Business Intelligence (BI) - artificial intelligence in business systems

Adam Kasperowicz - 279046

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# Preface

**Business Intelligence** has held its position as not only a trend but a standard business solution for a long time now. Simultaneously, the experimentality and riskiness of this technology have faded away giving place to major institutional investments and global standard of doing analytics. Nowadays every firm keeping up with the modern analytics race has its own CIO and a major share of its capital set aside for BI system development.

Unfortunately, the sudden advancements and hype surrounding the technology have resulted in a dilution of the term and transformation into a buzzword used for every minor type of IT related system a business employs. More often than not we can see a situation where a question “What is Business Intelligence?” is answered with a plethora of explanations not rarely contradicting each other. I would like to act as counterforce to this unsettling phenomenon. The aim of this paper is to organize and clarify the term “Business Intelligence” to the reader. Simultaneously, allowing him to identify the problems the technology can solve and use the methods which are employed to solve the aforementioned problems.

**The paper** is structured as follows:

In the introductory chapter the term “Business Intelligence” is defined. At the same time the general philosophy standing behind it is explained. Ending with a quick overview of the impact the technology has already done in the industry generally speaking.

The Chapter “Basics” presents the internals of BI system. We start off with structurizing the construction of a typical BI system. After that, the process of implementing such structure is described. The chapter is summarized with business cases presenting both successful as well as unsuccessful stories of firms trying to take advantage of the new way of doing analytics.

The third chapter is centered around different methods a functioning intelligent system offers to the business using it. Group of problems is presented, every one of which coupled with a functionality of a BI system. Method of exploiting the functionality to successfully solve the problem is intuitively explained backing the case with a real-life example.

In the end a quick glossary of current trends and possible future developments is stated. Additionally, a light economical analysis on the potential of future investments is made.

# Introduction

## Definition of Business Intelligence.

**We live in an information age.** What does it mean? It means that just as the knights of the medieval age measured their wealth with land in their possession or the entrepreneurs of the industrial age with capital the modern value comes from meaningful information.

Every type of modern organization is drowning in information. The modern era has brought upon us the need to use electronic devices for every type of operation we do within a business. This in turn spawned a waterfall of transactions records, customer’s profiles, clients’ feedbacks and many more bytes of endless data stream.

As the time has passed some more innovative firms have spotted the potential this data stream holds. It has been pointed out that usage of data could allow, for example, employment of statistical methods to predict, within some range of error, the future behavior of a customer. After decades of hardships and efforts of trying to implement the great idea we are currently able to witness the rise of a being which is currently the main driving force of current information revolution. That is, Business Intelligence.

**The term** has been defined already many times.

Laura B. Madsen’s definition goes as follows: *“BI is the integration of data from disparate source systems to optimize business usage and understanding through a user-friendly interface.”*

Howson described it in following matter: *“Business intelligence allows people at all levels of an organization to access, interact with, and analyze data to manage the business, improve performance, discover opportunities, and operate efficiently.”*

The last good example is given by Moss and Atre: *“It is an architecture and a collection of integrated operational as well as decision-support applications and databases that provide the business community easy access to business data.”*

There is only property I would like to underline given the definitions above.

**BI does not equal IT**. BI is a set of high-level processes which only partly employ computer technologies. The most vital part of BI is not the biggest amount of the best data or the most efficient and the smartest algorithms on the quickest machine but the human understanding of business environment in which the BI is employed. You cannot predict the behavior of a customer if you do not know who your customer is.

## Impact on the business.

*“****A key sign*** *of successful business intelligence is the degree to which it impacts business performance, linking insight to action.”* This quote by Howson lays ground for a method allowing us to measure the impact of implementing BI in a company. The goal of an owner investing in such a technique should be that simple formula. That means, he should measure the effectiveness of his new system by comparing the state of processes after the implementation with their state before the implementation.

Transforming Data With Intelligence (TDWI) Best Practices report gives us insight into the current state of industry and how it has been affected by the BI. The statistics are as follows:

The pie chart above is a summary of answers from 189 respondents, every one of which being a running company. The question given to respondents went as follows: *“Over the past 12 months, are your organization’s newest BI and analytics projects delivering their intended business value at a faster pace, at about the same pace as the previous 12 months, or at a slower pace?”*

Clear division is seen. The effect of BI has been positive in 50% of the cases but also nonexistent in the other 50%. The numbers might be discouraging but we have to take into account other factors. Incorporating BI into your business is not an easy task. The technologies are very fresh, almost experimental, and the number of professionals in the field is far from being sufficient. We have to realize that of 50% of companies not receiving benefits from the investment a big chunk has simply not completed the implementation phase and could not receive any of those profits. Reevaluating the given statistics, we should realize that the industry gives us proofs for the following statement. BI increases the pace at which projects deliver value but at the same time implementing such an improvement is a challenging feat.

## Overview of applications.

**BI has proven its worth** already in numerous branches of the world economy. Most of us do not realize how widespread the technique actually is. The list below is supposed to acknowledge the reader of different usages of the technology backed by examples and key factors allowing for improvement of the process.

* **Management and Control** – Most people do not know that a typical manager does not know what happens in his company, from financial side, until the publishing of quarterly reports. In this situation one has no possibility of reacting to misuse of company’s capital because by the time it is known the source of problem has already evaporated having exhausted resources of specific area of the company. BI is remedy for that problem. Granting the managers, a constant, clear and intuitive insight in the company’s stream of money and resources.
* **Improving Performance** – Pareto rule states that 20% of your customers generate 80% of your revenues. Every entrepreneur would like to take advantage of that by identifying which customer exactly is that and offering him even more products or by analyzing the inactive 80% and trying to activate their consumption efforts. Even tough the idea may sound easy it is almost impossible in the modern world of global multi-channel sales. Once again BI comes to the rescue organizing the data and taming the chaos.
* **Operations** – Every person has his favorite bakery. Every person also complains more or less often about the shortage of his preferred product in this special bakery. It is more reasonable for baker to bake too little and sell everything than to bake too much and throw away the wasted capital. Most of bakers also do not posses Ph. D. in statistics and are not able to predict very well the future demand. The solution? BI! Integrated systems can let everyone use the state-of-the-art algorithms with one click of a mouse. No more shortages of sweets!
* **Process Improvement** – The new technical report has shown that the assembly time of a specific machine takes twice as long as it’s supposed to. Outrage among the board calls for an urgent action. Team of engineers is ordered to leave their current duties, slowing the other respective processes, and to find the source of problem. They spend a month going trough every part. Finally, the problem is found. Couple of loose bolts. The engineers come back to their long-forgotten divisions. What is the modern approach? BI using the IoT to monitor the state of every device in the factory and signaling every smallest malfunction, which can be repaired within minutes by a simple line worker.
* **Customer Service –** Unfortunate series of events leads to a streak of warranties from one specific customer due to malfunction of every product he bought. Typical company would lose that man in stream of thousands other customers leaving him unsatisfied and more than ready to explore the offer of our competitors. Company employing BI would easily find that one customer and offer him special deals letting him his deserves the special care.
* **Public Institutions –** We live in times where it is more and more often possible to say that a computer has saved someone’s live. Madsen dedicates are whole book to exploration of usage of BI in hospitals. We can see fire departments, police stations, public transport services and many more all around the world using BI to deliver their services better without outlook for profit.
* **Sports, Politics and Everyday Life –** It is only possible to guess whether Donald Trump has won the elections thanks to the magic of predictive analysis. But, it is a clear fact that data is used by politicians, sport managers or scientists to make their work more efficient and achieve what has never been achieved. Even though the subjects enumerated here possess little to no similarities with companies mentioned earlier, they also take advantage of BI. What follows is a simple conclusion. BI can be actually used by everyone of us and does not have to be a millions-worth contract deal. For example, even mobile apps tracking your jogging statistics from which you are able to improve your training sessions could be called BI.

# Basics

# Components of BI.

**As stated earlier** BI is not simply IT. There are far more business-related intricacies involved than the everlasting hype suggests. In this chapter I would like to present all of the members of a set we call BI. I will support myself with a diagram used also by Sherman. The structure of BI could be depicted as follows.

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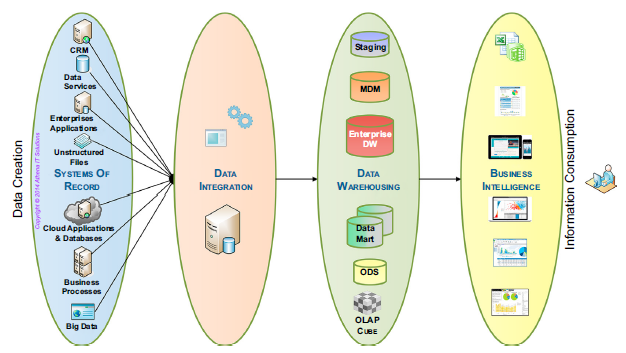
This paper encompasses only the definitions and explanations of the terms seen above. Reader willing to deepen his knowledge is redirected to Sherman’s book.

**Information architecture –** The layer could be compared to requirements definition used in software development or a business plan. The aim of this architecture is to answer the following questions:

* **What** business processes or functions are going to be supported, **what** types of analytics will be needed, and **what** types of decisions are affected.
* **Who** (employees, customers, prospects, suppliers, or other stakeholders) will have access.
* **Where** the data is now, **where** it will be integrated, and **where** it will be consumed in analytical applications.
* **Why** the BI solution(s) will be built—what the business and technical requirements are.

The point of this theoretical discourse is simply to realize what do we want and how are we going to achieve it. Exactly as the requirements definition and business plan it is the single most important step in the implementation of BI. Unfortunately, it is also the single most ignored one. For if the company sets out to employ this type of investment not preparing beforehand it’s future destiny is purely luck dependent.

**Data architecture –** Having prepared our information architecture we ready to start delving into the real implementation. The first step being definition of the type of our data and how it will be transported from the source to the end user. The general schema one should follow has been already defined in the industry. I will once again support myself with Sherman’s diagram.

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Even tough very explicit the diagram requires explanations of every stage.

* **Data Creation -** Every type of data has its source somewhere. In the past those were, for example, banking systems saving every type of transactions which they have done. Nowadays, thanks to the development of IoT, it is reasonable to state that every type of electronic device is a source of data.
* **Data Integration –** Logs of banking transactions from two different systems, even tough possibly pointing to the same entity, might be represented in totally dissimilar formats, sometimes even holding different information. That type of data is called raw data. To be of any use the vital parts must extracted. That is the job of a data integration layer. Different types of software, for example ETLs (Extract – Transform – Load), are used to format data into the form defined by Information architecture.
* **Data Warehousing –** Having prepared our fresh data we must secure it somewhere where it will be ready to be easily accessible by analysis tools. As easy as it may sound the task grows harder and harder as we try to store more and more diverse data in ever growing amount. The old proven solutions such as relational databases have given place in some areas to new experimental methods which cater to more specific needs. Example could be NoSQL which has been specifically designed to hold vast amounts of data.
* **Business Intelligence** – Finally, it is time to reap the fruits of our hardships. With well structured and readily available data we ready to employ the algorithms which in turn will empower our process to bring appropriate profits.

It is very important to underline the fact that the Data architecture can not be well implemented if it does not comply with the Information architecture.

**Technical architecture –** Thethird step in an implementation process is planning out the software we will use. There is not much to be said as this part will be mostly lead by the engineers’ teams and will depend on the specification done in the earlier architectures.

The one important matter to note are the two main strategies of implementing such architecture.

1. **Usage of all-in-one systems –** Those systems are for example Enterprise Resource Planners(ERP) which cover all of the layers in the Data architecture and thus require from the investing company only to adapt the system and then train the personnel to use it. They are developed by external companies and are sold for big sums of money. Such solution suits well businesses with very common needs. The reason being, the economics of scale which allows them to buy the system for a price far lower than the cost of own development.
2. **Usage of self-made systems** - If the company is either small and its BI requires only humble amount of small software or its need are very specific and not covered by the market products it could be possible that implementing every layer of architecture by itself would be much less costly.

**Product architecture –** With all of the specifications ready it is time to choose the actual software, hardware, configurations and the strategy for maintaining the whole structure. It is of utmost importance that this part should be completed as the last one. Otherwise, we could end up spending money on products with features we do not need or products not fulfilling our needs.

## Business examples of Success and Failure.

**Success** stemming from usage of BI can take many forms. I would like to present a Case Study of Bank of India. The institution took upon itself a challenge of implementing a Corporate Performance Management System. The system would allow to gain full insight into their portfolios across the most important product lines. The challenge was exposed to strict requirement. The system was to be completed in 24 weeks. Almost unimaginably small span of time when compared to industry standard of 2 years.

As to comply with the requirements it was decided that a pre-built system ought to be implemented. External company “Ramco”, which specializes in this area, was employed to install their solutions. Ramco provided Bank of India with proprietary software such as Ramco Banking Analytics software, pre-built Data Warehouse called the Universal Database and many more. Additionally, training of Bank’s personnel was delivered.

Professional approach and well-made software made it possible for Ramco to fulfill the full contract within the time span. Effective and short training session let the new system to be easily implemented and immediately started being used.

The whole investment was a major victory for the Bank of India. Among the numerous advantages achieved the most important were:

* A 360° view of loans, deposits, trade finance, customer portfolio as well as financial profitability of the bank rendered possible through analyses across several attributes.
* Comprehensive customer analysis and profitability analysis of various business lines and business units.
* ‘Single version of truth’ by elimination of ambiguity arising from several versions of management reporting data.
* Effective and transparent performance reviews.

**Failure** even tough bitter in taste has to be taken notice of and learned from. Such opportunity is given to us by Portland State University (PSU). The institution had to finally face the change of times and upgrade its reporting system, which until this time consisted mostly of random spreadsheets. PSU launched a DataMASTER program (Management and Analytics for Strategic, Timely, Education Reporting). The investment was supposed to bring a plentiful of improvements. Those were:

* Enterprise-wide systems that effectively support the university
* Improving and integrating related processes
* Eliminating shadow systems, paper, and duplicate data entry
* Clarifying roles and providing expanded training
* Simplifying and standardizing processes

All of those benefits were supposed to cut costs overall.

PSU took upon itself a challenge of developing the whole system by itself. They did not opt for a pre-made solution as they believed their approach had to succeed. The program was lead by an IT team, which made great efforts towards planning the whole development process. That involved being very transparent about the work they do, having very flexible plan, cooperating heavily with other departments and having a user-centric approach.

Unfortunately, the program did not achieve its goals. After two years of heavy work the DataMASTER was still not sufficient to replace the legacy systems. The parts developed also did not bring any increase of productivity or decrease in costs.

There were many problems, the ones showed here are in my opinion the most thought-provoking ones. More curious reader is redirected to the source article.

1. Project was run entirely by an IT group – Solution of an importance spanning the whole organization can not be isolated to only one department. In this case, the assignment of the whole project to just the developers made it impossible to acquire an adequate involvement of other departments.
2. **Project management must adjust to the customers involved – The case of PSU is an excellent one because it underlines the dislike towards change even with it being certainly positive. The university had to undergo a relatively quick switch from a decentralized world of self-controlled processes to a centralized one with every action monitored and integrated into the greater whole. Such disruptions are especially hard in a uncreative organizations, such as administration of a college.**
3. The leader should be a person rooted in the environment – One of the biggest factor which lead towards the goal not being achieved, in PSU’s case, was appointment of a totally fresh Project Manager. Person with no background in the organization could not have possibly successfully implemented solutions for problems sitting deep in the institution.

**Summarizing,** implementing BI is a feat well-worth its bad fame. With around 70% of BI adoptions being unsuccessful the head of the organization has reasons to doubt whether it is worth the trouble. The answer is clearly YES but it is vital for special risk measures to be taken during planning of such project.

# Intelligent Business with Case Studies

## [Measurement](https://en.wikipedia.org/wiki/Measurement).

## [Analytics](https://en.wikipedia.org/wiki/Analytics).

## [Reporting](https://en.wikipedia.org/wiki/Business_reporting)/[enterprise reporting](https://en.wikipedia.org/wiki/Enterprise_reporting).

## [Collaboration](https://en.wikipedia.org/wiki/Collaboration)/[collaboration platform](https://en.wikipedia.org/wiki/Collaboration_platform).

## [Knowledge management](https://en.wikipedia.org/wiki/Knowledge_management).

# The future is intelligent

## The hidden potential

## The development of technology