

# **ANALYTICS AND BUSINESS INTELLIGENCE: TOWARDS A STRATEGIC EDUCATIONAL EXPERIENCE**

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## **ABSTRACT**

Business Intelligence (BI), defined here as the creation and use of meaningful business information for management, has over the last 20 years shown over and over again its value to professional industry. The prevalence of BI has also demonstrated that a new brand of worker is needed to take advantage of the sophisticated tools available to modern industry. Evidence suggests modern universities have struggled to educate professionals on the tremendous impact BI can have on an organization if used properly. This work is a step in an endeavor to bridge that educational gap and generate an educational strategic advantage by providing a module to be used in current information systems courses.

## **INTRODUCTION**

BI is the advantageous implementation of “decision support technologies for the enterprise aimed at enabling knowledge workers such as executives, managers, and analysts to make better and faster decisions” [7]. Different organizations will define success differently, but BI success can generally be measured by the effectiveness of data analytics in facilitating decision-making.

BI tools can facilitate the recognition of company or industrial trends from patterns in sales, manufacturing, or other operations and make decisions based on those trends for the overall advantage of the enterprise. These tools use computational power and analytical algorithms to convert thousands or millions of records into meaningful information to assist leadership.

Anecdotal evidence suggests BI tools have only seen wide use in business during the last two decades, and as such, their value to organizations has not yet been fully realized. As these tools are continually refined, and as computational machinery continues to be developed, the potential value of these tools to business organizations will only continue to increase.

This thesis reviews the value of BI in both business and an educational environment and outlines a method by which students can be taught to use some of the BI tools offered in the Microsoft SQL Server Development Environment (2008 R2) to analyze stock market data gathered from public sources. The theme of this thesis is centered on the added value an education in BI can give students, which in turn creates value to industry and the world at large.

## **LITERATURE REVIEW**

## Value of Business Intelligence to Industry

Chaudhuri, Dayal, and Narasayya summarize the value of the BI industry over the last two decades. They suggest that BI has enjoyed explosive growth during this time. BI applications allow businesses to analyze business metrics, for example, to “report total sales by region for this year and compare with sales from last year.” These tools allow for common BI operations, such as “filtering, aggregation, drill-down and pivoting” among others [6]. Other more advanced tools bring more in-depth information. For example, data mining engines are designed specifically to provide analysis “that goes well beyond what is offered by OLAP or reporting servers, and provides the ability to build predictive models to a greater extent than the common BI operations would allow” [6].

Use of BI can be directly correlated with increased profits. Continental Airlines realized a return of investment of more than 1000 percent, investing roughly \$30 million into its BI infrastructure and creating additional revenue streams of more than \$500 million [1]. Lonnqvist and Pirttimaki put the average return on resources for all BI projects at 310 percent [12].

Despite the vast potential for increased profitability, “...upper management—especially at larger firms—is beginning to realize that information is worthless if it isn’t used to maximize profits” [18]. The world annually outlays \$60 billion in BI development, a sizeable investment. “Applying BI takes resources, and the benefits actually occurring in practice are not always clear” [12]. Research performed at the University of Cambridge in the UK suggests many industries may not have adequately prepared themselves for the acquisition and use of BI. “More than 50 percent of BI projects fail to deliver the expected benefit,” and “seven of 10 executives say they do not get the right information to make business decisions” [10].

Such executives who do not get the right information to make good decisions are unable to realize the full potential of BI in their business. The creation of new value, either by generating new revenue or by decreasing costs, is a main purpose of BI [18], but what that value is and how it’s generated will vary. For a CFO, BI success might mean having the ability to more closely analyze how operational performance affects the bottom line, but for a CMO, BI success might mean “better customer segmentation, more precise campaign targeting, (and) improved customer service and customer retention” [18].

By creating new value, companies set themselves apart from competition and substitutes, creating competitive advantage. Davenport’s work illustrates that when companies can no longer effectively differentiate their products, they create competitive advantage by improving business processes; Capital One, Amazon, and the Oakland Athletics attest to that [7].

The effects of competitive advantage translate directly to the bottom line. The degree to which BI directly translates to competitive advantage, however, will depend on the type of business, purpose of the business, and interests of the stakeholders. For some, BI can be used to offer a large competitive advantage, but for others, BI can only offer industry parity [18].

As an example of this idea, let us return to Continental Airlines. Brenneman outlines how this company saved itself through reconstruction and use of BI [3]. Continental designed, built, and deployed a massive data warehouse as part of a “First to Favorite” initiative. Because of this initiative, Continental has achieved near real-time BI. Continental uses its warehouse to quickly identify their most valuable

customers, identify high passenger-volume trends on certain routes and can adjust flights to quickly accommodate a heightened passenger load, etc. Interactive dashboards allow company leaders to “quickly identify issues in the Continental flight network and then manage flights in ways to improve customer satisfaction and airline profitability.”

Besides the airline industry, the effects of BI have been heavily in health care. Recently implemented federal regulations to doctors in the United States are meant “to create a nationwide care delivery system driven by data-supported best practices that deliver the highest quality care for the lowest possible costs” [9]. Current benefits of BI tool use in health care appear to be limited to the rate of industry acceptance and culture conversion [9].

Studies on the effectiveness of BI tools in health care industry reveal an increase in efficiency of health care business practices and a corresponding increase in doctor and patient satisfaction. Tools used in a clinic in the UK allowed the clinic to meet regulation compliance requirements, address key quality control indicators, easily distribute information across the hospital, make data available to hospital consultants, and save time through streamlining data management [5]. Black, et.al, demonstrate that BI has affected private and public sectors many ways, all of them positive [2]. “For companies working in highly competitive and information-intensive industries, BI is critical for understanding business operations, increasing customer satisfaction, and taking advantage of new opportunities” [13].

BI brings new power of choice to those in the business of decision making. Successful implementation of BI architecture will give decision-makers important information they can use to increase the value of their business. This affects individual communities, individual companies, and individual nations to a different degree, but its effect can be observed at all levels of business. BI has been and will more greatly be instrumental in the evolution of the business environment.

### **Importance of BI in Higher Education**

“... The ability for the average user to extract relevant data without the aid of specialized applications is limited,” despite the interactivity of BI databases. BI tools, while commercially available, can be very difficult to understand [8]. If the potential operator of any tool fails to recognize its value or simply doesn’t know how to use it, the tool is useless. This applies for BI tools as well. As previously described, BI tools make use of sophisticated computational systems to translate very big data into meaningful information, but if no educated worker is there to interpret that information or derive meaning from it, then the BI tool doesn’t fulfill its mission very well.

Elbashir, Collier, and Sutton postulate that if top-level management and operation-level management have a high level of “absorptive capacity” (i.e. the inclination to understand and utilize BI tools), those tools will be far more likely to be assimilated into the organization. They also conclude that the IT infrastructure sophistication “enhances BI assimilation. ...This supports the belief that underlying enterprise systems-related IT infrastructure plays an important role in BI assimilation” [8].

Thus, education in BI theory and tool application is critical in modern industry. As those with knowledge of the usefulness of BI tools enter the workforce, the value of those tools increases, as does the likelihood that the tools will be used. It is the responsibility of institutions of higher education to equip top-level and operation-level managers with the knowledge and expertise necessary to adopt useful BI tools and to use them for the good of industry.

Some institutions of higher education have attempted to implement some form of BI education, but very few. As a notable example, Purdue University implemented a one semester course on data warehousing, a fundamental in BI [16]. Students learn dimensional modeling, data mining, Extraction-Transformation-Load (ETL), etc. They design and implement a data warehousing solution, which they leave at the university upon graduation. Purdue's implementation has received positive feedback from students, and "90 percent of students who take these electives plan on getting a job in ... database" [16].

The University of Arizona is another notable example of excellence in BI education. They offer two courses in BI, one focusing on the impact BI has had on the social media universe, and another for graduate students in which students learn dimensional modeling, ETL, data staging, and many other important BI techniques. Beyond construction of a BI data warehouse and working with big data, students at Arizona, "learn how to gather strategic decision making requirements from businesses, develop key performance indicators (KPIs) and corporate performance management metrics using the Balanced Scorecard, and design and implement business dashboards" [18].

Purdue and Arizona are the exception. Innovation in business curricula has "failed to recognize the urgent need to introduce courses and specializations in the emerging field of BI" [15]. Of the Top 50 business schools in America as set forth by LaVelle [11], 12 include a BI course in their offering. None offer a BI major course of study, and only one offers a minor course of study [15].

### **CLASSROOM MODULE: USING REPORTING SERVICES FOR BI**

The Huntsman School is in a period of transition. In response to industry demand, resources are shifting and greater emphasis is being placed on BI. It is probable that a course dedicated exclusively to BI will surface in the Huntsman School of Business's curriculum within years. We view this proposed lesson module as the beginning steps toward a more complete BI curriculum. The classroom module should take a real-life application for BI tools and allow students to gain experience with them. In this section, we explore a basic tool in the Microsoft BI development toolset: the dynamic report.

The report can be used to review data both over a period of time in the past and in real-time. The quicker decision-makers get information, the quicker they can take action that will enable them to gain an advantage against the competition.

The question in this report is to determine whether or not a given stock should be bought or sold. Daily closing stock values are compared to a multiple day moving average price value of that stock. Moving averages of stock prices used in conjunction with current prices function as indicators for the purchase or sale of stocks on the market [14].

Purchase and sale signals are generated by market movement. The closing price of the stock must be compared to yesterday's closing price and the moving average. A buy signal is generated when the difference between the closing price and moving average is positive and when the previous day's difference is negative. Contrariwise, a sell signal is generated when the difference between the closing price and the moving average is negative and when the previous day's price is positive. Ideally, this data should be measured at the present.

Brock, et al., contains a full theoretical discussion to the merits of using moving averages for stock purchasing and sale decisions; such will not be addressed here [4]. Furthermore, the length of the

moving average is less important than the application of the moving average itself. In this application, a 35-day moving average is used, but any moving average of reasonable length could take its place.

The goal of this example is to introduce students to the decision-making power that can be derived from raw data analysis. It is also meant to introduce students to BI application use. This module is designed to be flexible as to its length and depth. We recommend two weeks of class time minimum be dedicated to the subject.

## METHODS AND BENCHMARKS

Students should learn (1) the value data analytics offers to decision-makers, and (2) how to use an analytical tool to provide a meaningful analysis. We use the reporting service in Microsoft Business Intelligence Development Studio for our example in the appendix to provide decision-makers with information about stocks so they can decide to buy, sell, or hold, fulfilling these objectives.

Sirkar suggests a balanced approach in BI education, emphasizing data analysis, instruction in use of information technology, and management sciences in his proposal for a BI minor [15]. Black, et al., recommended the use of Gagne's nine events of instruction for use in BI education [2]. The method by which this module is taught will vary according to the needs of instructors and students. We recommend instructors examine our example in the appendix and adapt it for classroom instruction.

## CONCLUSION

BI assists organizations to interpret the masses of data that circulate through the modern world and translate it into meaningful information for use by decision-makers. The value of intelligent use of BI tools for the benefit of industry and other organizations has been demonstrated repeatedly. Today's institutions of higher education, however, are still lacking in the application of both BI tools and principles in business classrooms. We firmly believe that a stronger BI presence in higher education will create a better world. As tomorrow's business professionals move into industry, organizations will maximize profitability through intelligent use of BI methodology. What we have designed here is meant to assist in the formation of those professionals.

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