Business intelligence and analytics: The mechanism of business value creation.

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was prepared by Aris Karvelas, AM 1018383, for the partial satisfaction of the requirements for obtaining a Postgraduate Diploma in Applied Economics and Analysis of Data from the University of Patras and was approved by the members of the three-member Supervisory Committee.
Dedication

I would like to dedicate my diplomatic work to my parents who supported me all these years from the moment I entered the kindergarten till all the duration of my studies at the university, as well as taught me that knowledge and studies are not enough in order to have an appropriate education. That is because education is acquired through the family environment and the choices of friends and people we associate with. On the basis of the above, I dedicate the thesis to all the people, relatives and friends, that stands beside me when I have them most need and not only in the joys.
Thanks

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Abstract

Business intelligence and analytics (BI&A) has emerged as an important area of study for both practitioners and researchers, reflecting the magnitude and impact of data-related problems to be solved in contemporary business organizations. The proposed study first will provide a framework that identifies the evolution, applications, and emerging research areas of BI&A (BI&A 1.0, BI&A 2.0, and BI&A 3.0 will be defined and described in terms of their key characteristics and capabilities). Secondly, the study will try to explain how business intelligence and analytics investments create business value (BV) by identifying elements of analytics technology assets and business analytics capability as part of a mechanism of business value creation.

Key Words: Business intelligence, business analytics, business value, information systems, IT system, agile methodologies, BA capabilities, BA technology, performance, BA benefits, financial value.
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INTRODUCTION

The term business analytics (BA) first appeared in the late 2000s. The 1990s saw the emergence of business intelligence (BI) from IT and business communities. Their address as BI & A was established for a system or technology that combines and uses BI and BA simultaneously. From 2010 onwards, the concept of creating business value began to enter in the world of BI & A. This has happened since the use of Internet-connected devices has reached record levels and the information that businesses could draw from consumers with data mining and other methods has opened up a new business (and not only) world.

This diploma thesis will deal with the analysis of the above two axes. The first is about delimiting and understanding the term BI & A as well as where it comes from and how it is nowadays formed as one of the main subjects of business study (mainly in the field of management and business planning). Of course, even more interest is expected over the course of time and BI & A enters all sectors and all business sectors in order to lead to better and more efficient returns with the ultimate goal of increasing the value of the business.

The second pillar we will analyze is the creation of business value. This additional value will be shown in the diploma with the term business value, as business value creation refers to the creation of an added value for the business exclusively from the use of BI&A.

The existing bibliography on business value and business value creation by BI & A is not clear and does not shed light on a precise mechanism for how value can be created. Of course, it is worth mentioning that BI & A itself has many dimensions and can play an important role in almost all business processes. Being multi-dimensional and complex, BI & A makes it difficult for analysts to create a successful process that results in a specific business value. In addition, each business and every business sector have its own peculiarities which must be included in the equation making it even more complex.

For the above reasons, the bibliography in its effort to incorporate the above-mentioned difficulties offers us in return a wide range of models that outline many points for BI & A business value creation.

Consequently, our approach to this diploma thesis is a means of modeling which, combining and complementing one another, creates a business value creation mechanism from BI & A.

In the third part of the thesis some case studies have been put in place in order to further understand the process of creating business
value. Case studies come from articles and are based on real business. The information and data they contain comes mainly from interviews with executives and employees rather than from official figures of the company, which would allow more in-depth analysis.

Despite the difficulties that must be addressed, this diploma thesis explains and presents a structure that can be adopted as a BI & A value creation mechanism and ends up with some very interesting conclusions that could inspire further scientific analyzes.
CHAPTER 1

Business Intelligence and Analytics

1.1 Introduction to Business Analytics

1.1.1 Business Analytics

Business analytics (BA) refers to the skills, technologies, practices for continuous iterative exploration and investigation of past business performance to gain insight and drive business planning.

Business analytics focuses on developing new insights and understanding of business performance based on data and statistical methods. In fact, business analytics makes extensive use of statistical analysis, including explanatory and predictive modeling, and fact-based management to drive decision making. It is therefore closely related to management science. Analytics may be used as input for human decisions or may drive fully automated decisions. Business intelligence is querying, reporting, online analytical processing (OLAP), and “alerts.”

In other words, querying, reporting, OLAP, and alert tools can answer questions such as what happened, how many, how often, where the problem is, and what actions are needed. Business analytics can answer questions like why this is happening, what if these trends continue, what will happen next (that is, predict), what is the best that can happen (that is, optimize).

1.1.2 Challenges of Business Analytics

Business analytics depends on enough volumes of high-quality data. The difficulty in ensuring data quality is integrating and reconciling data across different systems, and then deciding what subsets of data to make available.

Previously, analytics was considered a type of after-the-fact method of forecasting consumer behavior by examining the number of units sold in the last quarter or the last year. This type of data warehousing required a lot more storage space than it did speed. Now business analytics is becoming a tool that can influence the outcome of customer interactions. When a specific customer type is considering a purchase, an analytics-enabled enterprise can modify the sales pitch to appeal to that consumer. This means the storage space for all that data must react extremely fast to provide the necessary data in real-time.
1.2 Introduction to Business Intelligence

Business intelligence (BI) can be described as “a set of techniques and tools for the acquisition and transformation of raw data into meaningful and useful information for business analysis purposes” Bentley(2017). The term “data surfacing” is also more often associated with BI functionality. BI technologies are capable of handling large amounts of structured and sometimes unstructured data to help identify, develop and otherwise create new strategic business opportunities. BI technologies provide historical, current and predictive views of business operations. The goal of BI is to allow for the easy interpretation of these large volumes of data. Common functions of business intelligence technologies are reporting, online analytical processing, analytics, data mining, process mining, complex event processing, business performance management, benchmarking, text mining, predictive analytics and prescriptive analytics. BI can be used to support a wide range of business decisions ranging from operational to strategic.

In all cases, BI is most effective when it combines data derived from the market in which a company operates (external data) with data from company sources internal to the business such as financial and operations data (internal data). When combined, external and internal data can provide a more complete picture which, in effect, creates an “intelligence” that cannot be derived by any singular set of data.

1.3 Comparison of Business Intelligence to Business Analytics

Business intelligence and business analytics are sometimes used interchangeably, but there are alternate definitions. One definition contrasts the two, stating that the term business intelligence refers to collecting business data to find information primarily through asking questions, reporting, and online analytical processes. Business analytics, on the other hand, uses statistical and quantitative tools for explanatory and predictive modeling.

In an alternate definition, Thomas Davenport, professor of information technology and management at Babson College argues that business intelligence should be divided into querying, reporting, Online analytical processing (OLAP), an “alerts” tool, and business analytics. In this definition, business analytics is the subset of BI focusing on statistics, prediction, and optimization, rather than the reporting functionality.
1.4 Business Intelligence and Analytics Evolution

The term intelligence has been used by researchers in artificial intelligence since the 1950s. Business intelligence became a popular term in the business and IT communities only in the 1990s. In the late 2000s, business analytics was introduced to represent the key analytical component in BI (Davenport 2006). More recently big data and big data analytics have been used to describe the data sets and analytical techniques in applications that are so large (from terabytes to exabytes) and complex (from sensor to social media data) that they require advanced and unique data storage, management, analysis, and visualization technologies.

In this thesis we use business intelligence and analytics (BI&A) as a unified term and treat big data analytics as a related field that offers new directions for BI&A research.

1.4.1 BI&A 1.0

As a data-centric approach, BI&A has its roots in the longstanding database management field. It relies heavily on various data collection, extraction, and analysis technologies (Chaudhuri et al. 2011; Turban et al. 2008; Watson and Wixom 2007). The BI&A technologies and applications currently adopted in industry can be considered as BI&A 1.0, where data are mostly structured, collected by companies through various legacy systems, and often stored in commercial relational database management systems (RDBMS). The analytical techniques commonly used in these systems, popularized in the 1990s, are grounded mainly in statistical methods developed in the 1970s and data mining techniques developed in the 1980s.

Data management and warehousing is considered the foundation of BI&A 1.0. Design of data marts and tools for extraction, transformation, and load (ETL) are essential for converting and integrating enterprise-specific data. Database query, online analytical processing (OLAP), and reporting tools based on intuitive, but simple, graphics are used to explore important data characteristics. In addition to these well-established business reporting functions, statistical analysis and data mining techniques are adopted for association analysis, data segmentation and clustering, classification and regression analysis, anomaly detection, and predictive modeling in various business applications.

Most of these data processing and analytical technologies have already been incorporated into the leading commercial BI platforms offered by major IT vendors including Microsoft, IBM, Oracle, and SAP.
1.4.2 BI&A 2.0

Since the early 2000s, the Internet and the Web began to offer unique data collection and analytical research and development opportunities. The HTTP-based Web 1.0 systems, characterized by Web search engines such as Google and Yahoo and e-commerce businesses such as Amazon and eBay, allow organizations to present their businesses online and interact with their customers directly. In addition to porting their traditional RDBMS-based product information and business contents online, detailed and IP-specific user search and interaction logs that are collected seamlessly through cookies and server logs have become a new gold mine for understanding customers’ needs and identifying new business opportunities. Web intelligence, web analytics, and the user-generated content collected through Web 2.0-based social and crowd-sourcing systems have ushered in a new and exciting era of BI&A 2.0 research in the 2000s, centered on text and web analytics for unstructured web contents.

The many Web 2.0 applications developed after 2004 have also created an abundance of user-generated content from various online social media such as forums, online groups, web blogs, social networking sites, social multimedia sites (for photos and videos), and even virtual worlds and social games (O’Reilly 2005).

Many marketing researchers believe that social media analytics presents a unique opportunity for businesses to treat the market as a “conversation” between businesses and customers instead of the traditional business-to-customer, one-way “marketing” (Lusch et al. 2010).

1.4.3 BI&A 3.0

Whereas web-based BI&A 2.0 has attracted active research from academia and industry, a new research opportunity in BI&A 3.0 is emerging. As reported prominently in an October 2011 article in The Economist (2011), the number of mobile phones and tablets (about 480 million units) surpassed the number of laptops and PCs (about 380 million units) for the first time in 2011. Although the number of PCs in use surpassed 1 billion in 2008, the same article projected that the number of mobile connected devices would reach 10 billion in 2020. Mobile devices such as the iPad, iPhone, and other smart phones and their complete ecosystems of downloadable applications, from travel advisories to multi-player games, are transforming different facets of society, from education to healthcare and from entertainment to governments. Other sensor-based Internet-enabled devices equipped with RFID, barcodes, and radio tags (the “Internet of Things”) are opening up exciting new steams of innovative applications.
Mobile Business Intelligence (Mobile BI or Mobile Intelligence) is defined as “The capability that enables the mobile workforce to gain business insights through information analysis using applications optimized for mobile devices. The ability of such mobile and Internet-enabled devices to support highly mobile, location-aware, person-centered, and context-relevant operations and transactions will continue to offer unique research challenges and opportunities throughout the 2010s. Although Web 3.0 (mobile and sensor-based) era is a fact, the underlying mobile analytics and location and context-aware techniques for collecting, processing, analyzing and visualizing such largescale and fluid mobile and sensor data are still unknown. No integrated, commercial BI&A 3.0 systems are foreseen for the near future. Most of the academic research on mobile BI is still in an embryonic stage.

1.5 The Current and the Future State of BI&A

1.5.1 Current State

According to Eccles (1991), revolutions begin long before they are declared, as is the case with business analytics. While the popular notion of big data analytics seems to indicate a watershed moment of change and innovation, the truth is that this phenomenon has been in development for decades. Applications in finance, supply chain, and marketing that take advantage of huge volumes of data have been in use for many years, employing statistical techniques and algorithms from the mid-20th century. What is different today is the breadth of opportunities and the practicality of exploiting them due to the sharply declining cost of computer processing power and attendant reductions in the cost of massive storage devices; the ubiquitous networking for data transmission with the Internet; and the availability of powerful, cost-effective, and user-friendly software for analytics. These enablers of the analytics revolution have created new capabilities and even spawned new industries.

Second, the maturity of business performance management in the last five decades has helped create a more solid bridge between business strategy and data. Business performance measures have been an integral part of managing an enterprise.

Third, the realization that fact-based decisions are more critical at every level of the organization has resulted in the emergence of self-service analytics and business intelligence (Imhoff & White, 2011). Access to large databases and user-friendly reporting tools has contributed to the analytics revolution that is now taking place.

Fourth, advanced analytics techniques have been incorporated into enterprise-level systems, making even the most sophisticated
algorithms available to analysts. Of course, another major driver of the business analytics phenomenon has been the sharply declining cost per performance level of three key information technologies: computing power, data storage, and bandwidth.

### 1.5.2 Future State

The application of analytics to business problems is in an early stage of development and dissemination. Opportunities for employing data assets to enhance revenue, reduce costs, and manage risks abound, and these applications will continue to grow. For example, it has long been recognized that cross-selling or up-selling to current customers is more profitable than finding and creating new customers. Financial institutions, for one, are increasingly using data mining to uncover trends in customer behavior in order to better understand future needs. Hence, predictive analytics models are being developed to tailor the right recommendations for the appropriate customer segments.

A rich area for analytics is in reducing costs. In some cases, the path to lower costs involves tradeoffs between opposing forces. For example, procurement operations in corporations typically push for early payment to suppliers to take advantage of discounts. At the same time, financial managers will try to retain cash as long as possible. Optimization analytics coupled with careful metrics can find the optimal balance.

### 1.6 The Usage of BI&A in Industry

The increasing complexity in business scenarios creates a fertile field for the application of analytics in business decisions. Thus, complex systems are denominated by the influence of four dimensions: variety, heterogeneity, dynamic and opacity. The equivalence between these dimensions and the challenges of analytics, data volume, data variety and data velocity are clear.

On top of that, the implementation of the so-called Industry 4.0 (Integrated Industry) foments a total data availability and connectivity, both horizontal (across the supply chain and product life cycle) and vertical (from the shop floor to the strategic level).

Enterprises should, therefore, find themselves in an ideal context to use analytics to profit from the data available. Nevertheless, in practice it is not so simple for the users, especially SMEs, to implement analytical solutions.

"Essentially, all models are wrong, but some are useful". This famous phrase by George E. P. Box expresses not only that models are incomplete per definition, but also makes clear that there is an intrinsic difficulty in finding the right solution to the problem at hand.
According to studies, the big variety of enterprises that are intending to make decisions based on Data Analytics, they don’t possess an adequate strategy. Amongst the main causes for this problem we find that a) Implementation costs and efforts b) The benefit is not apparent c) Analytics can only be operated by experts d) Poor price/performance ratio are the more frequent.

Indeed, a lot has been said and done about Data Analytics. Terms like Big Data, Small Data, Data Mining, Neuronal Networks, Machine Learning, etc.; find their way in the media and specialized literature. The abundance of concepts, together with the fact that more than one approach is valid for a particular problem, create a situation in which the benefit of analytics is not visible, as the selection turns extremely difficult. Moreover, new analytical models are created every day, mostly as part of research initiatives, as a further development of analytical technologies and not as the solution of specific problems.

Specialized knowledge is required since enterprises need to find their way through this overwhelming offer of solutions. This causes not only an increase in costs, but also time required until the solution is implemented. On top of this, finding the adequate approach in this kind of projects is an iterative process, in which variables are analyzed and selected. Depending on their characteristics and influence on the objective function, models are created, tested and the most convincing are selected. Such approach is difficult for enterprises, who conceive the extended project times and iterations as a deterioration of the price/performance ratio. The effect is particularly noticeable by SMEs who, because of their characteristics, do not possess the financial means to perform long and costly projects.
CHAPTER 2

Business Value Creation in Business Intelligence and Analytics:
Models Approach

2.1 Introduction

In this chapter we will deal with the business value of business intelligence. Business value is the most important asset of diplomacy, since value creation for a business is the most vital and necessary part of the viability of the business. As Maizeish & Hander (2005) reported, BV of IT (or BI & A) has been a focus of research in information systems because IT represents a significant percentage of budget spending for companies and is a valuable strategic asset.

The business value issue at BI & A has been addressed mainly by IT scientists and the information and strategic industry. Reports on Finance journals or economics and econometrics do not exist on an extensive scale that analyze how you create business value in BI & A or how it can be measured. That is why in this chapter we will analyze the thoughts and how to create value based on some models invented by IT scientists and information management. Davenport and Harris (2007) reported a statistical association between the use of analytics and business performance. However, there is no clear mechanism by which analytics contributes to business performance.

In the second year, you are trying to put a more economical approach in order to find a way to measure business value in BI & A by providing a measurement mechanism with the help of some valuation models.

2.2 What is Business Value?

According to the studies done so far, there is no specific concept or definition that explains exactly what business value is and how it is created. In most studies, business value is associated with BA capabilities and how they lead to an increase in business performance and thus an increase in business value. In other studies, business value appears as a result of a more efficient organization and an increase in the speed of processes that the business is required to carry out as part of providing better services. Another aspect that is adopted is that business value is generated as the result of the
comparative advantage the business acquires over other companies that do not use BI & A. In addition, business value is created when businesses, using BI & A, are best able to be effective in order fulfillment, delivery as promised, delivery flexibility, flexibility to change product mix and flexibility to change output volume etc.

According to the approach of R. Vidgen, S. Shaw, D.B. Grant (2017), when referring to value creation, we refer to three main categories: a) Financial value (e.g. Increased revenue), b) Intangible value (e.g. Increased costumers satisfaction) and c) societal value (e.g. tsunami warnings). Most articles refer to the intangible value of BI & A and less to nothing in financial value.

In this section we are now trying to focus more on financial value, but we can not avoid going through intangible value as most articles refer to the second, and they imply that we are doing some way in creating the first one.

As a business value creation we will therefore consider either the intangible or the financial value, but from a purely economic point of view only the financial value is measurable and therefore comparable leading to a clear result. Another also economic approach is to identify business value creation by increasing the net asset value of the business, assuming that it is not affected by other factors such as a share capital increase (ceteris paribus).

To summarize, according to what has been said so far, there is a sequence to be adopted by any business that wants to be involved in creating a BI & A segment and investing in this technology. This sequence is summarized in the transition from BA technology to BA capabilities and from there to business value which needs to be transformed into a measurable financial value.

### 2.3 How to create value with BI&A?

There are not many business value studies. Of those that exist, the vast majority are involved in BA capabilities. As Tan et al. (2016) said, the interrelationships between the capabilities and the discovery of a pathway to analytical capability have yet to be made.

BI Analytics has been the focus of many business studies on BI Analytics. Cao, Duan & Li (2015) found that Business Analytics metrics range from decision-making efficiency while Bronzo et al. (2013) believe that Business Analytics performance comes from a complex metric, including the financial perspective, the prospects of
the market/process perspective, and the leaving and growth perspective. German et al. (2013) made an effort to incorporate the concepts of total sales growth, profit and return on investment (ROI). But the biggest problem is that: "Analytics is not fully understood; there are many incapable, imprecise and incomplete understandings" (Watson 2011) which makes finding Business Value of BI & A even more complex.

In the following subsections of the chapter we will present some models that result in the creation of Business Value with BI & A technologies.

2.4 Agile methodologies model

The most basic model for explaining business value creation by BI & A is the model shown in Figure 1. This model is derived from the article by Nerur, Mahaparta and Monglavaj (2005), which attempted to separate the traditional plan-driven methodologies from agile development methodologies. Indeed, they have proposed in their article a four (4) point process so that a business or organization deciding to use agile methodology can work.

Agile methodologies include BI & A technology as many BI & A articles use as a basis this model, one of which is of Vidgen R. et al (2017). Based on the model, any business that wants to use agile methodologies should adhere to some conditions that are summarized in quadruple management and organizational issues, people-related issues, process-related issues and technology issues.

In the segment of management and organizational issues, the structure or otherwise the "culture" of the enterprise, which is reflected in organizational routine and behavior, plays a key role. Equally key to adopting an agile methodology is a good structure between command and control management and leadership-and-collaboration. To make it easier, the proportions of autonomy and cooperation must be such as to leave the firm the flexibility and the responsiveness at the same time.

To achieve the above synergy, project manager should renounce authoritarianism and authority and work more as an organizer and coordinator, allowing all creative ideas of the whole to be heard and applied accordingly.
Continuing with management and organizational issues, knowledge management is vital to a business. An agile methodology does not allow for the complete recording of knowledge gained over time as some knowledge remains hidden and stored in the minds of the workers. In this way, workers gain power and become an elite group that, many businesses, do not accept it to exist in their potential. Finally, agile methodologies are based more on teamwork, so reward systems should be designed accordingly.

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The second part of the model is the people-related issues. In this strand, a basic prerequisite is good communication and cooperation between a group of workers who respect each other’s value and mutual trust. In addition, this team of employee-developers should be made up of people with special skills as well as be average people over the average. This team can create ethical issues as an elite group will be self-perceived, something that many managers do not want to have such teams in the business. Finally, the team-developers of this group should be in constant contact with customers by creating a relationship essential to the agile methodology system as customers are the main regulators of the team’s success and their participation is a prerequisite. Group relationships with customers can be characterized as being committed to commitment, knowledge, proximity, trust and respect.
The third part of the model concerns process (process-related issues). This strand highlights the need to make a change from a process-centric to a people-centric approach. This approach is appropriate for agile methodologies as the conditions for the exploitation of the individual skills and competences of each employee are created while leaving a rigid and uncompromising process that requires specific activities at a time. This is necessary to achieve investment in time, effort and capital. In addition, agile methodologies are based on speculation or strategy design, based on the fact that everything is uncertain. The above two hypotheses aim to create a rapid development and a business system that will provide high value based on flexibility and adaptability. This is to be achieved through major changes in work processes, tools and techniques, communication channels, problem-solving strategies and specified roles of people.

Additionally, agile methodologies give a lot of testing, prompting developers to test the code in advance. The logic behind the testing process is that before the final code is written, tests are done to make the resulting code more understandable and sustainable. The process we have described has been termed test-driven development (TDD). An advantage of using TDD is the ease it provides for subsequent integrations of new code or any changes without affecting the original base of the code.

The final part on the process in agile methodologies but very important is the choice of agile approach. The absence of a unified approach should be taken seriously by businesses because they have to choose the agile approach that is most effectively compatible with the company’s existing practices and may need some changes in the company’s practices in order to fully assimilate the agile methodology system.

### 2.5 Appropriate use-based models

In this section we will analyze two models that relate to how value can be generated by IT systems. The aim of these two models is to highlight a Business Value creation mechanism, which is used as the basis for many later articles dealing with value creation by BI & A.
2.5.1 "Appropriate Use" model

The Lucas model (1994) analyzes how value can be used using IT. The model proposes two conditions. The first, necessary but not sufficient, is the fact that IT must be designed in such a way that it fits in with the task of the company in an efficient way. The second condition is the need for an appropriate IT system use. No matter how good the new technology is if it cannot be used by employees, it cannot in itself produce Business Value.

![Diagram](image)

Figure 2. "Appropriate Use" model

Despite the fact that the two above-mentioned conditions can create value for the company, Lucas considers that it is not always enough. For this reason, it adds to the equation of the model the parameter other variables, which may be, for example, the reaction of competitors to new technology or economic downturns out of control of the business such as an economic crisis or a general contraction of the industry. To sum up, in the Lucas model, value is "always" created for the enterprise if there is a properly formed technology combined with its proper use since all other factors remain steady.

2.5.2 "IT Impacts" model

In the Sambamurty and Zmud model, two elements play a key role. The first is raw materials, which consist mainly of data, information technologies, knowledge of how to apply the technology and knowledge of business activities as well as business threats and opportunities. As in the Lucas model, raw materials alone cannot
produce a result without a proper use which in the Sambamurthy and Zmud model is called IT management roles and process. The difference in this model lies mainly in the result which is IT impacts. IT impacts are seen as new or improved products and services, transformed business processes, etc. The larger and better the IT impacts, the greater the business value (profitability, shareholder value etc.) will be. In conclusion, the Sambanurthy and Zmud model implies a relationship between IT management competences and IT impacts: the better the competencies, the better the IT impacts, with a physically similar effect on the Business Value of the business.

Figure 3. "IT Impacts" model

2.6 Business Analytics Success Model (BASM)

In this subsection we will analyze the Business-Analytics Success Model (BASM) that was linked by P.Seddon, D. Constadinidis and H. Dod (2012). This model is divided into two parts: the process model (Panel A) and the variance model (Panel B).

The process model presents a process-oriented explanation of how a business or organization can create value using BI & A. Assuming that huge amounts of information are needed, which the business can collect, the process model consists of three main paths. The first path begins with the use of the organization’s current analytical capabilities by people in different parts of the business, producing insights that in
turn lead to decision-making and from there create competitive operations that give some outcomes called organizational benefits.

In the second path, following the logic of the first one, we report that sometimes the use of an organization’s current analytical capability can lead to the production of insights that lead to decisions that in turn generate competitive actions that change some organizational capabilities. These new organizational capabilities help to better organize the business and increase efficiency, which often leads to increased business value.

The third path essentially recognizes that the extensive use of analytic capabilities can sometimes lead to more efficient analytic capabilities. This may for example be the result of improved data quality as a result of data-cleansing efforts or over time and with experience to create more capable analytical people ect.

The second part of the BASM model is the variance model. The variance model is complementary to the process model despite the fact that it presents a different explanation of how businesses produce value from BI & A. The variance model is essentially divided into two parts in time: short and long term. In the short horizon, there are four "assumptions". The first assumption is the greater functional fit of BA tools, the second is the availability of high-quality data, the analytical people third and the fourth the success in overcoming organizational criteria. If these four hypotheses make the most of their potential, then the better the organizational success in generating benefits from a project that respects the above hypotheses. In the long run, the analytical leadership assumptions, the adoption of an enterprise-wide analytical orientation, the selection of well-chosen targets, etc. (see figure 5) lead to BI & A benefits. In the article of the model each case is explained in detail.
Panel A: Process Model (executed over and over again in different parts of the organization)

Use Analytic Capabilities → Insight(s) → Decision(s) → Competitive Actions that use the organization's existing capabilities
Path 1

Use Analytic Capabilities → Competitive Actions that change the organization's capabilities
Path 2

Path 3: results in changes in, e.g., learning

Analytical Capabilities

Enabling Technology
• High-quality data
• Integrated Business Intelligence Platform

Analytical People
• Analytical executives
• Analytical professionals
• Analytical employees

Organizational Capabilities

enable


Figure 4. BASM model (Panel A)

Panel B: Variance model

Long-term organizational benefits model

Organizational Benefits from Analytics Use, from the perspective of Senior Management

On-going Business-Analytics Improvement Projects

Analytic Leadership

Enterprise-wide Analytics Orientation

Well-chosen targets

Extent to which evidenced-based decision making is embedded in the “DNA” of the organization

Pursuit of the next well-chosen targets guides decisions about which BA-improvement projects are to be undertaken in future.

On-going Business-Analytics Improvement Projects

Source: Seddon et al (2012)

Figure 5. BASM model (Panel B)


2.7 Business value creation in economic terms

An investment in BI & A can create business value according to the models of the previous subsection, but we must find a way to measure it. Supposing that the adoption of BI&A as an asset, then we must find how to measure the business value derived from the investment in that asset.

According to Williams S. and Williams N. (2003), the business value of an investment is measured as the net present value of the after-tax cash flows associated with the investment. Expanding the above widely accepted conclusion, in BI & A we cannot speculate that business value is just created somehow but should be measurable and potentially be included in one of the asset categories that increases revenue or reduces costs or both at the same time. For example, if an investment in BI & A costs 2 million, this investment should at least contribute either to saving 2 million, or to bring an additional 2 million to the business or a combination of them (e.g. 500.00 reduction and at least 1.5 million) so that it is worth investing.

Extending the above considerations, an improvement in managerial processes (planning, controlling, measurement, monitoring etc.) or operational process (fraud detection, sales campaign execution, customer order processing etc.) or improvement in company forecasting is not enough if this improvement cannot be processed in such a way as to create measurable business value (or financial value). To summarize, processing and creating measurable business value is one of the major problems that businesses investing in BI & A must face in order to make the investment profitable and worth.
CHAPTER 3

Business Value Creation in Business Intelligence and Analytics:
Case Studies Approach

3.1 Introduction

In this chapter we will analyze three case studies. Each has its own peculiarities, but all three attempts to demonstrate how business value is generated by BI & A. The first case study is Otto's retail business, which comes from The Economist magazine. It is the ideal case study that explains in detail how business value has been created and what parts of business have improved with the entry of BI & A technology. The most important point in the case study is the fact that it results in a distinct and measurable financial value following a series of logical explanations using BI & A technology. Unfortunately, case studies of this type are scarce.

The other two case studies analyze two companies that adopted BI & A technology and what are the beneficial results they created for the business. In the case of CompuCorp the results are more distinct and the explanation how we reached them quite clear. The only issue that is presented is that the stage of converting business value to financial value is not discernible. The third case study is that of Guess's industry. In this case study there is an unclear analysis of how we are finally structuring BI & A in order to reach business value and the various benefits as well as the conversion from business value to financial value is unclear. Such approaches are applied to a large number of articles.

This chapter highlights the issues the bibliography has to deal with, existing and future, through a comparison of the ideal case study and two incompletes.

3.2 Case Study Otto's Company

In this section we will deal with German Otto, an e-commerce merchant that uses AI to improve its activities. The main idea that led the company to engage in BI & A as well as "machine leaning" is its effort to lower returns of products, which are firm millions of euros a year. For this reason, it began collecting and analyzing data in order
to understand consumer preferences, to propose products to consumers and to create a personalized platform.

To achieve its goal, the company created a system using Blue Yonder technology, a startup company. Blue Yonder provided Otto with a deep-learning algorithm with which the latter can analyze around 3 billion past transactions and 200 variables to predict consumer preferences one week before they buy them.

With the above algorithm, Otto Company can solve two important issues before it was implemented. The first concerns the two-day shipment of the goods, since analyzes made by Otto found that the delay of more than two days of the product led many consumers to buy the product from another company with a significant impact on the increase in Otto's expenses returns of products. Secondly, consumers do not want to receive many packages at different times. On the second issue in particular, the situation Otto had to deal with was particularly difficult as being an e-commerce merchant who was selling other companies' products could not send all the products in one shipment. If he tried to send them all on a mission, there was a risk that consumers would buy all the sawmills from another company as a mission would be in conflict with the first two days delay issue.

The algorithm applied by Otto solved both issues at the same time as it predicts exactly 90% of what products consumers will buy one month before they are ordered by the company's website.

This new BI & A technology has a net economic impact on Otto as it reduces returns by two million products a year, resulting in a cost reduction from the return of products. Also, a second economic impact is that Otto's sales raised, as we have said by two million, which leads to an increase in sales and thus an increase in company revenues. Eventually, Business Value was created as this value turned it into a measurable financial value with a clear impact on the company's net worth.

### 3.3 Case Study CompuCorp

CompuCorp (code name) is a US-based technology company with a shared service center in India. The branch office in India has fully trained teams dealing with business analytics and collaborates with all other units in the company.
The company started to use business analytics widely in 2008. When BI & A was established, there was no specific strategy for how it should be applied and on what scale. When the procedures started, the company collaborated with peers' companies that had set up some structures that worked well.

In the early years, the BI & A business's contribution to business operation was not evident. Most employees at the beginning regarded it as a department that developed some models and operated as a consultant in the company or simply as a strategic partner. Over the years, BI & A has been fully integrated into the operating segment of the company and is a strategic business decision maker based on a science-based analytics division.

The original purpose of creating the department was to implant a data-driven work culture. Today CompuCorp uses BI & A in all business processes and across all of its fields. From pricing, sales and marketing to supply chain and online services.

In the BI & A equation, CompuCorp also places customers as they seek a closer bonding with them. It also helps peers’ companies develop a BI & A system, which has proven to be very effective and beneficial for increasing the company’s business value.

Two examples where CompuCorp used BI & A to make critical decision-making are a) in the marketing and sales sector where it developed a system based on statistical models combined with consumer data, which, based on output, produces lists of consumers to be targeted by the next marketing campaigns and b) in the contact center process, where each sector of the business before making a decision to change the plan, informs the BI & A department and expects to receive feedback. Once some analyzes and predictions have been made by the BI & A department, the other department can go ahead by taking feedback and making better decisions. In this way value is created in the enterprise in the form of business process expertise, cross-functional knowledge and multi-industry knowledge.

The main issue that does not analyze this case study is how business value creation can result in a measurable financial value. Another issue is that it does not explain what exactly are the BI&A technology or the BA capabilities that the company used to reach the business value.
3.4 Case Study Guess’s industry GMobile app

3.4.1 Developing GMobile app

Guess is an industry that designs, markets and distributes collections of modern clothing and accessories for men, women and children. It operates in 87 countries with a turnover of around two and a half billion, being a globally competitive fashion retail industry. Guess operates with many different business models based on its geographic region of activity. A main feature in the global business planning is the fitting of the right garment in the right store at the right time for the pleasure of its fashion-savvy customers. To succeed, Guess must be very good at creating fashion and very effective in distribution. For this reason, designers of the company must be very agile at discovering fashion trends and creating appealing styles. There is also a very capable group of buyers, planners and distributors who ensure maximum efficiency in the distribution of goods.

The idea for adopting BI & A technology, that we will analyze, first appeared during a BA vendor’s speech. Guess CIO and BI&A director thought they could raise their industry to a higher level. This has resulted in the idea of creating a BA technology that would be distributed through the iPad. The application serving the BA technology was called GMobile.

To build the GMobile app, BA Director has asked its team to download the most highly rated iPad apps and find out what makes them so popular. The team eventually came to understand what the right workflow was for maintaining the app and how the data could be distributed (how much and when) to make it work effectively. Two other team conclusions are that successful apps use many charts and images at the same time with a delightful design and also the contact details must be clearly visible.

In conjunction with a proper build of the GMobile app, two roles are very important for the smooth operation of the app. The first role is that of the graphic designer who in conjunction with the IT group helps keep images in being attractive and consumable. In addition, the designer is responsible for keeping the app easy to use and making sure that the user can easily return to the previous or home screen. The second role is that of the app developer. Beyond the obligation to ensure that GMobile leverage the nuances of the iPad within the interface design, he has another important job. This job is to ensure that the app will not replicate previous dashboards that are
designed for the web. Before the app was installed, twelve dashboards were used to transfer the data. The iPad supports a more interactive and versatile way to transfer data that helps users configure the GMobile app based on their own work style.

### 3.4.2 Generating Business Value with GMobile app

The GMobile app has led the Guess industry to three types of business value: a) Transactional value; b) Information value; and c) Strategic value. As far as transactional value is concerned, Guess has acquired some productivity improvements that have led to lower-line cost reductions. First of all, reductions were made in paper use as all written reports were replaced, thus reducing paper costs. In addition, the need for analysts declined as users wasted much less time finding the answers they needed through the GMobile app, and in the same time there is a reduction in the wage costs that had to be paid to the analysts (from twelve analysts originally the company now has seven). Last but not least, a third benefit concerns the reduction of expenses for meetings of forty representatives. Representatives used to gather weekly to discuss best-sellers items, and now they communicate through GMobile app and are informed about best-seller information in an effective way (the meetings were reduced on a bimonthly basis).

As far as the information value is concerned, the benefits are obvious but not measurable. The Gmobile app and iPad in general have led users to compare products with other companies as well as the information they have on the products is much better than previously. In this way, users-consumers can make more accurate and fact-based decisions about the products they will eventually buy.

In strategic value, the benefits for Guess vary. An important benefit derives from a deeper understanding of the business by users. This understanding leads to increased business performance, better purchasing and distribution decisions of higher profitability items. Another benefit to the business is the ability of GMobile analysts to discover a particular target group based on user-consumer profiles. Finally, consumers are becoming more aware of the introduction of GMobile app and believe that Guess is a leading company that uses advanced technology, which is driving the company into further improvements in all areas.
CONCLUSIONS

The contribution of the thesis is the extensive bibliographic study on a wide variety of articles with the main objective of finding a relationship between BI & A and business value and the mechanism that governs them. The analysis carried out throughout the thesis has led us to two main conclusions that have a common ending.

The first conclusion is that the literature focuses very much on building a successful structure that can support BI & A. Most articles are based on BA capabilities and BA technologies that lead to an increased business performance. The piece of business value comes to second place instead of being the main purpose of authoring the article. Additionally, most of the time, through a sequence of thoughts and conclusions, we lead to the creation of a not clearly defined business value. This business value is the result of BI & A (technology) operation, but without explaining the transition from BI & A to business value.

The second conclusion is BI & A itself. BI & A has a multidimensional and multilevel influence on the business, creating problems in determining its contribution to the business and therefore cannot be measured in a clear way. What is more, it is not easy to determine the time when the investment begins to bear fruit. Therefore, the issue of how to measure the added value that is generated and the more expensive the impact of an investment on BI & A will be made and becomes apparent.

The common conclusion is that there is no economically measurable size for business value. Whether on the one hand we have an arbitrary business value or on the other hand there is the difficulty of clearly understanding the BI & A’s influence on the business, the result is the same, that is, we arrive at a non-measurable value rather than an exact financial value. Creating an unmeasurable business value that we are constantly seeing in the bibliography does not allow businesses to adopt a BI & A technology since they are unable to make a prediction of the economic benefits of such a move.

To sum up, the general conclusion is that the literature on the subject we analyzed is incomplete. There is a very extensive literature on the processes of adopting and operating BI & A technologies in conjunction with the BA capabilities required. Also, there is a satisfactory analysis of how BI & A leads to the creation of business value. However, in the bit of conversion of business value into a
measurable financial value the current bibliography is incomplete to nonexistent.

My proposals for further research can be summed up in a main one and one secondary but not less important. The main proposal is about constructing a bibliography that focuses on creating a measurable financial value from BI & A rather than just an arbitrary business value. The secondary one considers that the BI & A technology and BI & A capabilities analysis should be more illustrative and specific, aiming at creating a specific business value at a time (for example, reducing shipment costs or increasing revenue from sales). In this way, any business that wants to adopt a BI & A technology knows which sector it will benefit from and what will be the possible net economic benefit from its investment.


