Business Intelligence.
A Presentation of the Current Lead Solutions
and a Comparative Analysis of the Main Providers

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The aim of this paper is to synthesize the concepts behind Business Intelligence, by studying the solutions available on the market provided by the main players. We will present the software solutions already provided by them emphasizing the main advantages and benefits of each of them, but also as a comparative analysis, designed to reveal the area in which each provider is more remarkable than the others.
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1 Business Intelligence

The concept of Business Intelligence includes, as stated in [1], a set of theories, methods, architectures and technologies, by means of which a great volume of primary data, most often historical data, is synthesized into information of interest such as key performance indicators for a company management. This information is presented in the form of reports, charts or tables.

Quality is the most important aspect when we talk about a correct implementation of any Business intelligence solution. This must be present in all of the four moments of the implementation: source data standardization, data processing, data warehouse implementation and reporting.

Regarding data warehousing, it has been noticed in time a change from relational to multidimensional. This change was necessary for the creation of dimensions as close to the user perspective as possible. Moreover, a multidimensional analysis offers a database much easier to consult and interrogate at a synthetic level, with less keys and administrative tables then in relational theory.

The reporting requirements of the companies have considerably changed during the last years becoming more and more complex in search of gaining the competitive edge.

The existing Business Intelligence solutions offer a diverse range of reports for company management, as described in [2], of which we distinguish:

- Static Reports. These reports are executed on demand or periodically, but always with the defining of the data prior to the execution.
  Examples: SAP Crystal Reports, Cognos Report Studio.

- Ad-hoc reports – Reports created by the end user, on demand, based on a standard template report.
  Examples: Cognos Analysis Studio.

- Interactive and multidimensional OLAP Reports – These reports offer the end user a high level of interaction by means of navigation techniques and data selection (Drill-down, roll-up).
  Examples: Oracle Discoverer, Cognos PowerPlay.

- Dashboard – Contains company aggregate, strategic and high-level data, in form of comparative and key performance indicators. They include both static and dynamic reports, charts and diagrams.
  Examples: Cognos Connection Portal, Oracle Hyperion, Microsoft SharePoint Server.

- Write-back reports – These interactive

reports are directly linked to the data warehouse, allowing data alteration. Most of the time, write-back reports are used for modifying and customizing products and clients' categories, for defining scenarios and forecasts, or for setting target volumes of sales.

Examples: Cognos Planning, SAP, Microsoft Access and Excel.

Gartner Group and Forrester Research are two of the biggest consulting and research companies in IT. Periodically, they analyze the providers of Business Intelligence solutions based on relevant criteria of evaluation, associating them with a type of provider within their Magic Quadrant [3] (Gartner – Magic quadrants squares: leaders, visionaries, challengers, niche players) or by assigning them scorecards (Forrester). Consistently in their analysis, between the leaders of the Business Intelligence technology, we find the four suppliers that we are going to present in this paper: IBM Cognos, SAP, SAS and Oracle.

2. IBM Cognos

"Cognos Company, part of the IBM group, is considered a global leader on the Business Intelligence market solutions in terms of performance management (BPM – Business Process Management). The company provides world-class software and services for activity planning and company strategy. The IBM solutions of Business Intelligence help companies plan, understand and handle the financial and operational results. Cognos Company was bought by IBM in February 2008." [4]

The main advantages are:

- The solution uses a powerful engine of analysis for dynamical planning and forecasting, a capability very appreciated by decision makers;
- The product allows the alignment of financial and operational objectives in one solution with a very short response time;

- The product has the ability to reduce the planning cycle by 75% and the report time from several full days to just a few minutes;
- It offers excellent performance for models and large data sets;
- IBM Cognos offers a dynamical and collaborative solution for sustaining the company's activities in all analysis and planning stages.

Many finance departments modify their strategy of support, performance management and risk management activities because the data validation process takes too long. These departments rely on individual solutions, which are entirely maintained by the IT department and which lack the performance and vital benefits to perform analysis activities on demand.

IBM Cognos radically transforms the planning, budgeting and forecasting processes, by executing "What-if" scenarios analysis, which facilitates the decisions and increases their quality.

Cognos TM1 is an analytic solution of planning which offers the following functionalities, as described in [5]:

- It allows an on demand analysis, planning, predictions and reports, and offers a complete view of the company's performance, including from the profitability point of view;
- It offers a various range of user interfaces, including Microsoft Excel, Apple iPad and web in order to cover a large range of work styles and personalized analysis on different types of activities;
- An easy browsing of large datasets, which uses exploring points to filter results. This product offers users the ever-necessary possibility of solving individual or work groups' problems. It is not a mere instrument of identification because it allows the transformation of information into actions in order to solve problems or to rapidly benefit from the rising opportunities, all

these functions being at hand on the desktop;

- It includes an innovative environment guided by models, which facilitate the development and implementation of planning solutions, analysis and forecast as the company necessities develop.

The features and benefits of Cognos TM1 include:

- A platform and a design that offer fast and complete answers for the entire company;
- Fast development of flexible models, including profitability models;
- Extensions to include risk analysis, rating matrices and reports;
- "What-if" analysis which immediately is reflected in diagrams and reports;
- The control belongs to the finance department because the final users

can easily use this software without the need of technical knowledge.

This product offers a complete solution to organizations for all data types and for all components of the life cycle of a report: collaborative reporting, types of reports for the entire company, reports that are created once and can be used everywhere (Figure 1: Reporting in IBM Cognos).

Reporting features for this product are:

- Using a flexible model to create the reports, fields that can be modified for each object dimension;
- A report can have many output format types: HTML, PDF and Excel;
- The existence of reports templates that contain object, queries and standard layouts (Figure 2: Reporting în IBM Cognos).

Fig. 1. Reporting in IBM Cognos

Fig. 2. Reporting in IBM Cognos

3. SAP BI

"Having over 232 000 clients in 188 countries, SAP is the world leader in integrated software solutions for company management offering products for all domains. Likewise, best solutions are supplied for specific business processes, company resource planning solutions (ERP) which increase the productiveness of the entire company and Business Intelligence solutions which provide a rapid return of investment." [6]

The main advantages are [7]:

- SAP BI uses an intuitive dashboard, which allows a manager to have a real time overview of the planned demand and real demand of the products, organized by lead sources and geographical zone;
- Text analysis, coming from the social media such as: Facebook, Twitter and other sites and Web blogs, allows the company to redefine the marketing campaigns having a better understanding of people's opinion on its products;
- SAP BusinessObjects BI solutions redefine the way information is used by the company and offer new perspectives through a reliable Business Intelligence platform;
- The software helps organizations monitor data coming from various sources using a complex engine of event processing, by identifying the ones which can affect the day to day operations. The product offers information in real time by means of reports and notifications, enabling the users to rapidly react in these situations;
- An important benefit of this product is the fact that users can visualize a data quality rating, offering them a degree of reliability for each piece of information presented. Thus, a high quality is targeted for cases such as: compliance with the law. Other times high quality is not as

important – for example, when a person wishes to find out people's perspective about a new product. In this case the decision remains to the end user, who will use this rating to make the best decisions.

SAP Business Intelligence is a product, which allows companies of any type or magnitude to visualize a diverse set of information in an intuitive graphic. With the SAP product a large quantity of information becomes a real strategic instrument, which helps organizations in their decision-making processes, based on a complex database analysis.

The solution was created with the purpose of increasing the quality of the decisions by implementing the following functionalities, as listed in [7]:

- The use of data warehouses for storing the report and analysis information and tools;
- The solution is addressed to all employees from all of the organization levels, helping them making fundamental decisions based on the provided information;
- SAP Business Intelligence assures the complete integration with all the other SAP components, which is very useful if one wants to extend the capabilities of Business Intelligence towards systems like CRM or ERP;
- This product is able to adapt to the changing demands of the contemporary society because it includes instruments through which the application content can be extended or integrated with other analysis and reporting instruments coming from third party providers;
- Another useful feature is the fact that the user can customize their interface and the access mode, as long as the security policies are followed.

The Business Intelligence solutions provided by SAP include data mining and predictive analysis algorithms, with the

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data used for analysis exploring business scenarios from the past and present with the purpose of identifying the trends and outliers in order to predict future behavior. SAP BusinessObjects Dashboard Software is a drag-and-drop instrument of visualization designed to interactively present strong dashboards, personalized with live connections to any data source. These dashboards can be shared with all business users involved in the decision-making process, so that they can easily agree upon the necessary measures.

This BI solution allows users to explore a large quantity of miscellaneous heterogeneous information in a very short time. Users can use common keywords words to find information stored in the data sources enabling them to explore the data in a direct way, without needing supplementary information regarding existing reports or data structure.

The functionality of reporting allows the exploring, visualization and supplying of reports using company applications or the web. This is ideal when questions are preset and each reply structure is known in advance. (Figure 3: Reporting in SAP).

Fig. 3. Reporting in SAP

4. SAS

"SAS is the leader in software and services for business logic analysis, and the largest independent vendor in the Business Intelligence market. Through innovative solutions delivered within an integrated framework, SAS helps customers from more than 60,000 locations to improve performance and deliver value by making faster and better decisions." [8]

The Business Intelligence solution from SAS provides complete end-to-end technology and also for data access and data quality. This ensures the fact that large volumes of raw data are processed into accurate reporting and analysis information.

For many users the most common tool of this product will be the SAS reports. These are dynamic views of a map of information, which can be displayed as a table, a chart, or a report (Figure 4: Reporting in SAS).

The main requirement of the companies is to perform an analysis of the problems, basic testing and the modeling of the results. SAS Enterprise BI Server product provides many tools for financial analysis, forecasting and statistical analysis, which is critical to solving problems and to allow the company to be more competitive.

The main advantages, as described in [9]

are:

- One of the main benefits which SAS Enterprise BI Server offers is that it allows the IT department to focus on other important tasks while still remaining part of the business by controlling the implementation, maintenance and security of BI platform. However, all employees can work on the platform for analysis and operational reports;
- Another advantage is that the product addresses a very broad area of fields, with the ability to store data and reports in one location. Also, an important benefit is that the product can work with other applications, such as Microsoft Office. Users can export their analysis and reports to Word, Excel, PowerPoint and Outlook;
- SAS Enterprise BI Server has a web portal that provides the functionality "point- and-click" which enables users to manipulate the layout and contents of the interface. It is also possible to transport data to the dashboard;
- Enterprise BI Server also has viewing functionality, which allows users to observe the analytical results that cannot be shown in a typical chart. Analytical results are displayed in a more interactive way, such as tables with bubbles, and even 3D videos containing data presentations;
- Another important feature is the Web-based reporting and distribution. Web-based reports have predefined layouts and custom templates and users can build and manage reports from multiple data sources. Reports can then be exported to PDF or Excel.

Fig. 4. Reporting in SAS

The features and benefits of SAS include:

- OLAP (On - Line Analytical Processing) refers to how business users can access the data using sophisticated tools, which allow navigation between different dimensions and hierarchies, such as "time" or "location";

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- Query and reporting - the possibility of receiving answers to questions about the data that were not available before. This generates reports, which respond to these questions and can be saved for future viewing;
- Advanced Analysis - sometimes referred to as data mining or predictive analytics and forecasting, it uses statistical analysis techniques to predict trends;
- Collaborative BI - refers to the concept of taking data structured analysis and reports that have unstructured content (such as comments, discussions, accessories) so that data can be enhanced with additional content;
- Corporate Performance Management (portals, scorecards, dashboards) usually provides a container for several pieces that connect in such a way that the aggregate is presented as a story;
- BI in real time - enables real-time distribution of reports via e- mail, messaging systems and interactive displays.

5. Oracle BI

The appearance of Oracle Business Intelligence came naturally, due to the company's great history in database technologies and powerful software solutions.

Therefore, Oracle had a solid basis for creating both standard and interactive reports, which synthesize great volumes of data, meeting the user's needs.

An important aspect in which Oracle has a different approach from the other providers is the use of the E-LT architecture for data integration, rather than ETL. [10] This involves uploading data immediately after extraction, with the transformation being done in the destination database. This architecture removes the need of the middle-tier server used for ETL

processing.

The main advantages of Oracle Business Intelligence, as described in [11], are:

- It eliminates redundant costs by standardizing a single platform for Business Intelligence;
- It provides a common infrastructure for creating reports, dashboards, ad-hoc analysis and OLAP analysis. The latter has a high degree of interactivity;
- It offers the users the opportunity to create their own reports and queries without the assistance of the IT department;
- Rapid highlighting of trends in very large data sets;
- Provides flexibility and scalability for the business solutions as the company implementing BI solution expands.

The features and benefits of Oracle BI include:

- The multidimensional analysis of data using the OLAP server enables users to create "what -if" scenarios used to predict business performance levels for different conditions;
- Scores and the management of the companies' strategies can be highlighted for each level of the organization and may be linked to key performance indicators so that performance can be measured, monitored and managed;
- Interactive dashboards are available in a Web interface for an instant view of metrics and important reports;
- The possibility of using a standard Business Intelligence solution, pre-configured by choosing the basic components;
- Users can quickly run their queries, and then analyze, visualize and share their results;
- Information is available through a variety of manners including: web-based dashboards, search bars,

ERP, CRM applications, mobile devices and Microsoft Office applications.
Oracle offers a wide range of software products for Business Intelligence. Oracle Business Intelligence Standard Edition One is a product for mid-sized companies in course of development. The most advanced features offered by it are the interactive dashboards. Oracle Essbase is the product that provides the ability to predict future behaviors by running "what - if" analysis. (Figure 5: Reporting in Oracle).

Fig. 5. Reporting in Oracle

6. Comparative Analysis

Table 1. Comparative Analysis

Criteria	IBM Cognos	SAP Business Intelligence Solution	SAS Enterprise BI Server	Oracle BI
Type of companies that the product addresses	Medium sized	All types of companies	Medium and large companies	Medium and large companies
Type of application	Divided into various tools: Analysis studio, Query Studio, Report Studio	Applications integrated into one package	Web application with portal access	Integrated application
Interface	Separately structured interfaces	Integrated dashboards	Web application with integrated dashboards	Web applications, ERP and CRM applications, mobile devices, Microsoft Office applications

Customization	Customizations can be made by the final user	Customizations can be made only by the IT staff	"Point-and-click" capability for the final users to manipulate the interface	Customizations can be made both by IT staff and final users
Navigation	Easy navigation between reports	Navigations between reports is time consuming	Easy navigation between reports	Easy navigation between menu items and reports
Intuitive	Yes	Yes	Yes	Yes
Tools used for analysis	Analysis studio and Query Studio	Desktop Intelligence-OLAP Intelligence	OLAP analysis capabilities	OLAP analytics, Mobile BI, Enterprise reporting
Integration with Microsoft Office	Yes	Yes	Yes	Yes

In terms of cost, there are three issues to be discussed: the cost of licenses, the cost of implementation and the maintenance cost. If the latter two do not show significant variations for the four suppliers, regarding licensing costs there are major differences. An IBM Cognos or SAS license can cost significantly more than an Oracle or SAP license. [12]

SAS shows the greatest benefits in the process of data loading. Firstly, the product occupies an important position in the market of ETL technology, which enables data mapping and cleaning methodologies. Moreover, SAS Data Access has a wide range of connectors for each type of database, storage container or file system. SAS Data Access connects to popular applications such as Siebel, PeopleSoft, Oracle, Baan and SAP.

As well as BusinessObjects and Cognos, SAS Metadata provides powerful metadata services that simplify not only the ETL mappings but also data formatting throughout the organization. These metadata services are crucial in making data easily and reliably identified to users who prefer ad-hoc analysis.

SAS can have a cost disadvantage compared to Oracle or IBM, but it compensates by reducing operational costs and risks. These benefits also include flexibility and an easy manner of changing the architecture of BI systems and data interoperability as well.

7. Conclusions

Medium companies from a wide range of industries are using IBM Cognos software to manage costs, make a profit and to encourage development. This integrated solution for planning and Business Intelligence helps companies with the specific capabilities that they need - reporting, analysis and planning. A feature of the product is that in can be extended as the company grows.

The product offered by SAP addresses all types of companies, all kind of managers and analysts who actively participate in the decision-making process, regardless of their technical knowledge. They will make decisions based on facts within the organization, relying on the business intelligence solution as they can easily access relevant information whenever they need in order to better understand how business works. By using such an instrument the decision makers will be able to act quickly and confidently to get the expected results.

The BI model proposed by SAS Institute focuses on analysis and reporting tools within SAS platform, which provides a complex processing of the data, information analysis and interactive reports. The application allows analysis based on a multitude of variables and dimensions, which can be set by the user himself.

Oracle offers a complete package of

Business Intelligence solutions in an integrated and unified architecture. Reports can include a high-level of interactivity and are available on a wide range of applications. Oracle's solutions meet the needs of all types of companies (from medium size to large ones) that may have problems that require complex analysis and reporting.

To conclude with, the Business Intelligence solutions belonging to four of the largest companies presented in this paper are solid solutions and the decision of implementing one of them is based on the organization's needs and business development strategies.

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