability in the predicted outcomes. Unpredictable data includes the weather, the economy, or customer's future buying decisions. For example, in energy production, the weather is uncertain but utility companies must still forecast production. To manage uncertainty, analysts must give context to the unpredictable data (Schroeck et al., 2012).

Data poses several challenges for BI in firms. Organizations must overcome problems with data accuracy, consistency, and access (*Current state of business analytics: Where do we go from here?*, The, 2011). Isik (2010) found the quality of quantitative data more strongly impacts BI success than operational components. Data quality refers to the consistency and comprehensiveness of the data. The data being used in analysis needs to be consistent and comprehensive or the analysis will not provide correct information. This problem is commonly referred to as "garbage in garbage out" (Isik et al., 2011). This indicates BI initiatives need to have high-quality data, which can be understood by the programs used to process that data, before the company can gain the most benefits from BI. Dermirkan and Delen (2013) also find a strong positive correlation between data quality and the effectiveness of BI systems. The effectiveness of the BI system also relies on the capabilities of the technical systems, described in the following section (Demirkan & Delen, 2013). However, less than a fourth of respondents

in the study by Lavallo et al. (2011, p. 23) stated, “concerns with the data” were an impediment to implementing BI data analysis.

Security issues are another key challenge of data. Security refers to the protection of sensitive data that should be kept private. An example of data which should be secured is customer’s credit card numbers and address. Fifty-eight percent of respondents in the study by Schroeck et al. (2012) report having security processes in place for their BI efforts. Privacy and security issues will also come to the forefront as companies analyze data about customers (Manyika et al., 2011). Organizations must address security and privacy concerns from customers and business partners when using customer data.

Technical Influence

After data, technical influence is the second component of BI. Technical influence refers to the role technical systems play in the outcome of BI projects. BI systems process data, turn the data into information, and the results of the analysis are delivered to relevant personnel who use the resulting information to make business decisions (Elbashir et al., 2013). Anticipating and creating the infrastructure for BI is important to delivering business value. Organizations must balance the configuration and deployment of their data services based on their needs. Many companies cite their primary big data priority is to improve technical capabilities to manage growing volumes of data, and their second is to manage the expanding variety of data (Schroeck et al., 2012). The study by Isik (2010) concludes technological capabilities influence BI efforts more significantly than organizational capabilities. Thus, technology is key in determining the success of BI initiatives. Results of a survey of BI professionals indicate the capability level for BI systems is highly correlated with the level of satisfaction of BI. Furthermore, as the

quality of the technical capabilities increase, the BI success in an organizational also increases (Isik et al., 2011).

Business intelligence systems offer a variety of technical capabilities. Gartner annually assesses the state of BI systems by comparing and evaluating the leading BI platforms provided by different technology companies. Gartner characterizes BI platforms by analysis, information delivery, and integration (Sallam et al., 2014):

- **Analysis** is a requirement of BI platforms, as the user must be able to analyze data efficiently, effectively, and quickly.
- **Information delivery** or the presentation of data to the user is a key part of BI. The user must be able to easily create reports, dashboards, and queries as a result of the data analysis.
- **Integration** of data between and within systems is critical for BI platforms to remain easy to use and provide the desired information in the evolving technology market.

Platforms should provide unified infrastructure and administration, development tools for the end user, and support for various data sources and types.

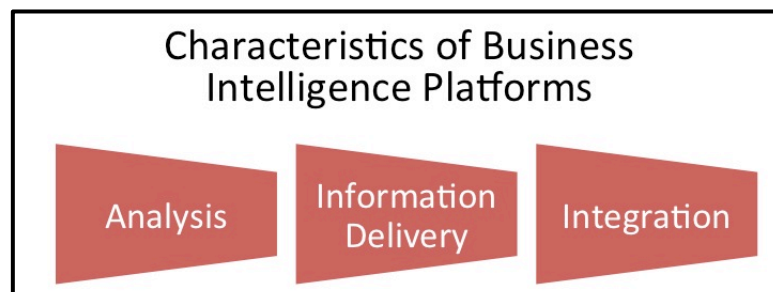


Figure 3. Characteristics of Business Intelligence Platforms

Analysis can be divided into three categories of descriptive, predictive, and perspective analytics, as shown in Figure 4:

Descriptive analytics is the use of data to find out what happened in the past. The main objective is to identify business opportunities and problems (Delen & Demirkan, 2013). Descriptive analytics is the most common type of analytics used by organizations. Combining data from different and often disconnected sources, firms can compare and contrast data to obtain a comprehensive view and context for what has happened and what is currently happening. This is the least difficult type of analytics for technical systems to provide and it provides less business value than the two subsequent types of analytics (*Descriptive*, 2013). An example of a firm using descriptive analytics is to assess the amount of product, such as the number of shirts, sold in different countries.

Predictive analytics is the use of “data and mathematical techniques to discover explanatory and predictive patterns such as trends, associations, and affinities representing the inherent relationships between data inputs and outputs” (Delen & Demirkan, 2013, p. 361). The main objective is to identify what will happen and why (Delen & Demirkan, 2013). Predictive analytics allows managers to plan ahead instead of reacting to what has already occurred. However, predictive analytics does not recommend actions. Predictive analytics is more difficult for technical systems to conduct, but it provides more business value. It shows the BI user what will happen in the future instead of just describing the past and the BI user must determine what steps should be taken next based on the predicted information (*Descriptive*, 2013). An example is when a firm uses the amount of product, like shirts, sold in each month in the past year

in each country to predict the number of shirts that will be sold in each month in the of the following year.

Prescriptive analytics is the use of data and mathematical algorithms to determine possible alternative courses-of-actions or decisions given a complex set of objectives, requirements, and constraints with the goal of improving business performance. The main objective is to identify what organizations should do and why (Delen & Demirkan, 2013). Prescriptive analytics explores possible actions and suggests actions based on descriptive and predictive analyses. This category of analytics presents business managers with a set of possible optimal solutions to business needs or resolutions to business problems. Prescriptive analytics takes uncertainty into account and provides recommendations for mitigating the potential risks. This type of analytics is the most difficult to conduct out of the three, as it requires advanced statistical techniques and more inputs. However, it provides greater business value as the outcome does not require the insight or intuition of the BI user (*Descriptive, 2013*). An example is the BI system determines the projected demand for products, like shirts, is expected to increase in October next year in Canada, and then provides the BI user with the most cost effective option to meet the increase in demand. This cost effective option could be to build a storage facility closer to Canada or increase truck deliveries to Canada. This option would take the costs of constructing a storage facility such as the cost of land or the costs of increasing truck deliveries such as the amount of gasoline.

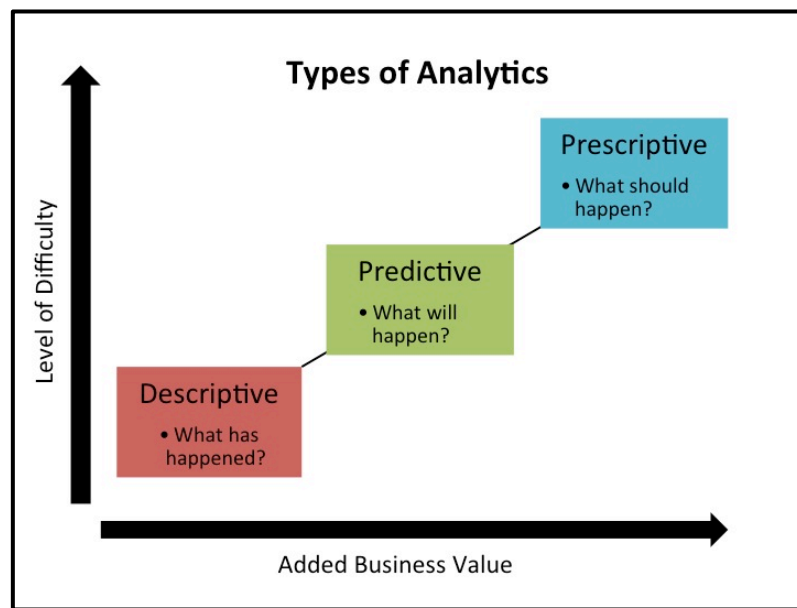


Figure 4. Types of Analytics

Integration of data is one of the most sought after characteristics of BI by managers (Lavalle et al., 2011). The technical capabilities of integration and user access to systems had a strong, positive relationship to BI success in the study by Isik (2010). A long-standing challenge has been the inability to connect data across organizational silos. A lack of integrated processes and sharing of information consistently across organizations impedes BI success (*Current state of business analytics: Where do we go from here?*, The, 2011). However, 65 percent of respondents in the Schroeck et al. (2012) survey considered their “integrated information capability” to sufficiently support their big data analysis efforts. Additionally, about two-thirds of respondents reported their BI processes are integrated, scalable, extensible, and secure.

Currently BI efforts are mainly concerned with descriptive and predictive analytics. Businesses still rely on traditional BI technology. Spreadsheets are the main tool firms use for business analytics (*Current state of business analytics: Where do we go from here?*, The, 2011). The study by Lavalle et al. (2011) found respondents focused on

historic trend analysis and forecasting, standardized reporting, and data visualization in 2011. However, two years into the future these organizations aimed to focus on big data visualization, simulations, scenario development, and analytics applied within business processes. Historic trend analysis and forecasting and standardized reporting were not their primary long-term goals. Data visualization is the visual representation of data. An example is representing the population of each state in the United States in a graph or pie chart instead of presenting the data in a table. The results of this survey indicate organizations seek to move beyond descriptive BI to predictive BI and further emphasize data visualization. More than 70 percent of companies reported in the study by Schroeck et al. (2012) stated their big data efforts increasingly rely on data visualization to gain a better understanding of larger datasets. Companies and software vendors selling business intelligence platforms are increasingly incorporating traditional reports, dashboards, interactive analysis, and advanced predictive analytic capabilities (Sallam et al., 2014).

As BI technology has become adept at presenting descriptive information, companies increasingly look for their BI technology to present predictive and prescriptive information. Cokins (2013) stresses this evolution to predictive BI, noting senior executives are increasingly using an anticipatory management instead of reacting to results after the fact. The Gartner report states BI and analytics platforms are rapidly moving towards BI systems supporting analysis, prediction, forecasting, and optimization (Sallam et al., 2014).

However, the gap between the current and potential use of analytics remains wide. Cokins (2013) reports information technology should be the focus of organizations, as many firms are not using technology as efficiently as they could.

Organizational Influence

Beyond the technical capabilities, it is important to create a positive organizational environment for BI users who will use the BI tools to drive enterprise efficiencies and productivity (Ellingsworth, 2012). The importance of integrating BI into corporate culture and improving BI use within organizations to achieve successful outcomes is asserted by Lavallo et al. (2011), Ellingsworth (2012), Elbashir (2013), and Bloomberg Businessweek's report on business analytics (2011). Integration of BI refers to the use of BI by employees in the majority of the decisions they make in all departments across the organization (*Current State*, 2011).

Contrasting the emphasis on technical capabilities for BI success mentioned above (Demirkan & Delen, 2013; Isik, 2010), the study by Lavallo et al. (2011) concluded the biggest challenges in adopting analytics are managerial and cultural. Integrating BI into all aspects of the organization is key for companies to gain efficiencies through BI. Decision makers at various managerial levels can use BI. Senior leaders use BI to make strategic and tactical decisions. At lower managerial levels, users can employ analytics in their everyday work. A shared understanding of what the BI capabilities are and how to leverage these capabilities to achieve the desired goals needs to exist between the users and decision makers. Elbashir et al. (2013) concluded it is necessary to share knowledge between business and information technology (IT) managers for BI to achieve significant business value. These authors studied the levels and outcomes of BI assimilation within organizations. BI assimilation is defined as the extent BI systems are used to support business strategies and value chain activities in a company. BI success and assimilation relies upon IT and business personnel

relationships. This relationship increases the knowledge and appropriate use of BI in the company.

Lavalle et al. (2011) stresses organizations with a high level of BI assimilation outperform their competitors. These “transformed” BI organizations reported they “substantially outperformed their industry peers” three times more than organizations in an “aspirational” stage of BI implementation. Transformed organizations are firms that employ analytics in the widest range of decision-making, from future strategies to daily operations. Top performing organizations used “rigorous analysis” in decision-making more than double the rate than lower performers. Furthermore, Lavalle et al. (2011) asserts BI success is closely tied to business strategy, must be easy for end users to understand, and integrated into organization processes. The differences between transformed and aspiration firms are shown in Table 2 on the following page. Thus, organizational influences of BI directly impact the success of BI projects. Companies with a rich analytical culture are benefiting more from their BI investments (*Current State*, 2011).

Comparing Three Stages of Analytics Adoption			
Table 2			
	Aspirational	Experienced	Transformed
Motive	Analytics to justify actions	Analytics to guide actions	Analytics to prescribe actions
Functional proficiencies	<ul style="list-style-type: none"> • Financial management and budgeting • Operations and production • Sales and marketing 	<ul style="list-style-type: none"> • All Aspirational functions • Strategy/business development • Customer service • Product research/development 	<ul style="list-style-type: none"> • All Aspirational and Transformed functions • Risk management • Customer experience • Work force planning/allocation • General management • Brand and market management
Key obstacles	<ul style="list-style-type: none"> • Lack of understanding how to leverage analytics for business value • Executive support • Lack of information sharing in organizational culture 	<ul style="list-style-type: none"> • Lack of understanding how to leverage analytics for business value • Skills within lines of business • Ownership of data is unclear 	<ul style="list-style-type: none"> • Lack of understanding how to leverage analytics for business value • Lack of management bandwidth to perform analytics • Accessibility of the data
Data management strengths and obstacles	<ul style="list-style-type: none"> • Limited ability to capture, aggregate, analyze or share information and insights 	<ul style="list-style-type: none"> • Moderate ability to capture aggregate and analyze data • Limited ability to share information and insights 	<ul style="list-style-type: none"> • Strong ability to capture, aggregate, and analyze data • Effective at sharing information and insights
Daily analytics use within organization	<ul style="list-style-type: none"> • Rarely used more sophisticated approaches to make decisions • Limited use of insights to guide day-to-day operations 	<ul style="list-style-type: none"> • Moderate use of sophisticated approaches to decision-making • Growing use of insights to guide day-to-day operations and future decisions 	<ul style="list-style-type: none"> • Most employees use sophisticated approaches in decision-making • Almost all insights are used to guide future decisions and most employees use insights to guide day-to-day operations and future decisions

Note. Adapted from “Big Data Analytics and the Path from Insight to Value” by Lavalle et al., 2011, MIT Sloan Management Review, 52, p. 24. Copyright 2011 by the Massachusetts Institute of Technology.

BI users directly contribute to the outcome of BI, as human insight is a core component of analytics. Data analysis cannot replace experience and human judgment (Ellingsworth, 2012). BI must possess situational awareness to put the information gained from the analysis into relevant context for their business (Harding, 2003). Intuition from experience is still a core factor in decision-making, and analytics are used at varying levels in the decision-making process (*Current State*, 2011). Bloomberg Businessweek (2011) found in a survey of business professionals, the average respondent utilized intuition 60% of the time in decision-making and analytics 40% of the time. Lavallo et al. (2011) studied the differences between the use of intuition versus analytics in different business categories for top and lower performing companies. The authors found top performing organizations are more likely to use analytics in financial management up to 22 more times than intuition. Lower performing organizations were more than four times as likely to apply analytics in financial management. In the category of operations and production and strategy and business development, top performing organization are more than seven times as likely to use analytics than intuition. In these same categories, lower performing companies were less than two times as likely to use analytics instead of intuition. The use of analytics over intuition was significantly less likely for both types of companies in the categories of risk management, customer experience management, work for planning and allocation. This shows intuition is still plays a significant role in decision making for the majority of businesses. However, BI analytics is more widely used in areas of financial management, operations, production, and strategy. Additionally top performing organizations are more likely to use analytics than intuition compared to lower performers.

BI projects focus on implementation, often overlooking the needed user training. This focus causes the workload of companies to increase, although BI should be decreasing the overall workload (Zeng et al., 2012). Without training, organizations lack enough analytical talent. Without analytical professionals, businesses cannot make good use of the BI technology and effectively apply the results. The McKinsey Global Institute (2011) estimates more than 150,000 analytical talent positions and 1.5 million data knowledgeable managers are needed to receive all the possible benefits of BI in the United States (Manyika et al., 2011). Only 23 percent of respondents in the study by Bloomberg Businessweek (2011) stated they “have the right analytical talent in place.” In the study by Lavallo et al. (2011), respondents cited a leading obstacle is “lack of understanding of how to use analytics to improve the business” followed by a “lack of skills internally in the line of business.” Training and recruiting analytic professionals is critical for organizations to implement BI effectively.

Goals and Outcomes of BI

The goal of BI is in its definition. BI centers on the broad goal of making data driven decisions to improve organizational performance. BI users seek to make the right decisions for the right reasons at the right time (Harding, 2003). Lavallo et al. (2011) report business leaders seek analytics to leverage their vast amounts of data and computing power to innovate for competitive differentiation. Specific goals of BI vary across companies and business functions. BI is still in emerging stages, as most organizations use traditional BI technology in decision-making and spreadsheets are the primary tool (*Current State*, 2011). The majority of firms employ BI in finance and operations with goals of “allocating annual budgets”, “establishing financial forecasts”,

“managing supply chain or logistics”, and “streamlining operational processes” (Kiron et al., 2011).

Bloomberg Businessweek (2011) found the six most important areas businesses hope to address or are addressing with business analytics are, in decreasing order of importance: reducing costs, increasing profitability, managing risk, optimizing internal processes, reducing the time to solve problems and make decisions, and increasing fact-based decisions by leadership. Schroeck et al. (2012) report that businesses ranked their top objectives for big data within their organizations were customer centric outcomes for 49% of respondents, “operational optimization” for 18%, “risk/financial management” for 15%, a “new business model” for 14%, and “employee collaboration” for 4%. This survey indicates businesses are looking to BI to analyze large data sets is primarily focused on enhancing customer experiences and understanding customer behavior. This contrasts the study by Bloomberg, which suggests business primarily seek operational improvements with BI. However, the targeted outcomes are not mutually exclusive. Using BI for the goal of improving customer experiences can also be a goal to increase profitability by better understanding customers’ purchasing patterns.

However, a high contrast exists between the goals of organizations in “transformational” and “aspirational” stages of BI usage. Firms in aspirational stages of BI implementation have objectives of financial and supply chain management. Aspirational firms primarily use spreadsheets, and analysis is done when needed. Transformed organizations have a high level of BI assimilation and employ analytics across a wide range of functions including strategic planning, human resources, and customer decision-making. Transformed firms use BI to guide day-to-day decision-

making and use a comprehensive portfolio of tools to support advanced analytic modeling (Kiron et al., 2011; Lavallo et al., 2011). See Table 2 on page 20 for more detail on transformed and aspirational firms. The overall success of individual BI efforts is not studied in the paper by Kiron et al. (2011). However, the transformed organizations are 3.4 times more likely to “substantially outperform their industry peers” than aspirational organizations (Kiron et al., 2011, p. 5). Thus, the overall goal of improved organizational performance to outperform competitors is accomplished through a high level of BI assimilation within the company’s decision-making strategies.

Quantifying the success of BI involves several different metrics. Return on investment (ROI) is the most common form of measurement, however, the exact monetary return cannot always be easily measured. Many benefits of BI are intangible or non-financial, such as time savings. Due to the fact BI projects do not directly and immediately correlate to quantifiable variables such as revenue and cost savings, BI users employ subjective measures to assess outcomes. Isik (2010) also suggests BI success can be measured through the Competitive Intelligence Measurement Model, which combines quantitative and subjective measures. This model considers completion of objectives, satisfaction of decision makers, and the costs associated with the BI project to determine ROI. Other commonly measured variables are cost savings, cost avoidance, time savings, value contribution and revenue (Isik, 2010). A study of 50 Finnish companies found the majority of respondents did not consider cost or time savings as a primary benefit when investing in BI systems. Instead respondents hoped BI would lead to large future returns (Negash, 2004). Measuring the success and outcome of BI projects is not an exact science

and involves the subjective perspective of BI users and managers. Furthermore, firms may have to wait a significant amount of time before assessing the full impact of BI.

Isik et al. (2011) studied the overall satisfaction of BI professionals with their BI systems. About 70% of all surveyed reported they were “satisfied” or “strongly satisfied” with their BI overall. However, the survey’s results indicate BI users and managers are not “strongly satisfied” with the precision, timeliness, decision-making support, or user friendliness of BI. Thus, BI professionals still see improvements that can be made to their current systems. Respondents were least satisfied with the “quality of external data sources, external data reliability, and the extent of BI interactions with other systems.” In contrast to the study by Isik et al. (2010), the study by Elbashir et al. (2013) finds business executives are “generally dissatisfied” with the information generated by BI systems. These business leaders deem they could achieve a higher level of insight if they utilized a larger percentage of the data they possess.

Bloomberg Businessweek (2011) also surveyed business professionals about the outcome of their BI projects. It concludes businesses are not achieving the full value “promised in the promotion of analytics.” In response to the question “how effective would you say the use of business analytics has been in helping your organization make decisions,” 51 percent of respondents answered “somewhat effective.” Twenty-four percent responded “very effective” and 12 percent answered “neither effective nor ineffective” (*Current state of business analytics: Where do we go from here?*, The, 2011). The majority of respondents in the above survey indicate they believe their BI efforts are providing value. Nevertheless, business professionals indicate BI projects could be more effective.

Overall, companies are increasing their BI initiatives. Over 58% of respondents in the survey by Bloomberg Businessweek (2011) said their business analytics efforts had increased from 2010 to 2011. 36% of respondents maintained the use of analytics and only 7% reported a decrease. In the study by Schroeck et al. (2012), 47% of respondents were planning big data activities, 28% were implementing big data activities, and only 24% had not begun big data activities. Kiron et al. (2011) reported 70% of transformed organizations had increased “the level to which analytics and information was integrated into the business strategy and day to day operations” from 2010 to 2011. “Experienced” organizations, categorized as firms with a moderate BI use, reported a 55% increase and “aspirational” organizations reported a 34% increase. This indicates a strong positive trend in the increasing use of data analytics and BI in corporations. Furthermore, organizations already employing BI are increasing their BI usage at a faster rate than organizations in the beginning stages of their BI initiatives. Additionally, the study by Lavalle et al. (2011) found more organizations cited analytics as a source of competitive advantage from 2010 to 2011. Eighty percent of respondents at transformed organizations and 65% of experienced organizations cited analytics as a competitive advantage in 2011. These results were up 23% and 66% respectively from 2010. However, only 37% of aspirational organizations reported analytics provided a competitive advantage in 2011, down 5% from 2010. These findings further indicate firms with BI projects already implemented find more benefit from their BI projects than firms in beginning stages of BI efforts.

Some sectors are poised to achieve greater benefits from BI. Barriers to capture value from BI are higher for certain sectors due to a lack of data driven mindset, lack of

available data, and relatively low IT investments. These sectors include public businesses, including education, and health care. Sectors possessing the opposite characteristics are retail, manufacturing, and professional services (Manyika et al., 2011).

Case Study 1: Microsoft, A Company with a Strong Foundation of BI

To gain further insight into the goals and challenges associated with the practical application of BI and views of professionals in the industry, I interviewed five employees at Microsoft and analyzed a large data set for the Business Intelligence team at Microsoft as an intern. The insights gained from each interview and from my experience as an intern are combined and summarized. The interviewee's identities will be kept anonymous due to the sensitive nature of the information regarding the company's internal business practices.

Overall the BI project confirmed the goals and challenges presented in the BI literature reviewed above. The project involved collection of data, processing of data, and presentation of data to employees. The objective and details are described below.

This case study has several limitations. The information gained from interviews with five employees or individual projects do not provide a comprehensive view of Microsoft's BI strategy and practices. The interviews were limited to the employees at the Microsoft site in Reno, Nevada. The BI project also does not incorporate all aspects of BI platforms and the numerous components that can be associated with BI. Its purpose is to provide a view of common and typical BI and data analysis projects implemented by organizations.

Case Study 1: Insight from BI Project

The BI project involved analyzing manufacturing data about four different computer tablets manufactured by four different companies to discover trends and patterns in data. The goal was to compare the different products to each other in terms of number manufactured, activated, and returned based on overall performance and geographic performance. The findings from this comparison were then presented to employees working with the different manufacturers. Key challenges stemmed from data acquisition and consistency, the capabilities of data analysis technology, and increasing the use of data analysis within current organizational practices.

The main data points used in the analysis were unique product identification number, manufacturer of product, date manufactured, date activated, country in which product was activated, and, if applicable, date product was returned. The data was historical and covers eight months. Data was both external and internal. Manufacturers provided data about date manufactured (external) and Microsoft provided data about activation time and place (internal). Data about the products' specifications were also gained through Internet web sites. This data identified the key differences between the products, which included battery life and product size. Data processing systems of Access and Excel, both Microsoft products, were used to analyze the data. After the data was collected and grouped in Excel, the information was manipulated and turned into visual graphs, charts, and tables.

Challenges with the project were both technical and organizational. The data did have a few quality issues and consistency issues, as one data point was not available from one of the manufactures. The data analysis process was frequently slowed down due to a

lack of processing power by the computer used in the project. Furthermore, analyzing the data relied on human insight to determine potential patterns and trends. Having more information about the product and marketing strategies from the perspective of Microsoft and the manufactures lead to greater insights and understandings about the information gained.

Visual presentation of the information was important, as the individuals to whom the data was presented could more easily understand the findings when shown graphs and charts. One of the employees commented insights from data analysis are commonly presented in tables in a spreadsheet, but the visual information makes it more likely the audience will look at the data. The visual information takes less time to analyze than a table with only numbers. This shows presentation is key to encouraging employees to actually use the information gained from BI. BI analysts cannot expect others to easily comprehend the tables and data they are given.

Case Study 1: Summary of BI Goals and Challenges

Below is a summary of the BI goals and challenges I experienced at Microsoft through the project and from interviews. As the interviews were anonymous, the transcripts of the interviews are not provided to protect the identity of the interviewees. A list of the questions which lead to information presented is provided in Appendix A. The insights are categorized by each of the three core components of BI: data, technical influence, and organizational influence. Subcategorizes and terms are discussed and defined in the literature review section above.

Case Study 1: Data

The interviewees asserted controlling access to data is critical for security and privacy reasons. In the company, approval to access data is often required. The approval is easy for the user to receive and easy for the manager of the data to approve. Data for different departments is also stored in online systems and on SharePoint websites that can be easily accessed by users who have permission. The majority of the data are historical and not necessary to analyze in real time. Also the majority of data generated by the company is structured. The interviewees did not view any significant challenges with data quality, access, timeliness or security. While they want to ensure the data remains high quality and employees have the necessary data to make decisions, they believe the data they currently have is sufficient to support operations. The availability of data is key to enabling employees to use the data in their decision-making.

The vast majority of BI projects in the company use internal data, however my project incorporated external data as well. External data consistency and quality is difficult to control. To achieve the full benefit of BI, companies need to standardize and communicate with all parties involved to make the data analysis more comprehensive and correct, since different companies have different structures for data collection and reporting.

Case Study 1: Technical Influence

The BI team at Microsoft did not say they have any significant challenges with technical systems. The company provides employees with access to data analysis software and the BI team indicated employees can easily ask for additional technical systems they may need in their work. Currently, the majority of employees use

spreadsheet applications such as Microsoft Excel and Access for their current BI efforts. The interviewees were generally satisfied with the ability of their technical systems to integrate data from different systems. However, current systems can require significant processing power and time to aggregate and deliver data to the employee. Thus, they see room for improvement in the category of integration. In the project, acquiring data required a large amount of time and computing power. Furthermore, combining multiple data sets required additional time and computing power. Decreasing acquisition times and increasing processing power of the computers of BI users increases the overall efficiency of BI projects. The more quickly and accurately technical systems can process, manipulate, and analyze data, the greater the benefit to the organization from the BI effort. In the category of information delivery, the BI team was also generally satisfied. Current systems are able to present data in different forms such as graphs, charts, and maps.

Descriptive analytics are the most common type of analytics utilized by employees. Predictive analytics are a growing area of interest for teams across the company. The interviewees expressed their interest in improving predictive capabilities to forecast demands, particularly in areas of supply chain and finance. Prescriptive analytics are not widely used by employees and increasing prescriptive analytics was not a current goal of the BI team.

Furthermore, the interviewees asserted the ability for technical systems to visually present information is important. Visual presentation of data allows individuals to gain a better and faster understanding of the information. While the majority of analytics takes place in spreadsheets, where the information is present in tables, visualization is strongly

encouraged and expected when employees are sharing the information with other employees.

Case Study 1: Organizational Influence

The main goal of the BI team is to further integrate BI into all departments across the organization. To achieve this goal the BI team is focusing on employee training for data analysis techniques as well as providing the needed data and technical systems. This involves scheduling online workshops open for employees. These workshops explain how to use technical systems, such as Excel, to analyze data and how to perform statistical analysis. This increases the use of data analytics by all employees and makes individuals more aware of the different capabilities of data analytics. The objective is to make each employee more knowledgeable about analytics and not necessarily to increase the number of employees in the BI department performing analytics for each team.

The main challenge observed by the interviewees is organizational, as it requires all employees across the organization to see the value in BI and make it part of their daily decision making process. The BI team still faces challenges in encouraging managers to place greater emphasis on BI. In regards to the BI project, the utilized data was being collected and stored, but not analyzed as part of any one employee's job. One goal of the project was to determine if valuable insights could be gained from the data, as the team did not have excess resources to analyze the data. Thus, for BI to increase in companies, managers need to see the value in the BI project and allocate sufficient resources to complete the project.

Case Study 1: Conclusion

From the feedback in the interviews and my perspective as an intern, Microsoft is a “transformed” company in terms of BI usage. Kiron et al. (2011) and Lavalle et al. (2011) described “transformed” organizations as organizations that employ analytics in the widest range of decision-making, from future strategies to daily operations. At Microsoft, data analysis is encouraged and utilized in many aspects of decision-making at all levels. The goal of the BI team is to integrate BI into daily decision-making. In the long run, the BI team does expect to see cost reduction and improved operational efficiency. These goals confirm findings of Negash (2004), who stated firms do not seek goals of cost reduction or improved efficiency in the short to medium term. Within the company, employees value the information gained from data analysis, which is perceived as less biased than human instinct. However, the company seeks to increase BI in all departments.

BI is more strongly integrated into departments of finance and supply chain due to the availability and ease of access to data. Many finance employees rely on data to analyze, plan, and forecast budgets by various teams. Other uses of data in finance include calculating the performance of teams and employees in terms of sales and money spent. The data are stored and shared on a central website, facilitating the governance of the data. Also, in supply chain teams, individuals use the data to assess when products are manufactured, delivered, and purchased. This data allows teams to find inefficiencies in the supply process. Data for other departments is not as easily available, not collected, or not included in the current decision making process. This confirms the findings by Isik

(2010), who states data quality and technical capabilities are key determinates of BI success.

Technical systems are not a central challenge, as all employees have access to basic analysis systems, such as Excel, and employees can obtain other necessary systems if required. However, not all employees possess the same level of knowledge about how to use each system to its full value, thus training is necessary. The need for increased analytical talent is also asserted by Lavallo et al. (2011), Bloomberg Businessweek (2011), and the McKinsey Global Institute (2011).

Data visualization and predictive analytics are an increasing focus of the company. This correlates with the findings the studies by Lavallo et al. (2011), Kiron et al. (2011), and Schroeck et al. (2011). These studies mention the increased emphasis by companies to represent data visually and anticipate future needs instead of rely on historical information. These studies also show the majority of BI efforts use descriptive analysis, just like the current BI efforts at Microsoft.

Overall, the insights from the interviews and personal experience confirmed many of the findings in the literature review above.

Case Study 2: Click Bond, A Company in the Beginning Stages of BI

To gain the perspective of a company in the beginning stages of implementing BI projects, I interviewed a member of the business intelligence team at Click Bond, an aerospace and engineering company. This company manufactures parts used in assembling aircraft. Its main office is in Carson City, Nevada, and they also have two more offices in the United States and England. Click Bond's main goal is to create a data-oriented culture using the data they already collect. Key challenges for this goal are

changing how people view and use data. The team is looking to make data and easy-to-use data analysis systems available across all departments of the organization. To achieve this goal, the team plans to make BI simple to use and understand, clearly communicate the plan to introduce BI systems into the organization, and integrate BI into daily decision-making. The company is in the initial stages of implementing the goal. The desired long-term outcomes are to scale operations efficiently, increase performance, and reduce costs.

This case study has several limitations. The interviewee's identity will be kept anonymous to protect sensitive company information. Further sensitive information such as data about the company's operations will also not be included in the summary.

Case Study 2: Summary of BI Goals and Challenges

Below is a summary of the information about Click Bond's BI goals and challenges I obtained through interviewing a member of the BI team. As the interview was anonymous, the transcripts of the interviews are not provided to protect the identity of the interviewee. A list of the questions that lead to information presented can be found in Appendix A. The insights are categorized by each of the three core components of BI: data, technical influence, and organizational influence. Subcategories and terms are discussed and defined in the literature review section above.

Case Study 2: Data

Click Bond's BI projects focus on internal data from all departments including manufacturing, supply chain, human resources, and accounting. The company generates a large volume of data and estimates it only uses a small percentage of the data in finance, manufacturing, and supply chain operations in their BI efforts. The unused data are

largely irrelevant to the current decisions they make. The data are stored and collected in different technical systems, thus the BI team found a BI platform that can incorporate data from various sources. The BI team mainly uses BI to provide historical analysis of data. A smaller portion of their BI efforts focuses on real time data analytics. This is especially useful in manufacturing where, for example, employees can immediately see differences and problems in production lines. In the future, the BI team looks to incorporate external data into the BI system. The team has already purchased a technical system to pull data from external websites. Data points like weather or metal prices pulled from websites online could be aggregated to the system and analyzed to assist in making decisions. However, they do not expect to use this system to a significant extent in the next year.

Another issue the BI team deem important is data security. They are looking to ensure employees only have access to data relevant to their projects and data are protected from individuals outside the organization. For example, managers in human resources may need to access employee salaries, however this data should not be available to all employees. Protecting data against outside access involves securing technical systems against hackers.

Case Study 2: Technical Influence

The BI team requires their technical systems to process and analyze its data and present the data in a simple to understand manner. The BI platform used by the company has the ability to integrate data from numerous systems and sources. Most importantly, the platform can present data visually through graphs, charts, and tables. The team places a high value on the ability to visually present data, as employees can more quickly

understand the information provided when shown in graphs and charts. Interactive dashboards and systems are another emphasis of the BI team. They want the user to be able to manipulate the level and category of data to their requirements. For example, an employee in manufacturing can see a graph of the total amount of product manufactured per month. To see the detail of an individual month, the employee can click the individual month and the graph will change to display the amount manufactured per week in the selected month. The type and presentation of data can be altered depending on the needs of the department and user. This makes it easier for the user to quickly understand the information the data provides. The easier it is for the user to understand the data, the faster they can make decisions.

The BI team aims to provide employees with technologies that are simple to use and do not require a large amount of training. The team will build customized dashboards for each department in the company, accessible through the BI system. These dashboards will be built by business analysts who have information technology and business knowledge to turn data into relevant information presented in a simple, visual manner. A project management team will be responsible for launching the BI system across the different departments and rolling out future improvements. The technical system needs to be able to grow and change with the company's growth.

The BI team's plans mainly involve descriptive analytics, which analyze historical information. The team also looks to incorporate predictive capabilities into their BI systems in the future.

Case Study 2: Organizational Influence

Click Bond's main goals and challenges around their current BI projects are organizational in nature. Receiving management support is part of the organizational challenge, as the BI team must convince the executives of BI and ensure managers encourage their employees to use BI in daily decision-making. To overcome these challenges, the BI team aims to implement BI in phases and clearly explain how BI can provide the company with increased performance in the long-term through systems which can immediately provide employees with relevant information they can use daily.

A large challenge to the organization is creating a data oriented culture. To integrate BI into the corporate culture and change the way employees utilized as well as understand data, the BI team is emphasizing simplicity in data presentation and training on how to use the systems. Communication is another core focus of the BI team. They will inform employees how they plan to launch the BI system, train employees to use the system, and incorporate the feedback from employees into the system. Ineffective communication can limit the benefits and increase the time to achieve the full benefits of BI. They want to ensure employees have the correct expectations of the BI system and know when to expect changes as well as improvements to the systems. The BI team plans to launch the new system in phases. During the first phase each department will receive their BI system and dashboard. Alterations and updates to the system will occur in subsequent phases.

Furthermore, communication between the employees designing the technical systems and the employees using those systems is deemed necessary. If the technical systems do not offer the types and levels of information needed, the BI project will not

add the intended value to the company. Training is also viewed as critical. Employees possess different levels of technological expertise and knowledge of how to incorporate the new information obtained from the data into their decisions.

Beyond improved efficiency, the BI team seeks to involve all employees in decision-making to a greater extent after introducing BI platforms and increasing their interest in Click Bond's operations. By showing employees that their decisions have a direct impact on the company's performance, the BI team hopes to create a positive environment where employees are excited to be involved with the day-to-day operations.

Case Study 2: Conclusion

Currently Click Bond is an "aspirational" company in terms of BI usage. Kiron et al. (2011) and Lavallo et al. (2011) identified "aspirational" organizations as companies that employ analytics in a narrow range of decision-making in few areas of the organization. The BI team aims to turn the company into a "transformed" organization. The main challenges and goals of Click Bond's BI efforts revolve around organizational capabilities. The BI team's chief goal is BI assimilation. Simplicity is the key to integrating BI into the organizational culture and daily decision-making. Creating technical systems that can be easily manipulated and understood by the majority of employees will facilitate BI integration. Also, increasing employees' interest in the company's operations and allowing employees to see the impact of their individual work. The BI team asserts that using BI to increase employee's connection to the company is key to creating a positive culture where employees are more productive.

The company is seeking to move to a "transformed" level of BI, which, as described by Lavallo et al. (2011), involves implementing data analysis within a wide

range of decisions. The BI team expects this organizational change will lead to increased efficiency, productivity, and a higher level of competitive advantage in the long-term. This reflects the findings in the studies by Lavelle et al. (2011). Lavelle et al. (2011) shows a strong positive relationship between the extent of use of data analysis within a company and the extent of the company's competitive advantage. However, at Click Bond, cost savings is not the primary reason for investing in BI, confirming Negash's (2004) study. Negash found the majority of respondents did not consider time or cost savings as the primary goal of BI projects.

Furthermore, the BI team emphasizes the need to strengthen the relationship between IT and BI users. The study conducted by Elibashir et al. (2013) concluded the bridge between IT and business managers is central to achieving significant business value. The BI team asserts the analysts creating the BI systems for the different departments must work closely with the BI users in those departments for the user to get the intended value out of the BI system.

In the future, the BI team plans to continue improving data, technical systems, and organizational capabilities. Data security is also a present and future issue, which the BI teams will continue to evaluate and improve. Increasing the use of data visualization and incorporation of dashboards into daily workspace is a central goal of the BI team. This shows BI projects need to regularly be assessed by the BI professionals and BI users to ensure the BI projects fulfill the necessary needs for the company.

Conclusion of Literature Review and Case Studies

BI is an ambiguous term and vast field that encompasses the current practices, often referred to as data analytics, of many companies. BI is a rapidly evolving

technology that seeks to improve the efficiency and effectiveness of a firm. This goal aims to take companies to a level of efficiency that could not be reached solely by intuition-based decision-making. Research indicates this outcome is not only possible, but also probable if the BI efforts are implemented properly. By having technical systems process data and provide information, employees have the tools to make better decisions that are based on quantitative analysis instead of human intuition. Currently a gap exists between the potential and actual capabilities and outcomes of BI (Cokins, 2013; *Current State*, 2011). Intuition is used more than analytics in fields other than financial management in the average company (*Current State*, 2011; Lavalle et al., 2011). Many firms are still in the beginning phases of BI projects, although the majority of firms report an increase in BI efforts in the literature and case studies (*Current State*, 2011; Kiron et al., 2011; Lavalle et al., 2011; Schroeck et al., 2012).

A common long-term goal is increasing operational efficiency, reducing costs, and gaining a competitive advantage as indicated in the study by Negash (2004) and the case studies of Microsoft and Click Bond. The short- to mid-term goals and challenges vary greatly from firm to firm and are based on the available data and level of importance the company places on BI use. Companies with data about customers may use BI to achieve customer centric goals, while companies with data from manufacturing operations may use BI to improve manufacturing processes. Areas of finance and supply chain are the most popular use of BI, as most businesses collect financial and supply chain data. This finding was supported by the surveys conducted by Bloomberg Businessweek (2011), Kiron et al. (2011), Lavalle et al. (2011), and the McKinsey Global Institute (2011) as well as the case studies by Microsoft and Click Bond.

The reviewed literature questioned authors about different aspects of BI projects, and three key components of BI emerged in the papers. These components are data, technical systems, and organizational influence. Addressing each of these three areas is critical to BI success. To implement BI successfully, firms must first set goals for their BI projects and then determine the needed data and technical systems to achieve those goals. Each component of data, technical systems, and organizational influence on BI is important to reach desired outcomes.

For data, challenges exist in ensuring data quality, security, and privacy. Companies in the literature review and case studies do not report any significant challenges with data. However without sufficient proficiency in aforementioned areas of data, the analysis will not provide useful information.

Technical systems must be able to process the existing data effectively and efficiently. Currently, many companies use BI to analyze historical data and to provide descriptive information. However, firms seek to provide real time information and predictive information. These objectives require enhanced data collection and processing systems. Visualization is also an increasing focus of BI, as individuals can more easily and quickly understand the information gained from BI presented in graphs and charts. Keeping the technical needs of real time processing, predictive, and visualization capabilities in mind is necessary for the progression of BI. Greater insights and value can be obtained from BI that incorporates these capabilities.

Within the organization, users must have adequate training and knowledge of how to use the system and how to incorporate the information into their work. Firms must first address challenges with data and technical systems before the organization can benefit

from the BI analysis. However, many firms already possess high quality data and sufficient technical systems. Thus, overcoming organizational issues are key to achieving success with BI. Assimilating BI into the corporate culture of decision-making leads to a long-term competitive advantage and improved operational efficiency.

While, the studies by Kiron et al. (2011), Lavalle et al. (2011), and Bloomberg Businessweek (2011), and the McKinsey Global Institute (2011) all conclude BI enhances a company's performance, the impact of BI projects is not realized immediately. Long-term goals of cost reduction and increased efficiency cannot always be directly attributed to BI. Thus, companies should focus on measurable goals, such as the level of BI used in decision-making by employees. This goal is strongly and positively correlated to better company performance (*Current State*, 2011; Kiron, Shockley, Kruschwitz, Finch, & Haydock, 2011; Lavalle, Lesser, Shockley, Hopkins, & Kruschwitz, 2011; Manyika et al., 2011).

However, the goal of integrating BI into organizational culture faces many challenges. This is the key challenge cited in the studies by Schroeck et al. (2011) and Lavalle et al. (2011) and in the case studies of Microsoft and Click Bond. Firms need to incorporate BI into the corporate culture, ensuring employees know how to conduct data analysis and use information in their day-to-day decisions making process. The focus on increasing analytical talent and managers' encouragement of BI in decision-making is critical.

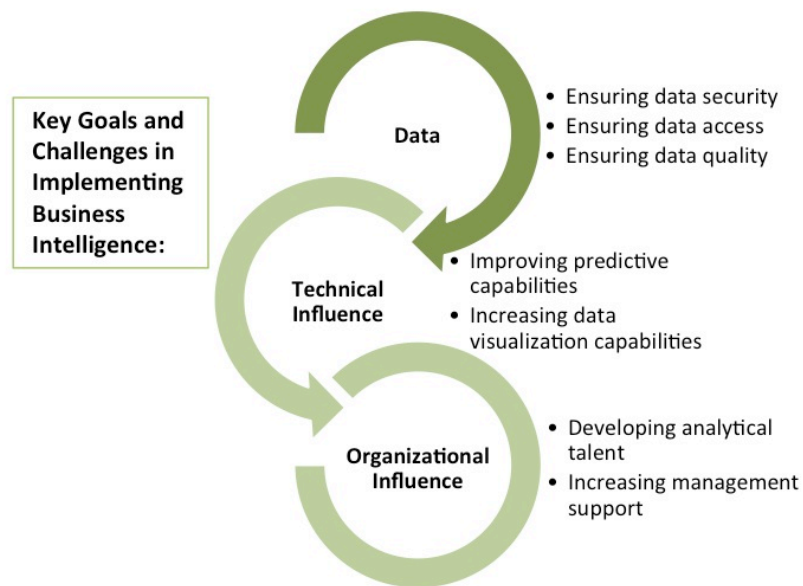


Figure 5. Key Goals and Challenges of Business Intelligence.

Contributions and Further Research

This thesis offers a view of the current goals, challenges, and outcomes faced by companies using BI. The goals, challenges, and outcomes are interconnected and dependent on one another. Unifying and combining the above areas of study about BI provide the business and information technology community with a better understanding of the field. None of the reviewed papers investigated all three topics of goals,

challenges, and outcomes faced by organizations. Thus, this paper offers a greater level of insight into the state of BI by comparing the findings and statistical results.

Another contribution of this thesis is separating BI into three categories of data, technical influence, and organization influence. By defining and examining the different aspects of these categories, a more complete view of BI is presented. Furthermore, these three categories are identified as critical to the success of BI projects. Projects need to first ensure they overcome challenges with data, then overcoming technical issues organizational issues. This provides valuable information to business managers about the necessary components they need to ensure BI success. Information technology professionals can also gain insight into the needs of the technical systems for successful BI outcomes. By knowing the challenges of goals of firms like data visualization and predictive analytic capabilities, IT professionals can make their BI platforms more effective and tailored to business users' needs.

Evaluating the research on these topics indicated that many studies confirm one another's findings and there were a few disagreements between the reviewed papers. While many papers asserted the importance of organizational influence impacting the outcome of BI (*Current State*, 2011; Kiron et al., 2011; Lavallo et al., 2011; Manyika et al., 2011), others stressed the importance of technical and data influences on BI success (Elbashir et al., 2013; Isik et al., 2011; Isik, 2010). Thus, more research needs to be done to understand the relationships between the three BI components and the outcomes of BI.

Additionally, research on the outcomes of BI projects is necessary. The papers by Isik (2010) and Isik et al. (2011) are the only studies to link BI user's satisfaction with BI systems to BI capabilities, indicating which capabilities, like integration capabilities, of

technical systems BI users find acceptable. However, the survey population size was small. Kiron et al. (2011) and Lavallo et al. (2011) link BI efforts with overall competitive advantage, however they do not assess the success of individual BI projects or satisfaction with BI components. The Bloomberg Businessweek (2011) and McKinsey Global Institute reports (2011) also indicate firms are content with current BI efforts and capabilities, as their BI efforts are increasing. However, these reports also indicate BI is not achieving its full value in many firms. Therefore, more research is needed to evaluate the specific outcomes of BI projects and satisfaction with the different components of BI.

Additionally, research into the quantifiable outcomes of BI by companies is difficult to conduct, as firms want to protect its sensitive data about organizational performance and strategies. Thus, the majority of information about BI goals, challenges, and outcomes are conducted through anonymous surveys. These surveys are dependent on the answers of BI professionals. The anonymous surveys poses limitations to BI research.

Further research is needed by academic and industry professionals to gain a better understanding of how the goals and challenges of BI evolve over time and how these two areas differ among different businesses. Research is also needed about the outcomes of BI projects and if those projects are successful in achieving their initial goals in the short and long run. The main body of literature reviewed was published in or after 2010 and did not measure BI efforts in firms for longer than a two-year period. Thus, more long-term studies are needed to more accurately evaluate BI outcomes. Understanding the challenges of BI will allow BI professionals and companies to gain greater value from their BI efforts and greater understanding of how to effectively implement BI projects.

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Appendix A

Interview Questions For Microsoft and Click Bond

General BI Information:

- What are the main goals of your BI efforts in the short and long run? How do you plan to achieve these goals?
- What are the main challenges faced by your company in implementing these BI efforts? How do you plan to overcome these challenges?
- What stage are you implementing your BI efforts?
- How will your BI efforts change in the future?
- Is the BI team and employees satisfied with current BI efforts?
- How will you measure the outcome of the BI projects now and in the future?

Data:

- What are the main types of data used in BI projects: structured, unstructured, internal, external?
- How would you describe your current data quality?
- What security and privacy measures do you have in place?
- What measures are taken to ensure employees have access to necessary data?
- Is the BI team and employees satisfied with the quality, access, timeliness, and security of data?
- What are the goals for data used in BI? How do you plan to achieve these goals?
- What are the challenges you face in the area of data? How do you plan to overcome these challenges?
- Does the BI team and employees seek to collect more data in the future or plan to use a larger percentage of the available data?

Technical Influence:

- What are the current technical systems used in BI efforts?
- What are the key components you look for in a BI system? Do look for BI systems to analyze deliver information, and integrate data between systems?
- What are the main types of analysis used by employees: descriptive, predictive, or prescriptive analysis? Why? Do you expect this to change in the future?
- Is the BI team and employees satisfied with current technical systems?
- Is the BI team and employees satisfied with the ability of technical systems to analyze, deliver information, and integrate data between systems?
- Is the BI team and employees satisfied with the ability of technical systems to analyze, deliver information, and integrate data between systems?
- What are the goals of technical systems for BI? How do you plan to achieve these goals?
- What are the challenges you face in the area of technical influence? How do you plan to overcome these challenges?
- What is the future plans for technical systems?

Organizational Influence:

- What are the goals for BI use within the organization? How do you plan to achieve these goals?
- What are the challenges you face in integrating BI into the organization? How do you plan to overcome these challenges?
- To what extent is BI currently used in the organization? What the departments in which BI is used most? Why these departments?
- Does the BI team plan to increase BI use in the organization?
- Do employees have sufficient knowledge of conducting data analysis in technical systems? If not, do you plan to provide trainings or hire more employees to the BI team? Do you face challenges in this area?
- Do you face challenges from managers and upper management about increasing BI efforts?
- Do you seek to create a data driven culture? Why?