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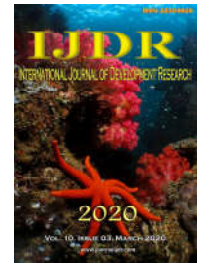
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RESEARCH ARTICLE

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## ANALYSIS OF THE APPLICABILITY OF BI SOFTWARE IN COMPANIES

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### ABSTRACT

The study aims to describe, in a synthesized and analytical way, the Business Intelligence (BI) software, describing all its potential when used correctly within companies, as well as its main resources, tools, support technologies, architectures and technologies that aim to increase the efficiency of processes and the assertiveness of the information generated that will serve as an aid to rational decision-making. In order to respond to the research objectives, the methodological choice was an explanatory and descriptive research, addressing and exemplifying resources, evolutions and factors that influenced the success trajectory of BI software as a tool capable of solving problems at several levels of complexity. The BI software provides knowledge to users through reports, graphs and dashboards. After collecting, organizing and analyzing raw data, the system generates value and displays in easy-to-view ways for managers to decide what to do based on it, resulting in better information and process management, such as drastically reducing costs.

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## INTRODUCTION

The world is more and more connected, producing whirlwinds of information, which are very valuable for any company that wants to always be ahead in the market with a solid synchrony with its customer. With the great amount of information being generated day after day, it was diagnosed the opportunity for companies to use such information in order to be more assertive with their target audience, having the opportunity to launch products that are likely to arouse great demand from customers, thus bringing a satisfactory financial return and distancing themselves from the dark chances of failure and loss, an unpleasant situation that always needs to be considered. Business Intelligence (BI) software is designed to help companies discover and visualize their data and generate better business results. These widely deployed applications incorporate a variety of practices, techniques and technologies, and are generally expensive, but many companies are well served by free services that incorporate most of the key

features organizations need. The practice of obtaining information about and about their customers and potentials, transforming them into graphics and possibilities, designing pathways and developing products based on the possible acceptance of this audience, aiming at assertiveness, which in turn reduces the risks of failure by presenting a product compatible with what the target audience expected, is called Business Intelligence. And where is stored this universe of information to be worked by Business Intelligence? In the development of Business Intelligence solutions, the Data Warehouse technology (data warehouse, in its translation to Portuguese) is certainly the most important, being where analysts will access the necessary information to make decisions. To be efficient, the Data Warehouse technology has enough features and structures to handle an analysis composed of a large volume of data. The Data Warehouse has a well-defined technology, with a relatively simple process to understand. The entire process begins at the Data Source, a step where all the information we need for the rest of the

process is gathered. Then, such data will be conducted to the final storage in the Data Warehouse through the Extract Transform and Load, or simply ETL (Extract, Transform and Load, in its translation into Portuguese) with the help of the Staging Area, which is responsible for helping the data transition from its source to its final destination in the Data Warehouse (Técnicas, 2019). After these steps, we arrive at the Data Warehouse, already having only data that will really be needed by analysts and managers. Amidst so much information stored in the Data Warehouse, we have some subsets of internal information called Data Mart (Data Repository, in its free translation into Portuguese), which store specific information that will only serve specific departments, further increasing the accuracy of access to this information. After gathering the data, storing it and fragmenting it into small pieces, it is time to generate ways to visualize and analyze this data, we have Data Mining (Data Mining, in its translation to Portuguese), which uses techniques that help us in the search for relevant information amidst the large amount of data, in which most of us are not interested at any given time. We also have Online Analytical Processing, or simply OLAP (Online Analytical Processing, in its translation into Portuguese), which in turn provides us with the possibility of analyzing information from various angles, with reports and dynamic queries, which in turn can be developed by the users themselves (Técnicas, 2019).

### Theoretical Reference

**History:** Business intelligence (BI), a term that can be translated as business intelligence, is a process that helps a manager make decisions. It is based on the collection of raw data, which will be transformed into useful information to guide the actions of companies. Technology advances at great pace every week, and the consequence of this is that the options of consulting tools and sources of information are much wider. And the amount of data available is also absurdly larger today. A previous reference to intelligence, but not related to business, occurred in Sun Tzu - The Art of War. Sun Tzu says in his book that to succeed in war, one must have all the knowledge of his weaknesses and virtues, in addition to all the knowledge of the enemy's weaknesses and virtues. The lack of this knowledge can result in defeat. A certain school draws parallels between disputes in business with wars: gathering information; discerning standard tests and the meaning of the data (generating information); responding to the resulting information. The term "Business Intelligence" is originally created by Richard Millar Devens' in "Cyclopaedia of Commercial and Business Anecdotes" in 1865. Devens used the term to describe how the banker, Sir Henry Firnese, profited by receiving and acting on information about the environment before his competitors. The ability to collect and react appropriately based on retrieved information is an outstanding skill in Firnese, and today it is entirely the workings of BI. Everything began to change in the 1970s, with the evolution of forms of storage (DASD) and data access (DBMS). The term Business Intelligence, appeared in the 80s and refers to the intelligent process of collecting, organizing, analyzing, sharing and monitoring data contained in the Data Warehouse / Data Mart, generating information and decision making support. With the evolution of technology has been embedded a series of tools such as EIS (Executive Information Systems), SS (Decision Support System), Spreadsheets, Data Marts, Data Mining, OLAP Tools, among others. In 1958, an IBM researcher Hans Peter Luhn used the term "Business

Intelligence" in an article. He used in an online dictionary the definition of Intelligence: "the ability to perceive the interrelationships of present facts to help guide to desired goals.

### The importance of bi for businesses

Business intelligence processes are used to assist in decision making. In this way, the company reduces the risks to which it is exposed. And those who use business intelligence to support their decisions are always one step ahead of those who do not. The result of data collection and analysis is the possibility of acting in a more strategic way, because each movement will have a reason to exist. The insights obtained in BI processes work as a beacon to guide the company's actions. This approach is important both in a macro scenario - when positioning the company in the market or designing a new product, for example - as well as in the content of a publication in a social network. In the end, besides the lower risk, the manager will see a higher return on investment (ROI), as he will bet less. Instead, he will shoot straight. The decrease in costs will also happen because he will have more agility, optimized processes and will lose less time with unsuccessful analyses. And, if there is a mistake, the measurement of performance and results, another premise of business intelligence, will facilitate the correction of the direction of the project in question.

### Bi Software Features

- **Cost-Benefit:** as a cloud-based solution, Power BI stands out because of its low cost. The initial investment to deploy the system is very low: only \$10 per month. No license costs or costs to maintain servers are required.
- **Ease of use:** The system is intuitive and Microsoft offers robust and complete documentation to assist in use. The data can be viewed via a browser or mobile application, and a report can be accessed within two weeks or a month.
- **Performance:** Being a system in the cloud, performance is another point to be highlighted, with good processing capacity and speed in information availability.
- **Connectivity:** Power BI is also compatible with several other tools on the market, most common databases and other cloud applications. In addition, users can integrate the program with the R language and combine the power of these two technologies for predictive analysis.

Business Intelligence is a key concept to assist management, as it allows a broad view of the business from data analysis. Thus, it is easier to make decisions appropriate to processes and needs and achieve concrete results for business growth and optimization of internal activities.

### MATERIALS AND METHODS

**Materials:** For the development of this article Microsoft's Power BI solution was used. The goal of Power BI is to provide interactive visualizations and business intelligence capabilities with a simple interface for end users to create their own reports and dashboards. Microsoft Power BI features

dozens of data connectors so users can incorporate information from multiple sources into their queries. The platform also allows companies to transform CSV data and Excel spreadsheets into visually compelling reports that can be shared with others or published online. Finally, Microsoft Power BI features an impressive number of customizable views so users can organize data into all types of graphs, from bubbles to heat maps, graphs, histograms, cards and more.

**Methods:** In order to respond to the objectives of the survey, the methodological choice option was an explanatory and descriptive survey.

## RESULTS AND DISCUSSIONS

**Data Warehouse:** Data Warehouse is the environment where all data of decisive information is stored, data with relevance to corporate management, with its main function of storing company information to assist in better control of processes and their respective decisions (Conhecendo, 2019). The concept of Data Warehouse was born from the need to incorporate data from corporations that were dispersed in different machines and systems, so that it was finally possible to convert the data, enabling the accessibility of this data to all those responsible for different areas and/or the decision-making area of the company, as can be seen in Figure 1.

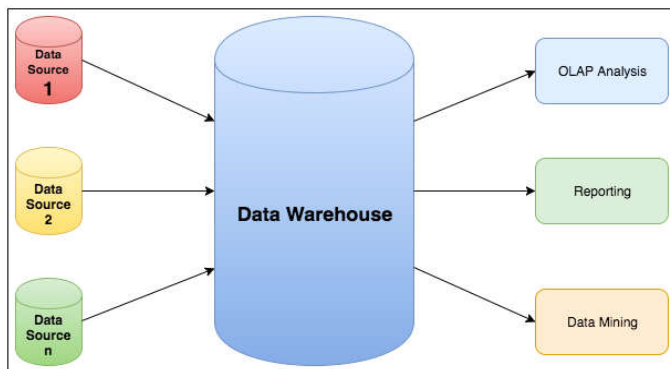


Figure 1. Simplified example of Data Warehouse (Data Warehouse, 2019)

All queries and reports are accessed directly in the Data Warehouse, so that unreliable data and information are avoided. The purpose for the use of a Data Warehouse is based on the principle that the information needs to be completely reliable, so that all decisions that need to be made are not wrong (Bi and Data Warehouse, 2019).

**Mart Date:** Considered a small variation and with a structure very similar to the Data Warehouse, the Data Mart is a subgroup of information that can be identified by individual and specific departments present in the Data Warehouse, which focuses on offering decision support to small organizational groups (Conhecendo, 2012). The figure 2 shows an architecture for the data warehouse and mart. Data Marts focus primarily on the needs of specific business units, rather than those of the corporation as a whole. They optimize the provision of decision support information and focus on summarized management and/or exemplary data instead of atomized level history. In addition, data can be appropriated and managed by users outside the corporate IT department. Due to the flexibility and practicality of the Data Mart, its popularity is increasing, especially compared to large Data Warehouse systems, the main reasons being (DM, 2019).

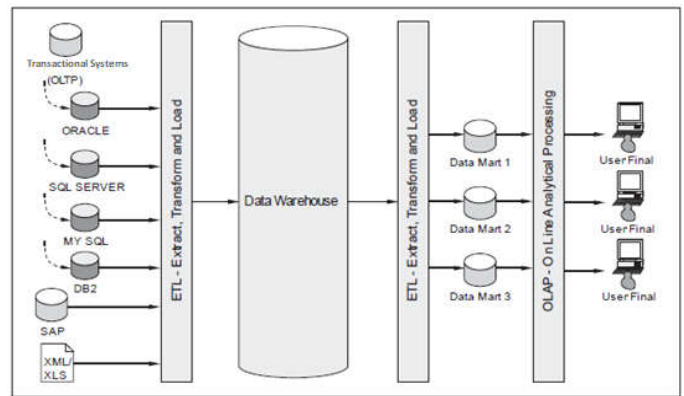


Figure 2. Architecture for the data warehouse and mart

- Achieving a significant reduction in the cost of implementing and maintaining decision support systems, facilitating access for a much larger number of corporations;
- The Data Mart can be prototyped with much more speed, with cases of pilots being built between 30 and 120 days and more robust and complete systems being built between three and six months;
- Data Marts have the most limited scope compared to the Data Warehouse, but are much more identified with user needs groups, resulting in a more concentrated team effort.

**ETL:** The ETL, acronym for extraction, transformation and loading, is a set of processes associated to the extraction and manipulation of the source data, that later these data will be transformed and finally positioned for the use in the Data Warehouse. Every transformation requires the involvement of multiple steps, such as the cleaning of the data, profile data, conversion of all types of data, validation and integrity, and in some occasions, the denormalization and normalization (Técnicas E Solucoes, 2019). Having as main objectives the treatment of systematization and cleaning of data from the various systems present in organizations, to later occur the insertion in a Data Warehouse or Data Mart and finally to be used in data analysis in OLAP or Data Mining, according to the representation in figure 3. The ETL has three main steps for the transition of the source data to be used later in the data warehouses, they are, in order (Extract Transform Load, 2019).

- Extraction: as most Data Warehouse projects consolidate data extracted from several source systems, you first need to extract data from the source systems, converting it to a certain format for entry into transformation processing.
- Transformation: applying several rules or functions to the data that was previously extracted in order to be able to derive the data to be uploaded
- Loading: consists of the insertion of data in the Data Warehouse to assist in decision making, a process that can vary widely according to the needs of each organization.

With a wide range of ETL tools, capable of adapting to the most diverse forms of databases, languages and their formats, there is a great offer for ETL tools, companies that have Business Intelligence tools, or for the elaboration of a Data Warehouse, commonly make available specific software for

the function, such as ETL tools from Microsoft software (Extract Transform Load, 2010).

**OLAP:** Online Analytical Processing is a database that adjusts data so that the user can have greater insight into it. It works in a specific way for decision making, besides, it has several dimensions that can be visualized, hierarchically organized and has as its own characteristic to follow a logical model with multiple dimensions. Thus, managers and directors of large companies would have a clearer analysis of the data so that the decision-making process becomes "easier" (OLAP, 2019). However, OLAP should not be conceptualized as a process, or even a tool, but rather as a set of them, since its application in several layers of technology becomes one of its main characteristics, as shown in figure 4, where it is possible to see the joining of processes and tools for data collection. At a certain moment the need arose to create a tool where the user could have an easier reading, clearer of the data of a certain organization and with this the easiness to make the right decision (Técnicas E Solucoes, 2019).

server, where it will be processed, and returning the data to the user.

- ROLAP (Relational On Line Analytical Processing), in this case the information is processed and stored on the relational database server itself.
- MOLAP (Multidimensional On Line Analytical Processing) is a tool with a somewhat high cost, but the benefits are quite high, because the information is processed and analyzed directly in the database of the multidimensional server. This makes the user experience more attractive.
- HOLAP (Hybrid On Line Analytical Processing), also known as hybrid processing. Recently emerged, providing the user with a new way of accessing data, this tool is a mixture of technologies where ROLAP and MOLAP are combined. With this mix of technologies the biggest advantage is that the best functions of each have been maintained, such as the ability to manipulate ROLAP data and the high performance of MOLAP.

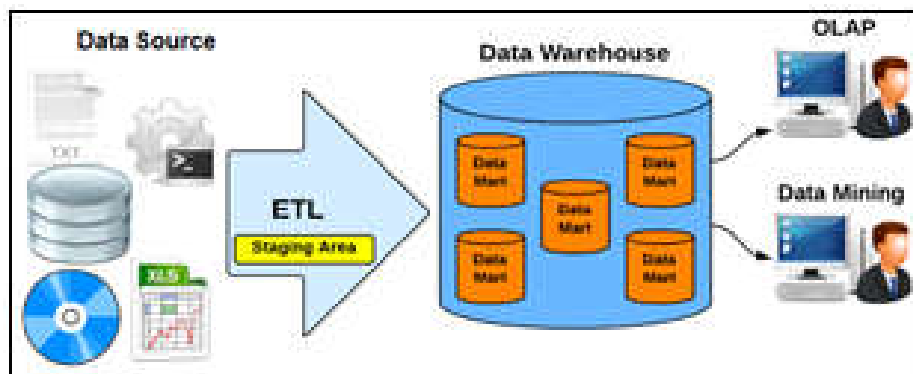


Figure 3. ETL Processes (Conhecendo, 2019)

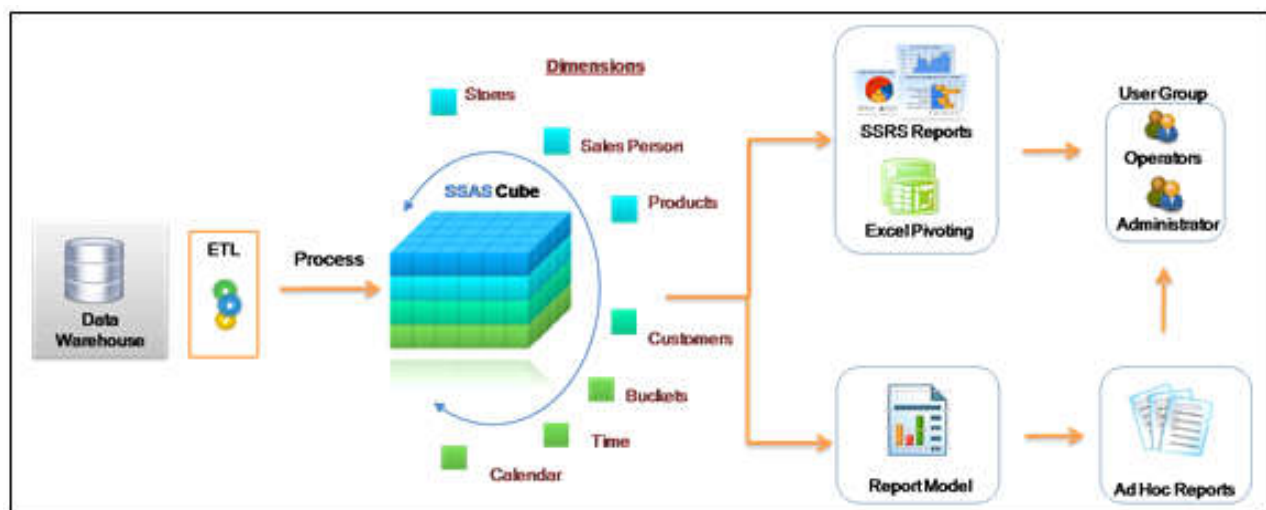


Figure 4. OLAP Processing Steps

As a main characteristic, we have the multidimensional view, where information about the data of one or more dimensions is provided. This data when returned from the database to the user is manipulable and viewable by an infinity of angles and levels of groupings. There are numerous processes responsible for bringing the user as much information as possible, so that it facilitates the vision and manipulation of data, let us see some of these tools (OLAP, 2019).

- DOLAP (Desktop On Line Analytical Processing), responsible for transporting an instruction to the

**Data Mining:** It is an analytical process specifically designed to explore large amounts of data related to any type of business, it is a novelty within computer science that has worked very well, and has generated surprising results both in the area of scientific research and in the market in various types of business, but it ends up generating a very high acquisition cost, with this it is very important that all its tools are used to the maximum (Técnicas E Solucoes, 2019). A very important advantage that characterizes this tool is that we can obtain a comparison of records within the database, for example, commercial transactions can store numerous records of products, where they were purchased, the quantity, the

comparison of prices in the market, etc. As a consequence, we can indicate strategies to improve or increase the financial results of the company (Técnicas E Solucoes, 2019). As with any process, DM (Data mining) is subdivided into several steps, which can also be seen in figure 5 and with the following division of these steps (DATA MINING, 2019). Understand the problem: it is first necessary to define the main objectives of the data mining process, such as what is expected, what goals will be achieved, what problems will be solved, etc. The focus of this step is to understand the benefits of data mining for use in the organization or business where it will be developed. Data extraction and preparation: this step extracts the data that the statistical tools have collected and will be used, in addition to the use by experts, where they describe and explore the data. Also being made the preparation of the data, a process that depends on its origins, being necessary to prepare this data by methods of filtration, combination and filling.

Creation of the models: this step has the function of having a direct relation with each objective of each process of data mining, because it is necessary to choose a modeling technique, which can guarantee the solution of the proposed problems.

- Exploration or data mining: at this stage data mining techniques are now applied to identify patterns, correlations or relationships between the different types of information within the base.
- Validation of models or interpretation: at this stage the results obtained by data mining are inspected, evaluated and analyzed, helping to find out which patterns are really relevant and impactful to be used as a useful body of knowledge.
- Implementation and updating of models: this is the final stage of data mining, in this phase the results obtained are imported into the databases or other

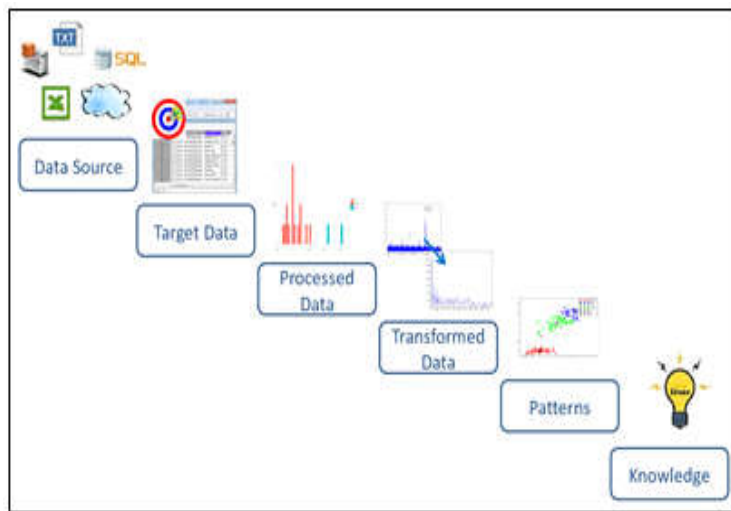


Figure 5. Demonstration of Data Mining Steps

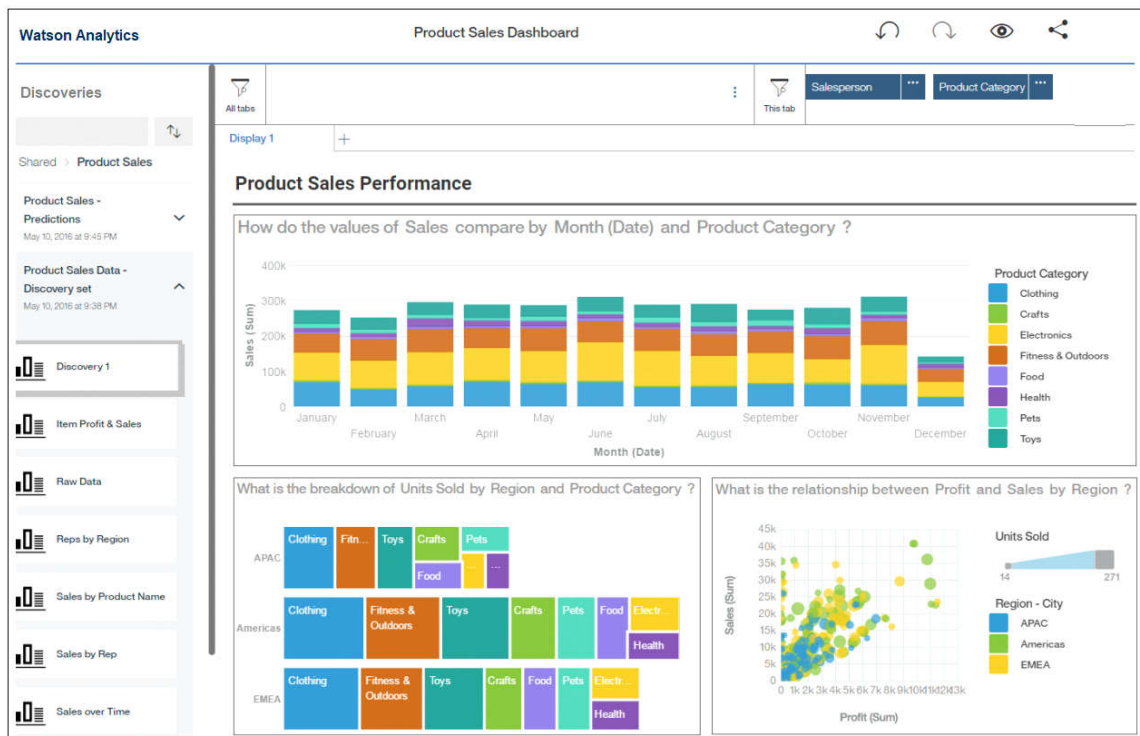


Figure 6. Demonstration of IBM Watson Analytics BI Software Sales Analysis [14]

types of directories, i.e., it is the final product of the stages that is presented to stakeholders. Through data mining techniques, the organizational analysis teams are able to process what is collected from several different perspectives. These techniques make it easy to categorize the processed information and finally identify relevant relationships among the various knowledge obtained by the field (Desbravando, 2019).

chances of failure, often the consequence of wrong decisions. For a better management of the data universe we have already talked about, we have at our disposal some Business Intelligence tools. Among the several existing Business Intelligence tools, we can mention IBM Watson Analytics, with this tool companies not only have at their disposal a technology that helps to visualize and analyze data in an easy



Figure 7. Reporting View of Google BI Software [7]



Figure 8. Power BI Dashboard Example [7].

**BI Tools:** Companies need correct decision making, the use of Business Intelligence in the wrong way can cause serious damage, leading companies to the same path that if they had chosen to make decisions manually, accumulating risks, when precisely this is the goal of Business Intelligence, avoiding the maximum of risks, gathering and analyzing a universe of data with the aim of transforming them into information that will increase the chances of assertiveness of companies in the decision making process and consequently decrease the

and reliable way, but also a technology that has the ability to receive questions in natural language and from that, in real time, provide answers [7]. Another excellent tool is Miners Monitor, which allows organizations to have knowledge about consumer satisfaction in relation to brands in the same segment, having available filters by region, gender, period and age, allowing companies to have greater control of the data that really matter. This tool helps the company to develop a product that has great chances of acceptance in the market,

focusing on what, according to the consumers themselves, is missing in the products and/or services of competing companies [7]. If a company feels that none of the tools fully meets its needs, they can opt for Google Data Studio, an open source Business Intelligence tool, thus allowing a development team to develop more features to add to those already existing in the tool, thus covering the specific needs and especially of that organization, without the need for the company to be tied to standard resources. Another feature of this platform is the easy generation of personalized reports, which can be shared. In Data Studio, it is allowed to generate up to five editing reports and unlimited sharing [7]. Power BI is an excellent BI tool, as it is very simple and powerful. It doesn't only support traditional data sources like databases, CSV, JSON, XML and etc., but also supports emerging sources that are available in HDFS, Spark, R, Salesforce, Google Analytics and cloud platforms and etc. It is extremely easy for users that are only familiar with tools like Excel. It has desktop, mobile and online service versions. The desktop version is free to everyone.

### Conclusion

Business Intelligence has allowed companies to be more assertive about their bets in the market, through easy-to-read graphics that provide an overview of the business, which are a reflection of the large amount of data generated in organizations, no longer requiring great manual efforts to reach the conclusion of the situation of a company in a given period, and thus try to draw a future amid so much distinct and dynamic information, a task almost impossible if we are dealing with an organization of large proportions. Business intelligence is a set of techniques and tools to help transform raw data into meaningful and useful information in order to analyze the business. BI technologies are capable of supporting a large amount of unstructured data to help identify, develop and even create a new business strategy opportunity. The goal of BI is to allow easy interpretation of large volumes of data. By identifying new opportunities and implementing an effective data-based strategy, you can also promote business with competitive advantage in the marketplace and long-term stability. BI technologies provide insight into the history of business operations as well as current vision and possible forecasts. Typical BI functions are reporting, online analysis processes, analysis, data mining, complex event processing, business performance management, benchmarking, text mining, predictive analysis, and prescriptive analysis. BI can be used to assist in the decision making of a wide variety of businesses, ranging from operational to strategic. Basic operational decisions include product positioning and pricing. Business strategy decisions cover priorities, objectives and directions at the broadest level. In all cases, BI is most effective when combined with data from the market in which a company operates external data with data from internal company sources for the business, such as financial or operational data.

When external and internal data are combined, they can provide a more complete picture. In fact, it creates an "intelligence" that cannot be derived by any data set. In the course of the article the concept of Business Intelligence was addressed, its mission within organizations, the technologies that support the entire process necessary to actually have Business Intelligence applied efficiently, following a trail of essential steps, which make use of tools that will help in viewing the data in an analytical and reflective way, to later support the making of important and decisive decisions within an organization, helping to achieve goals, advantage over the competition and exponential success.

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