

Business Intelligence in an Educational Landscape

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Abstract—This paper reports a work in progress about the effectiveness of Business Intelligence in the academic environment. Business management, competitiveness, excess of information and dispersion of data in the organizational environment have proven to be important barriers that need to be overcome by managers today, both in process improvement and decision making. This paper presents an initial study on this topic and shows the benefits of Business Intelligence application to assist private educational institutions to achieve better academic results in their whole process of management. Our preliminary results indicate that BI is a great differential to promote a successful management.

Keywords—academic environment; business intelligence; data warehouse; knowledge

I. INTRODUCTION

With the development of management models and society, information and knowledge have to be considered the main assets of an organization, contributing to its success and differentiation. However, the over-dispersion of data and information end up becoming barriers that need to be overcome in order to improve processes and decision making.

We can say that control and management of information play an important role in strategic planning and decision making in all sectors of society, including education.

The fast transformation of the contemporary world has given organizations, including educational ones, a great challenge to overcome. How to get passed them and monitor changes effectively, seeking to maintain competitive advantages are the issues of management today.

According to Tachizawa and Andrade [1], a new era in terms of competition is emerging, not only from known competitors in traditional markets (or other organizations that enter in certain economic sectors), but also through the disintegration of access barriers to markets previously isolated and protected.

Educational institutions cannot feel excessively confident by market slices and competitive positions already conquered, instead, they should seek to reduce operational costs, increase the profit margin and improve the quality of services provided.

Many industries felt the shock of competition and survived; now, the time has come to teach these institutions. They can either adhere to a more contemporary and responsive business model or accept that in the next years,

many private higher education institutions will be sold or close doors [2].

In this context, it is necessary to use technological information in order to accelerate the competitive intelligence in private educational institutions.

Data analysis is very important for an efficient management. Through Business Intelligence [13] it is possible to take action and make more assertive decisions. While someone deals with management information, others can detect changes in the market. This way, it is possible not only to obtain advantages but also to achieve goals successfully.

This paper relates directly to this topic: knowledge discovery and intelligent knowledge querying. It reports a work in progress on business intelligence, its architecture and components, and finally, the benefits of its application applied in an educational landscape.

II. ANALYTICAL INTELLIGENCE AND BUSINESS INTELLIGENCE

Analytical intelligence consists in the use of data and systemic reasoning in the process of decision making [3].

According to Pinheiro [4], analytical intelligence constitutes the use of knowledge through practical applications and markets that can generate competitiveness to a company.

With the capacity expansion of data storage and computerization of processes, the volume of data available in organizations is increasing; however, these data contribute very little to decision-making. It is necessary to transform them to be used strategically, in a way that they can interact in the process of making decisions according to the needs of the institution. In this context, analytical intelligence is essential.

This information allows a company to recognize their strengths and weaknesses, making actions more substantial and efficient [4].

A. History and Concept of BI

In the early 1980s, the concept of executive information systems (EIS) appeared, increasing the computerized support to managers and top-level executives. Some of the introduced features were dynamic multidimensional reporting (ad hoc or on demand), predictions and forecasts, trend analysis, details, status and access to critical successful factors. These features appeared in dozens of commercial

products in the middle of the 1990s. The same features and some new ones appeared under the name BI.

According to Power [5], in 1989, Howard Dresner proposed "business intelligence" as an umbrella term to describe concepts and methods to improve business decision making by using fact-based support systems.

According to Atre and Moss [6], BI is neither a product, nor a system. It is an architecture and a collection of integrated operational programs as well as decision-support applications and databases that provide to the business community an easy access to business data.

According to Kimball and Ross [7], Business Intelligence is a term that has emerged and evolved over the past few years and is now often used to describe all systems and processes an enterprise uses to gather, process, provide access to, and analyze business information. The term data warehouse is now used to mean the platform for all forms of business intelligence.

Business refers to a commercial activity for profit. Intelligence is intelligence, refers to the ability of learning and understanding.

The process of BI is based on transforming data into information, decisions, and then, finally, into action.

B. Results of Surveys about IT and BI

2,335 chief information officers (CIO) responded to the Gartner 2012 CIO Survey, the annual appraisal of CIO priorities, including all major industries and geographies [8]. The survey result has identified that analytics and BI will be the top technology priorities for CIOs this year.

According to Goasduff and Pettey [9], analytics/business intelligence was the top-ranked technology for 2012, as CIOs are combining analytics with other technologies to create new capabilities. For example, analytics plus supply chain for process management and improvement.

The research results reveal that Business Intelligence is an essential tool for businesses because it allows making the best choices while minimizing the risks of a wrong decision.

C. Architecture and Components of the BI

Figure 1 shows the flow of data, their transformation into information, and finally, knowledge that serves as basis for better decision making. Although this figure shows an architecture with very high level (because it has all the components of a BI tool), it can be used either as a model for a new initiative (according to need of the institution), or as a mean of assessing the current status of an existing architecture in relation to all the components shown in the figure, thus enabling those new components to be added over time.

According to Dresner [10], BI 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, enterprise-class query, analysis and reporting, including dashboards for performance monitoring, and production reporting against enterprise data sources.

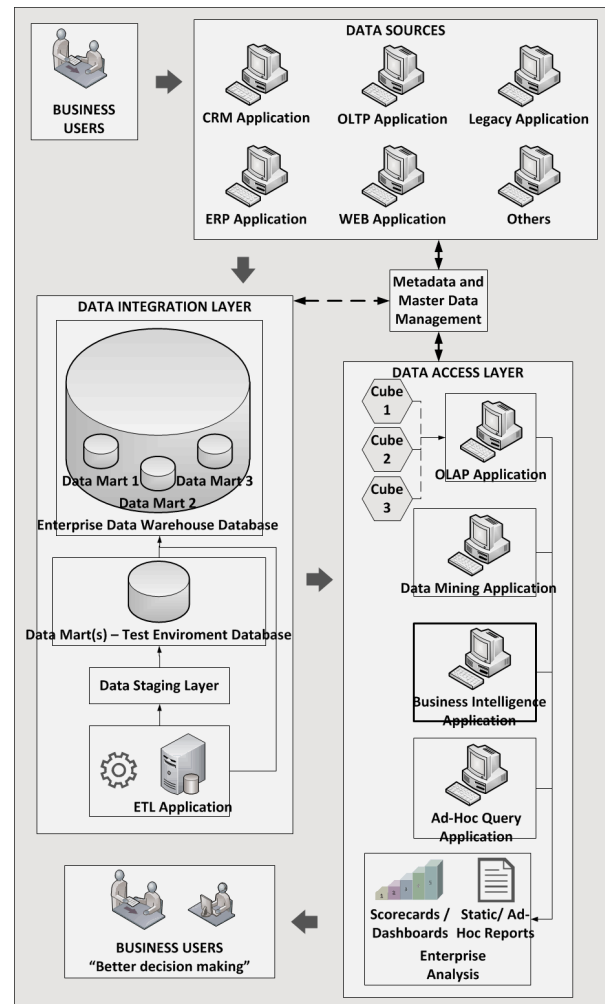


Figure 1. BI Architecture

A BI architecture typically contains the following components:

- **People (Business Users, Administrators, Developers, Technical Support):** People are fundamental in Business Intelligence architecture, as well as the processes and technologies involved. The community of BI users is diverse, but the vast majority focuses on the tactical and strategic levels and their relation to each other.
- **Metadata and Master Data Management:** Metadata can be defined as "data about data." The metadata is stored and managed in a database and is used to describe the definition of the structure, policies and data management of a company. The objective of Master Data Management is to provide processes to collect, aggregate, combine and consolidate data, ensuring quality to distribute these data across the organization to ensure consistency and control maintenance and use of this information.
- **Data Sources:** The data may have several shapes and be obtained from various sources, such as CRM and

ERP. These many data sources make up the landscape of business intelligence company.

- Data Integration Layer: This is where the data gathered by the applications is refined into a corporate structure [11]. Through components such as Data Warehouse, Data Mart, ETL, Ad-Hoc Query Application, it is possible to transform data into quality information that can be useful for any company, especially in decision-making process.
- Data Access Layer: The components as Cubes, Data Mining, OLAP application, BI application allow performing business analysis more efficiently and effectively and are the basis for better decision making.

III. BUSINESS INTELLIGENCE APPLIED IN AN PRIVATE ACADEMIC ENVIROMENT MANAGEMENT

Private educational institutions are making extensive use of business intelligence and predictive modeling in marketing, recruitment and retention [12]. To achieve these goals, they develop the IT infrastructure with new software and process, taking into account "operational efficiency" and "customer intimacy". They understand the needs of students and employers and adapt the curriculum and course offerings in order to promote an alignment with the requirements of the job. Many educational institutions are also deploying academic analysis to create predictive models to improve the retention of students in order to develop an individual learning plan [12]. The assertiveness level in decision making, planning and resource allocation and process improvement have been observed. Some institutions have developed specific analysis to accompany new students in courses, mainly targeting disadvantaged students, and the financial aspect of performance; therefore, making possible to intervene early if a negative factor is identified, thereby aiming to act as a responsible institution that cares about its students. Analysis focused on issues related to access, learning and students performance at all stages of their academic life, allows them to take greater responsibility for their success, in collaboration with parents, teachers and employers. It is noteworthy that the application of Business Intelligence effectively requires a cultural change where decision making and action are based on evidence. This cultural change in an educational institution requires the support of managers in activities, emphasizing performance, creating incentives to support innovation, promoting a change in the traditional academic culture at all levels of the institution [12].

IV. OUR RESEARCH

Aiming to verify the effectiveness of a Business Intelligence tool deployed in an educational landscape, we started a research project in 2012 with completion scheduled for 2013 in an educational institution in Brazil. The scope of the research and a summary of the information collected to date are described below.

A. The Educational Institution

The Educational Society of Santa Catarina - SOCIESC is an educational, cultural and technological institution in Brazil that has existed for 53 years. It possesses 7 campus in two states, and has more than 100 partnerships in E-learning's Centers. It currently has about 20,000 students enrolled in classroom, 4,000 students enrolled in e-learning mode and 1,200 employees that support this whole structure. It operates in various levels as undergraduate, graduate, business training. In addition, a differential of SOCIESC over other educational institutions is that it offers engineering services, consultancy and management for the development of new technologies for national and international companies. Services are offered from modern infrastructure with laboratories in the areas of metrology, chemical and mechanical, through the areas of Technology Management & Research and Development, Tooling, Foundry and Heat Treatment. SOCIESC is certified NBR ISO9001.

B. Research Question

What are the benefits of using a BI tool in an educational institution?

C. Proposal of Research

Analysis the contribution of the use of Business Intelligence Tool in management processes and decision making: A Case study in an educational institution (SOCIESC).

D. Methodology

- Interview with employees of IT department in SOCIESC who are responsible for the project and support of BI in the institution.
- Analysis of the data collected.

E. Study Sample

3 interviews were conducted in the IT department, including one manager and two system analysts who use the BI tool.

F. The BI Tool

The SOCIESC has currently the TOTVS BI Version: 1.11.30. Some features of this tool are:

- Integration with LOGIX ERP [14], currently used in SOCIESC.
- Online information access, using different browsers.
- Enables integration with various data sources, such as Oracle database [15] and Microsoft Excel spreadsheets [16].
- Developed in Java [17] and runs through a server Apache Jakarta [18].
- Operates on Linux [19] and Microsoft OS [20].
- Simple and quick search of information and export data to spreadsheets, analysis customization and graphical views, schedule and automatic send of information via e-mail and security access through system access profiles and analysis access.

G. The BI Architecture

The current BI architecture comprises a data warehouse created in Oracle 10G, which is loaded with data extracted from tables of academic ERP (WAE) and business ERP (Logix) that are also on Oracle 10G database.

H. User Profiles and Departments that use BI

Currently 84 employees distributed in 46 different departments of SOCIESC make use of BI. The audience of BI is: 14 directors representing 17% of audience, 23 managers representing 27% of audience, 38 analysts representing 45% of audience and 9 technicians representing 11% of audience.

I. History of BI in SOCIESC

According to the interviews, the initiative to use a BI tool in SOCIESC started in 2007 by the IT department that developed some analysis in order to leverage and maximize their management decision making. Once the results were positive, the tool was adopted by other departments of the institution contemplating the administrative area and also teaching. Over time, new versions were released by TOTVS, making it more agile and with new features which contributed to a rapid deployment and user training.

J. Analysis Developed in BI

The BI tool of SOCIESC currently contains about 22 analysis developed over the years which help users make better decisions about trade issues, costs, purchasing, human resources, information technology and education. When it comes to numbers, just education alone possesses 10 different types of analysis that allow monitoring of entries in selection processes, enrollment, financial monitoring organization, institutional research conducted by students and teachers.

V. NEXT STEPS OF RESEARCH

The next steps of the research are (i) conduct more interviews and apply questionnaires with users of other departments that use the BI tool, (ii) analyze the data collected, (iii) describe the analysis of BI, (iv) and describe a case study pointing contributions of BI tool in the management of processes and decision making in an educational institution.

VI. CONCLUSION

Aiming to verify the effectiveness of a BI tool deployed in an educational landscape, we started a research project in 2012 with completion scheduled for 2013 in an educational institution (SOCIESC) in Brazil. So far, we have collected various information through interviews about the profile of institution, the BI tool, the architecture of BI, the profile of users and departments that use the tool, history of BI in the institution, and analysis developed.

Our work in progress has demonstrated so far that the current global competitive environment has also impacted the educational sector and that educational institutions are seeking to adjust its strategic. Several educational institutions are looking for the potential of BI, and, therefore, are

adopting BI architectures, applying mainly in predictive modeling in marketing, recruitment and retention of students. The architecture is accessible through the Internet, which provides a greater analytical power, allowing users (parents, students, teachers and analysts) to access and analyze data, information, contextualize and interpret the results and then make the best decisions.

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