Comparative Analysis of Business Intelligence Tools for SMEs

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Abstract: *One of the current challenges in companies is the decision-making process based on the information generated in the operation. One way to meet this challenge is through the use of Business Intelligence (BI) tools which allow optimizing the process and implementation of decision making. SMEs, in addition to facing this problem, must do so without affecting their operating costs, which is why an analysis of BI tools taking into account the specific needs of SMEs is of interest and in order to limit the use of some of them to the benefits and goals that are intended to be achieved in the implementation of this type of solutions. This report presents a comparative analysis of BI tools based on the current market offer and taking into account the needs of an IT SME.*

Keywords: Business intelligence, SMEs, Data warehouse, Decision making, CMMi Dev2 and Moprosoft

1. Introduction

Reference [1] says that the concept of BI is associated with a set of methodologies, processes, technologies, and tools for the collection, integration, analysis and presentation of information, which help identify and develop new business opportunities through the interpretation of the interrelations of the facts and data that as a final objective facilitates the decision-making process. [2] The BI tools allow this process to be carried out semi-automatically. In an SME, an internal project is being implemented using BI. [3] This SME adheres to the MoProsoft standard to structure the organization in terms of processes together with the Capability Maturity Model Integration Model Dev2 (CMMi Dev 2) for the software development and maintenance process. The information of an SMEs is generated under the rules of MoProsoft and CMMi Dev 2 through various sources of information and heterogeneity. Currently the information is integrated by the personnel of the company and extracted manually to generate the required information. Since this manual process does not integrate the information with the necessary quality to support decision making, it is proposed to implement a BI solution in SMEs.

[4] It is worth mentioning that small and medium enterprises (SMEs) are considered today as one of the key actors of development in our country. This assertion is based on the examination of socio-economic indicators (incidence in employment, GDP and foreign trade, indicators of international organizations, etc.) as well as its consolidation as a relevant issue in the development agendas. It is considered that the management of knowledge and information as a central factor of an optimal business management in Latin American SMEs should be perceived as a solution to the limited margin of maneuver that these organizations have to survive in a globalized world. As explained in [5], this margin lies in "the ability of management to develop competitive strategies" and in the "capacity to articulate agreements, among agents of the private sector, to build chains in which each link increases the value of production "

The rest of the present article is structured in 4 sections. Section 2, Business Intelligence is dedicated to explain in detail each of the phases of the BI architecture. Section 3, Tools BI describes the characteristics of the tools to carry out the decision making in a SME. Section 4, Related Jobs mentions who has done work related to this. Section 5, Conclusions and future work is devoted to presenting the conclusions reached during the development of the article and presenting the activities that will allow the improvement of this article.

2. BI Architecture

Figure 1 [6] shows a basic architecture to implement a Business Intelligence solution:
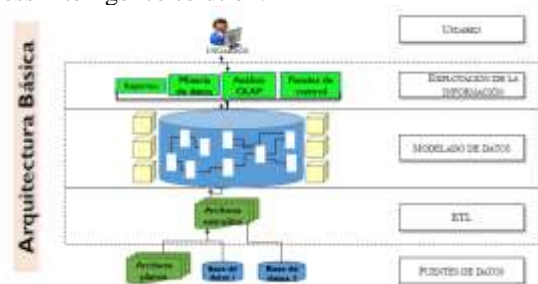

Figure 1: Business Intelligence architecture

- Data Sources: Data sources are those that contain the data at their highest level of detail, usually come directly from the daily operation of the business, but may have different presentations. These conserve the information that the client considers relevant according to what he has defined, being able to rely on Information Technology or not. The data sources can be classified into 2 groups:
  o Structured Data Sources. They are those sources of information that have a certain order and are easily

manipulated for the entire BI process.
- o Structured Data Sources. They are mainly texts.
- ETL (Extraction, Transformation and Load): it is the back-end process of the architecture in which the information that is generated in the company is integrated. The activities of ETL are:
  - o Extraction: Consists of extracting data from different heterogeneous sources: relational databases, CRM (Customer Relationship Management) systems, XML files, flat files, etc. The objective of the extraction phase is to convert the data into a single format that is appropriate for processing in later stages. Within this phase it is very important to validate the data in order to confirm that the data is consistent according to pre-established values. If the data do not coincide with the validation rules, they will be rejected totally or partially, to be analyzed later and to identify and correct the incorrect records.
  - o Transformation: once two are extracted, the data is still not useful for the end users until they are loaded into the warehouse destined in the repository. In this stage, a series of rules or functions are applied to the data extracted from the source to derive the data to be loaded in the repository. [7] Some data sources will require very little or no data manipulation.
- Data modeling: consists in the modeling of a repository known as the "Data Warehouse" (DW). The DW is an organizational database of support for decision making that is characterized mainly by allowing the integration of data from one or more sources. [8] According to Will Inmon, it is a data warehouse with the following characteristics:
  - o Oriented to the topic: the information is specific to a subject, subject or area that is of interest to the company, excluding data that lack value for decision making. The DW is designed to conduct inquiries and research on the activities of the organization rather than focusing on the dynamics of the organization's transactions.
  - o Integrated: integrates data from different sources that are generated in different areas of the company to give a coherent global vision.
  - o Variables in Time: due to the large amount of data being loaded in the DW when a query is carried out, the results expected by the user take too long to originate; this is called variable time. All the information of the DW has its own time stamp and this is a great advantage of the DW, because the data is stored together with their respective historical. Therefore, thanks to this feature of the time stamp you can access each of the versions of the same information.
  - o Non-volatile: the information is stable in the DW since, although data is added and modified, the existing data is not removed.
- Exploitation of information: is the front-end of the BI solution that allows the exploitation of information through functionalities such as OLAP analysis, Reports, Dashboard, Data Mining, giving senior management the opportunity to make intelligent decisions in real time and answer strategic questions that ensure the success of the company.

Since a key element in the BI process is the exploitation of information, in this article we focus on presenting the analysis of BI tools that cover part of the processes described above.

3. Analysis of BI Tools

3.1 Methodology

The methodology used was the following, first a research was carried out on the subject of Business Intelligence in order to clarify aspects and generate a comparative report of the BI tools to make use of them in a SME; second, an analysis of the tools was carried out in order to evaluate the quality of each of them. Finally, the assessment of the tool was done internally, observing which best covers the needs of a SME.

The selection of one or another tool has multiple aspects to consider:
- What information is needed. Indicators and complex models that will be presented to the final user.
- For what information is wanted. Support for decision making hides multiple specific needs: check that everything is going well, analyze different aspects of the company evolution, present information in a more intuitive way, compare information in different periods of time, compare results with forecasts, identify behaviors and exceptional evolutions.
- Who is it for? Organization in general, management, direction, strategic direction, etc.
- Technical aspects (response times, integration, security, etc.).
- Functional areas and benefits of BI. Originally, management information systems basically provide economic-financial information. With the extension of Business intelligence tools, this concept now covers all the functional areas of the company: human resources, quality, commercial, marketing, etc.

Among the traditional obstacles to BI implementation is the difficulty in calculating your ROI (Return On Investment). Most of the benefits produced are intangible, derived from the improvement of the company management. Quantitatively, the benefits are derived from the increased efficiency in the decision-making process: more information, better quality, more reliability, shared throughout the company, shorter response times in obtaining it, improved communication in the company and creation of a homogeneous language. In the implementation of BI, it is important to highlight the difficulty of integrating with the rest of the company system and, above all, the difficulty in combining the expectations of users with the implemented solutions, so that the conceptual definition and platform selection aspects, along with the management of change in the implementation of the tools acquire a relevant importance. Experience says that purely organizational factors originate more than half of the failures of BI projects.

3.2 Comparison of BI tools.

Business Intelligence tools are used to make use of the data generated by companies, so it is very important to analyze their characteristics in order to identify which tool is most optimal in order to facilitate the decision making process. Our analysis of tools in the market was done on the following criteria:

- Reports: Refers to the type of reports that can be generated by the tool that offers results in an orderly and coherent manner. Each tool generates a report in different formats such as: PDF, xlsx and Image.
- Dashboard: It is a graphic visualization of the main indicators (KPI) that intervene in the business objectives and that is oriented to the decision making to optimize the strategy of the company.
- Ad-hoc: Refers to a data analysis where there is a wide flexibility and makes queries openly, without any restrictions or previous limitations, not all tools have this feature.
- Data Mining: They allow us to explore large databases, automatically with the objective of finding repetitive patterns, trends or rules that explain the behavior of data in companies.
- ETL: Consists in the extraction, transformation and loading of information that are in different data sources such as PDF, xlsx, access stored in a database.
- OLAP: This feature analyzes interactively large volumes of data. In order to do so, OLAP cubes containing summarized information from where the data are stored are used.
- KPI'S: It serves to reduce the complexity of a company to a small number of key indicators, in order to make it more understandable.
- License: There are BI tools with License and Open Source, Licensing tools are complete tools and the cost varies depending on the number of users or the annex of some additional function. Open Source some of its functions are limited in storage capacity and can not be exploited to the maximum.
- SMEs: (Small and Medium Enterprises), Most of these companies do not have the implementation of a BI tool, which allows them to carry out a better management of their information that is generated based on their processes.
- Platform: It is the environment where you can implement the tool, whether Linux, IOS or Windows, to make use of it.
- Databases: It is an entity in which data can be stored in a structured manner with the least possible redundancy and that varies in storage capacity.

The tools we analyze are the following:

- Tableau: offers highly interactive and intuitive products that allow business users to easily access, prepare and analyze their data without the need for coding. Since its inception, it has focused on improving the analytic workflow experience for users with the ease of use that is the main focus of much of its product development efforts. Figure 3.1 shows an example of the Tableu interface and Figure 3.2 shows the graphs [9].
- Power BI: It is a business intelligence tool of Microsoft

Power BI to model data, analyze and interact with a massive amount of data that can support up to 10GB of information in its free version and that information is updated in real time and it's available on all your devices. Reports, dashboards and dashboards are created in a simple way, with the powerful technology that Power BI offers to drag and drop, so that in a way it facilitates the use of a variety of graphs and visualizations to make better business decisions. This tool already has analysis: OLAP, KPI'S and data mining can be applied and can be used in Windows and in IOS. It is worth mentioning that it also has the facility to extract information from databases such as Excel, Sql, Oracle, etc., in the cloud and on desktop computers in Power BI Desktop in order to increase their skills in creating reports with security. And it has more than 20 integrated visual objects and a dynamic community of visualizations customized by the end user [10].

- QlikView: is a business discovery platform that offers a BI. With QlikView we can analyze data, formulate and answer our own questions, compress the data and keep it in memory, where it is available for an exploration, it offers an excellent associative experience in all the data used for the analysis, and regardless of where they are stored [11].
- Alteryx: it is a software that allows intuitively and through a multitude of tools, the treatment, integration and advanced analysis of data. Currently, Alteryx offers three main products: Alteryx Designer, Alteryx Server and Alteryx Connect. Alteryx also hosts a cloud-based website known as the Alteryx Analytics Gallery [12].
- Birst: is a business intelligence platform based on the cloud that allows companies to analyze, explore and visualize big data. Birst was founded in 2004 and is a global leader in BI and analytics in the cloud. It is designed to be a native application in the cloud and, therefore, comes with low TCO in public and private cloud or on premise through a device, has recently been associated with Exasol in order to improve performance and scalability of the platform [13].
- Board International: Integrated platform for decision-making, allows organizations to have a unique perspective on their performance, in a simple and highly effective way. Information from various sources is integrated into a virtual data repository shared by the entire organization and which provides users with a personalized and global perspective. It explores data, perform effective analysis, create interactive dashboards and generate excellent reports. It combines the self-service profile of the user with the control over the management of the data in the entire scope of the company. It links the insights provided by Business Intelligence with the planning and control cycles of the company. Automate the creation of sophisticated predictive and data mining models. It improves decision making thanks to obtaining more meaningful and predictable insights from your data [14].
- Pentaho: is a solution-oriented platform that covers broad needs for data analysis and business reports. Pentaho is a programming language in Java and has an implementation environment in Java, making Pentaho a very flexible solution to cover a high range of business needs asking for reports, reporting analysis or multidimensional OLAP, data integration. Figure 3.8 shows an example of the pentaho

interface [15].

Table 1: Comparison of Business Intelligence tools

Functionalities / Criteria	Business Intelligence platforms							
	Tableau	Microsoft | Power BI	Qlik	Alteryx	Birt	Oracle	Board International	Pentaho
Reports	YES	YES	YES	NO	YES	YES	YES	YES
Dashboard	YES	YES	YES	YES	YES	YES	YES	YES
Ad-hoc	YES	YES	YES	NO	YES	YES	NO	NO
Data Mining	NO	Weka	NO	Nativo	NO	X	X	Weka
OLAP	YES	YES	NO	NO	YES	YES	YES	YES
ETL	YES	NO	YES	NO	NO	YES	NO	YES
Characteristics								
License	YES	YES	YES	NO	NO	YES	NO	YES
Open Source	YES	YES	YES	YES	YES	YES	NO	YES
Single version	NO	NO	NO	NO	NO	NO	NO	NO
SMEs	YES	YES	YES	YES	YES	YES	NO	NO
Platforms								
Linux	YES	NO	NO	NO	NO	SI	NO	YES
Windows	YES	YES	YES	YES	NO	YES	YES	YES
IOS	YES	YES	YES	NO	YES	YES	YES	NO
Databases								
Mysql	YES	YES	YES	NO	NO	NO	NO	NO
Sql	YES	YES	YES	YES	YES	YES	NO	NO
Oracle	YES	YES	NO	NO	NO	YES	NO	YES

In a particular SME, two possible tools to be used were selected:

- Pentaho. Pentaho Community Edition It is a free software under several licenses, including the GPLv2 license. This license implies that it can be used, copied, distributed and modified for free. Adopting this tool is a benefit for SMEs because it does not generate any outlay. One more reason to propose the use of Pentaho in this SME is that it has been created under free Java and MySQL platforms, they are platforms that are booming, they are easy to use to compile and program what allows an easy development and integration in others. Systems already created or to develop. Currently the organization has contemplated the merger of other projects with the BI.

In addition, Pentaho has a very broad community and a constantly updated wiki that provides support and guidance to users in possible problems or doubts they might have when using or implementing the software. [16] Decision making needs to be carried out through reports, analysis, dashboards, data integration and Pentaho in a solution to this need because it is not a single application, but a collection of specific programs as explained in Table 1 that shows the comparison of Business Intelligence tools.

- PowerBI. It is open source software and licensed, it is used to model data, analyze and interact with a massive amount of data can support up to 10GB of information in its free version information is updated in real time and may be available on all devices. This is an option to be implemented in the SME since with this tool you can create reports, reports and dashboards in a simple and easy to use way. This tool has analysis: OLAP, KPI's and can apply data mining can be used on Windows and IOS platforms. It is worth mentioning that it also has the facility to extract information from databases such as Excel, Sql, Oracle and in the cloud with customized visualizations for the end user. Power BI is the best option for SMEs because they can visualize the information required through reports and thus make

decisions in a timely manner that benefit the company

4. Related works

Business Intelligence tools have evolved over time and new tools have been developed for the collection, integration, analysis and presentation of information. Some works have addressed the same problem to which we propose in this article. [17] Comparative study of methodologies and implementation of alternatives Business Intelligence Opensource VS. Owners in traditional environments; Case prototype of SMEs in the agroindustrial sector This work carried out an analysis of BI tools, 12 proprietary BI tools and 8 Opensource together with an analysis of the Kimball methodology in depth for its development. They opt for the Tableu tool as it allows to analyzing, visualizing and sharing data quickly and is a tool fully compatible with any data source and user-friendly graphical interface. In [16] Implementation of a Datamart as a business intelligence solution for the logistics area of T-Impulse In this work, a study of 8 BI tools was carried out and for this reason they chose SQL Server Integration Services (SSIS), since that for them it is the tool that best meets their needs and at the same time the analysis of the methodology to work with this BI tool was analyzed and they selected the one from ROADMAP. This work implements a Datamart as a solution to apply business intelligence in the logistics area of T-IMPULSO. In [18] Open Source Business Intelligence Tools for SMEs. This paper presents a list of 6 open source BI tools, these were analyzed taking into account that the main objective is to reduce expenses in SMEs and increase their profits. The SpagoBI tool is the most complete BI packages in analysis and whose single version (Community) contains more functionalities. The OpenI tool has as a weak point the lack of ETL own methods and the impossibility of exporting data; it is therefore a frankly more rudimentary tool against SpagoBI. Pentaho is a consistent and quite complete tool. The only aspect that differs is the absence of GEO / GIS localization support. JasperSoft is a powerful BI tool, it lacks just Data Mining processes and KPI is balanced, since it allows ad-hoc queries and GEO / GIS localization manager. The Paio tool does not support Data Mining, KPI, and GEO / GIS location features. But it allows to be added to Microsoft Excel and to the Open Office Cale. The Vanilla tool is identical to the Pentaho solution package, with similar functionalities available. The most important in the implementation of BI solutions in a business, is the use of these tools makes it possible to extract information capable of originating essential knowledge for the elaboration and imposition of business metrics. In [19] "A survey on business intelligence tools for university dashboard development" offers a guide to facilitate the process of making decisions about BI tools, by examining the best BI tools in the market in terms of cost, support, scalability and other necessary parameters. This document discusses the Business Intelligence tools that are available either open source with a lower cost of implementation for a university. This is prepared with the intention of identifying a suitable tool for the visualization of data in a typical university for academic and management purposes. In [18] they make a selection and evaluation of 5 Open source BI suites, the tools are chosen

for being those that according to the research are currently active in the market with the concept of open source suit. For instance, the Open Business Readiness Rating methodology (OpenBRR) which is an open source software evaluation methodology uses an open and standard evaluation process. What the authors intend with this work is to help in the choice of the best Open Source suite of Business Intelligence, thinking of an application in a small and medium company trying to demonstrate that these solutions are viable in this type of companies, since they do not There are acquisition costs, although you need some effort and investment in your work and implementation.

5. Conclusion

After having carried out an analysis, it can be concluded that the general objective of the established analysis of the BI tools that support the processes of data preparation and analysis for decision making purposes for small and medium-sized enterprises (SMEs), was achieved allows hem to facilitate and standardize the procedures for integrating real, necessary, fast and reliable information. All this requires giving it a utility that helps to generate value in companies to efficiently maintain their processes, identify new business opportunities and make decisions. With a higher level of optimization with BI contributes to achieve these results.

It is clear that no matter the size or type of business of the companies to implement a BI tool, although from the beginning the BI were developed thinking of large companies and not in SMEs for the reason that they are expensive for their acquisition, but some BI tools not only handle the license but the Open source version that allows SMEs to implement BI for the administration of their business by offering a range of features exposed in this document to help them in the decision-making process.

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