

A DEVELOPMENT OF BUSINESS INTELLIGENCE SYSTEMS

ADAM STECYK

University of Szczecin, Faculty of Management and Economics of Services, POLAND
e-mail: adam.stecyk@wzieu.pl

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ABSTRACT The aim of the article is a presentation of the key elements of business intelligence concept and BI systems. The first part of the article contains an overview of the definitions related to Business Intelligence components such as: BI objectives, development and innovation of IT concepts for BI software, maturity models systems and main BI features. The second part of the paper contains a description of understanding the way in which data is stored, in order to build a data model that can be subjected to multidimensional analysis. In the end, the article presents analytics and business intelligence trends for next years, that firms should be aware of to build their competitive advantage.

Introduction

In a dynamically changing reality, the right approach to business analytics, and in particular to Business Intelligence systems, can be a leading source of competitive advantage. Enterprises have the opportunity to use many sources of information to build a specific digital transformation and redefine the needs and expectations of customers. In order to achieve the business and social goal sets, leaders and data analysts must create an

innovative data-driven culture focused on new analytical solutions. For companies that have not yet implemented BI into their operational strategy, the final time is coming to catch up. Otherwise, the gap between enterprises using innovative tools and those that do not use sophisticated analysis methods will dramatically increase and eventually lead to the disappearance of the latter from the market.

The key elements of Business Intelligence

There are many definitions of the concept of Business Intelligence (BI). Usually they refer to software used to collect and analyze the data or knowledge management in the enterprise. The idea of BI was introduced in 1989, and defined as “a set of concepts and methodologies designed to improve business decision-making by using fact-based systems” (Hashmi, 2006, p. 6).

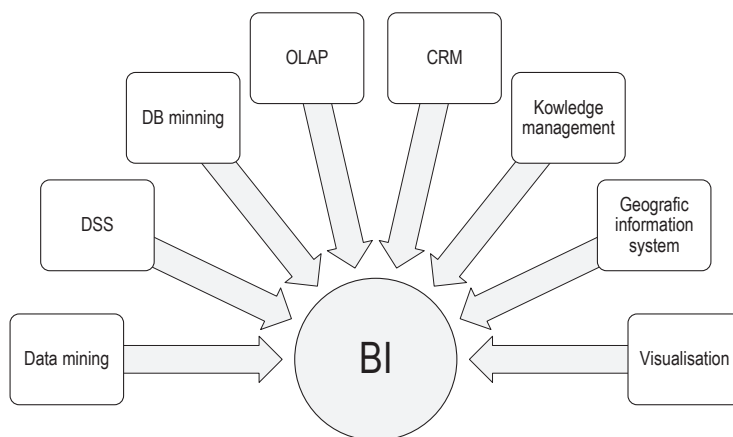


Figure 1. Main components of Business Intelligence systems¹

Source: own elaboration.

Another definition says that Business Intelligence is “the capability of the organization or company to explain, plan, predict, solve problems, think in an abstract way, understand, invent, and learn in order to increase organizational knowledge, provide information to the decision process, enable effective actions, and support establishing and achieving business goals” (Wells, 2008). The next definition indicates the technological aspect of business intelligence: “BI technologies provide historical, current, and predictive views of business operations. Common functions of business intelligence technologies are reporting, online analytical processing, analytics, data mining, business performance management, benchmarking, text mining, and predictive analytics” (Cebotarean, Titu, 2015, p. 23), and “BI tool is the ability to collect data from heterogeneous source, to possess advance analytical methods, and the ability to support multi users demands” (Ranjan, 2009, pp. 13–17). Regardless of the accepted way of defining BI concepts, it can be assumed that it consists of four key factors:

¹ Business Intelligence tools and technologies include query and reporting, OLAP (online analytical processing), data mining and advanced analytics, end-user tools for ad hoc query and analysis, and dashboards for performance monitoring.

- data gathering,
- data storage,
- knowledge management,
- analysis of complex information for decision maker.

The above statement reminds the definition of decision support systems (DSS), which seems to be understood, because the BI systems are data-driven DSSs. It can be accepted, that BI systems are the result of the development and innovation of other IT concepts over the years. Figure 1 shows the main components of the BI systems.

Methodology of business intelligence

“Every organization has a number of informational systems that contributes to its good ongoing daily activities. Though it’s about an informatics system for client management, sales, payments, or human resources, all these are managing the daily process transactions, and are being designed for that purpose” (Nedelcu, 2015, pp. 34–36). From that point of view the main task for Business Intelligence system is to transform chaotic information to valuable data; the input stage (adding data) and output stage (reporting data). The transformation is defined as a set of specific actions, which are performed on information. The input stage is characterized by the following actions: extracting, cleaning, modeling, transferring, loading. While the most commonly performed actions in the output stage are: querying, reporting, analyzing, mining, visualizing. These actions are designed to achieve the desired effects, which should improve business performance. In other words, “the business intelligence value chain represents a “from DATA To PROFIT” approach and is recommended to ground any performance management program” (Muntean, 2012, pp. 56–57. Table 1 shows main techniques which are used in BI systems.

Table 1. Main techniques in business intelligence

Technique	Description
Predictive modeling	Predict value for a specific data item attribute
Characterization and descriptive data mining	Data distribution, dispersion and exception
Association, correlation, causality analysis (Link Analysis)	Identify relationships between attributes
Classification	Determine to which class a data item belongs
Clustering and outlier analysis	Partition a set into classes, whereby items with similar characteristics are grouped together
Temporal and sequential patterns analysis	Trend and deviation, sequential patterns, periodicity
OLAP (OnLine Analytical Processing)	OLAP tools enable users to analyze different dimensions of multidimensional data. For example, it provides time series and trend analysis views.
Model Visualization	Charts, plots, histograms, and other visual means
Making discovered knowledge easily understood using Exploratory Data Analysis (EDA)	Explores a data set without a strong dependence on assumptions or models; goal is to identify patterns in an exploratory manner

Source: Ranjan (2009), pp. 13–17.

In 2018, Wisdom of Crowds® Business Intelligence Market Study² pointed main BI objectives: better decision making, improved operational efficiency/cost savings, growth in revenues, increased competitive advantage, enhanced customer service and compliance/risk management. Figure 2 characterized the level of importance for

² The Wisdom of Crowds BI Market Study is the annual research agenda, providing in-depth portrait of the state of the BI market.

six main objectives. The priority of these rankings is unchanged over time. Less than 10 percent of the respondents consider any of the offered BI objectives “unimportant.”

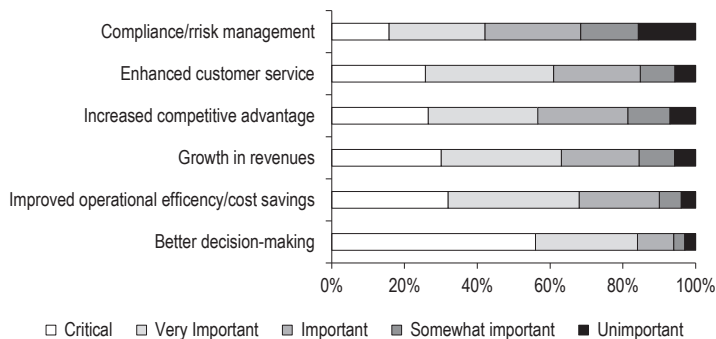


Figure 2. Business Intelligence objectives

Source: Dresner Advisor Services.

Another element of business intelligence systems that need to be comprehended, is related to the maturity model of the enterprise. If a company wants to raise the level of its efficiency and achieve a competitive advantage in the market, the way the business is done needs to be changed. In other words, the maturity model for Business Intelligence helps organizations understand where they are and how they can improve. There are several maturity models that can be used. The most common and most widely recognized models are:

Gartner’s Maturity Model for Business Intelligence, that recognizes five levels of maturity: unaware, tactical, focused, strategic, and pervasive. The assessment includes three key areas: people, processes, and metrics and technology (Hostmann, 2006).

AMR Research’s Business Intelligence/Performance Management Maturity Model, that has four-level framework: Level 1: Reacting – where have we been?; Level 2: Anticipating – where are we now?; Level 3: Collaborating – where are we going?; Level 4: Orchestrating – are we all on the same page? (Hagerty, 2006).

TDWI’s Business Intelligence Maturity Model, which focuses mainly on the technical aspect for maturity assessment. Maturity is being evaluated through eight key areas: Scope, Sponsorship, Funding, Value, Architecture, Data, Development and Delivery. Each of the eight aspects is graded with the following five grade scale: Infant, Child, Teenager, Adult, and Sage (Eckerson, 2007).

The maturity model is valuable since it can be used to estimate which areas of the enterprise need special attention. The model shows spaces, which otherwise could be neglected. Companies, which want to get an evaluation of business intelligence maturity should use one of the recognized models offering evaluation and comparison to other ventures in the market. It can therefore be presumed that the maturity models are designed to select the direction of the development of BI systems in the enterprise, or to get solutions for the following issues:

- Analyzing the current enterprise situation,
- Management of the business performance,
- Business scheduling and financing,
- Controlling and reporting.

In conclusion, Business Intelligence is a professional combination of tools, software and expert knowledge that can be used to create dynamic data visualizations, to provide access to current, complete and consistent information about the enterprise.

Data model as the basis for business analyzes

Typical BI tools work, so that all the information flowing through the company are collected, processed and then made available in the form of interactive charts and graphs, which makes the analysis fast and intuitive. Thanks to the latest solutions, Business Intelligence software no longer requires technical or IT knowledge, but requires expert knowledge in the field of modeling and data management. The most important element of this knowledge seems to be understanding the relational data model, that is, the logical structure of the links between the collected information. A modern business analyst, who wants to build a competitive position of his company, must understand the way in which data is stored, in order to build a data model that can be subjected to multidimensional analysis. In particular, this knowledge should be based on:

- recognition of business data sources in the enterprise and beyond,
- distinguishing between data types,
- data cleaning and transformation activities,
- data normalization and data storage in tables,
- creating relations between tables (data model),
- clear definitions and validation of the measures and dimensions,
- data visualization (dashboards) for quick and easy interpretation.

The above skills indicate a comprehensive approach to modeling and data analysis. Depending on the role of the analyst in the company, knowledge of specific areas must be deepened. In large corporations, the business intelligence process is defined in detail and assigned to specific teams responsible for particular part of the operation: loading data, data cleaning and transformation, building a data model, calculating measures and dimensions, visualization and interpretation. In small and medium-sized enterprises, where the volume of information and the complexity of processes is not so complicated, some of these areas can be combined and assigned to a particular analyst. Regardless of the size of the enterprise, the use of BI systems is always associated with three stages:

1. Preparation of good quality data.
2. Development of good quality analysis.
3. Construction of easy-to-interpret reports.

It can therefore be assumed that the main goal of BI system is company development based on optimization of business analysis, in order to increase sales opportunities, market analysis, customer segmentation, etc. Analysts who combine the benefits of a relational database, multidimensional data models and real-time data will be able to identify growth capacities, evaluate supply and demand, calculate the profitability of the product and determine firm position in the market.

Another important aspect of using BI systems is solving urgent problems. Business Intelligence offer ad hoc reporting that allows analysts to enter, apply and understand data in a very short time. Thanks to the intuitive interface, these solutions enable to locate and extract critical data from particular set and generate reports on the fly. This alone saves time from undemanding looking through information in the various databases.

The most commonly used reporting solutions in BI systems are the dashboards and score cards that show the overall performance of the company. Data can be modified to adapt to key performance indicators (KPI's) and real-time reports. Thanks to the dashboards, analysts can plan business condition in the range of threshold values. If the minimum or maximum tolerance level within the range is reached, automatic notifications are taking place. In the meantime, one can configure scorecards to provide intermittent pictures of company progress against its goals.

More sophisticated BI software can also be equipped with predictive analytics and forecasting functions that calculate the future outcomes. These tools use specific patterns (resulting from explicit cycles and historical data) to generate the necessary forecasts. The possibilities of predicting results of certain events and incidents mean, that the enterprise obtains the necessary level of flexibility, which can be a key factor in gaining a competitive advantage on the market.

Therefore, it can be pointed out that one of the main trends in improving business analytics is the development of the BI systems. This is in line with recent research on this industry. IDC predicted that Business Intelligence will grow to \$187 billion global market in 2019, which is an impressive 50% raise from 2015. Undoubtedly, more enterprises today appreciate the benefits of BI solutions across the company and overall business effectiveness (IDC, 2018).

Conclusions

At the end, one should indicate solutions in which BI systems will be equipped in the near future. The most important of them is artificial intelligence, usually using advanced neural networks, serving the detection of anomalies and repeating patterns in the context of historical data. As the demand for real-time data increases, and innovative solutions bring a lot of new information (eg. Internet of Things), the necessity to minimize the time needed to conduct the analysis must be met. An important element of the development of Bi systems is also Natural Language Processing or computational linguistics. This is part of the artificial intelligence that is responsible for the processing and understanding of human speech by the computer. The improved forms of this tool will not only change the interface of the BI software and the way of interaction between the analyst and the computer, but also the whole approach to the problems of business analysis and business conduct. According to Gartner, in the next two years, 40% of tasks performed on data will be automated, which will reduce the barrier of using BI systems for less experienced users (Gartner, 2017).

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