DESIGN OF BUSINESS INTELLIGENCE SYSTEMS ALIGNED WITH THE COMPETITIVE INTELLIGENCE PROCESS IN A GRAPHIC BRAZILIAN ORGANIZATION

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In order to enhance their competitiveness or just to survive in the market, companies have intensified their efforts to systematize processes related to Competitive Intelligence (CI). Information Technology (IT) is a key component in this ccontext, since it affects managerial activities and supports decision-making. Specially, IT applied to Competitive Intelligence encompasses "Business Intelligence" (BI) Systems that includes tools and techniques for supporting decision-making. The decision-making support and the facilitation of managerial analysis have attracted the attention of companies to BI systems and also motivated researchers to study the characteristics and impacts of these applications. BI has been considered a high priority in researches with CIOs since 2006, probably due to the necessity to improve business performance in the scenario of great economical uncertainties. In Latin America, following this global trend, analytical capacity and BI are considered top priorities for 2012 - 2015. However, there is an emphasis in technological aspects of development and utilization in detriment to the focus on managerial aspects. This approach makes difficult to associate the organization's CI processes with the directions for designing IT related applications. This paper studies the design of BI systems in alignment with the planning of CI. The adopted methodological approach was a case study, performed in a large Brazilian graphic company that implements BI systems, highlighting the use of performance indicators. The discussion of the results was made based on the perspectives of the CI planning and of the design of BI opportunities. The main contribution of this paper is to relate CI and BI concepts, emphasizing the strategic aspects of the design of the BI system.

Palavras-chaves: Competitive Intelligence. Business Intelligence. BI. Case Study. IT alignment

1. Introduction

The 21st century globalized economy imposes innumerable challenges to corporations, such as elimination of protectionism and taxes, expansion of multinationals and strengthening of competition (MAXIMIANO, 2000; HEINRICHS; LIM, 2005). Especially in Latin America, global spectrum opportunities press for similar competitiveness requirements compared to developed countries (DREYFUSS, 2012).

According to Caixeta and Caixeta (2011), "companies need to be based on strategic activities based on knowledge, marketing intelligence and corporate reputation." To reach a higher degree of competitiveness, or to even maintain itself in the market, companies have intensified their efforts to systematize processes related to "competitive intelligence" (CI), permitting them to consciously adapt themselves to the environment (GOMES; BRAGA, 2001). An important component of this context, Information Technology (IT) impacts most of managerial activities and supports decision-making in all communication areas (MAXIMIANO, 2000). When applied to competitive intelligence processes, IT is called "Business Intelligence systems" (BI), representing the techniques and tools that support the decisions (CABRAL NETTO, 2011).

BI issues, initiatives, and technologies have been considered as a maximum priority in research with CIOs since 2006, probably due to the necessity to improve business performance within the scenario of great economical uncertainties (HOSTMANN, RAYNER and HERSCHEL, 2009). In Latin America, following this global trend, analytical capacity and BI are considered some of top priorities for 2012 - 2015 (DREYFUSS, 2012).

This article describes the conception of BI systems aligned with competitive intelligence planning, inspired by Dishman and Calof (2008) who point out that the principle challenges of effective intelligence processes are related to the executive management, and not the collection of all possible information. The case study in a BI system of a large-scale graphic company is presented to illustrate how performance indicators were established through a competitive intelligence planning process.

According to Cabral Netto (2011), concepts of competitive intelligence are more frequently found in business literature, whereas business intelligence concepts are more often found in technology literature. In relation to BI, greater emphasis is made on the technical aspects and concepts like data mining, in counterpart to a minor focus on matters pertaining to the creation and design of these systems (OLSZAK; ZIEMBA, 2007; WILLIAMS; WILLIAMS, 2007). The main contribution of this article is to correlate the concept of competitive intelligence to the concept of business intelligence, reinforcing the strategic aspects of BI system conception.

The article is structured as follows. Section 2 presents the theoretical framework created from the literary review about the concepts and models of competitive intelligence and business intelligence systems. The methodological proposal and criteria used are described in section 3. The case study of a graphic conglomerate, showing its BI system in capacity management, is detailed in section 4. Section 5 details the resulting analyses and arguments, whereas final considerations, restrictions and proposals for future works are presented in section 6.

2. Theoretical foundation

The theoretical framework of this article is composed of concepts and models of competitive intelligence and business intelligence, presented in the following segments.

2.1. Competitive Intelligence

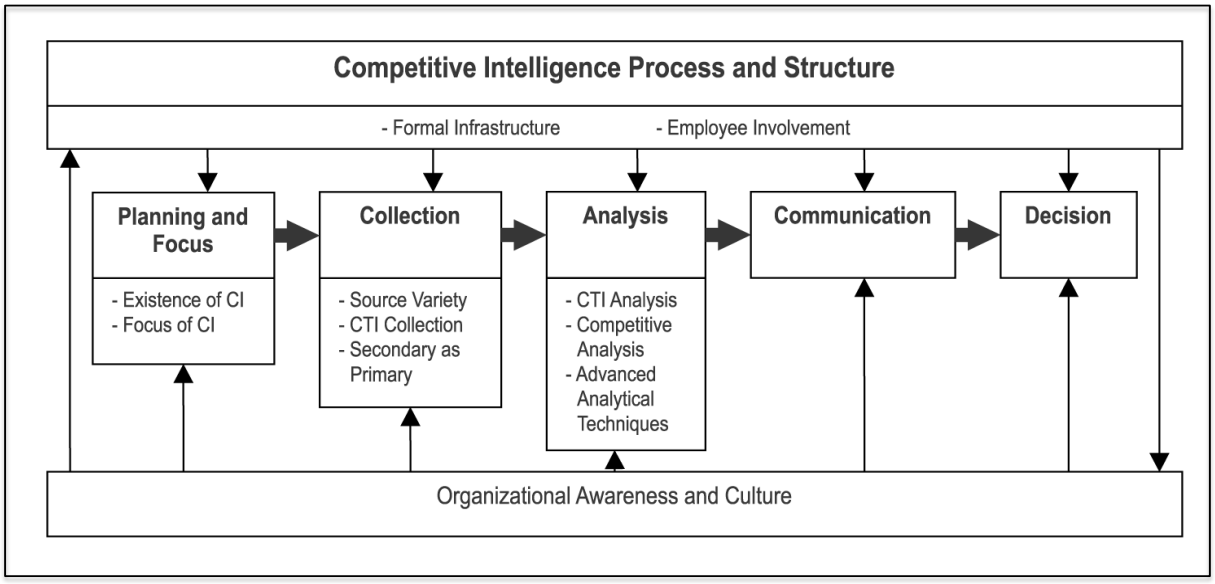
Competitive intelligence represents the development of organizational capacities regarding the collection and analysis of data or information and dissemination of knowledge about business (ERICKSON; ROTHBERG, 2009), and is fundamental for the development of information and relevant analyses that can be used as inputs for strategic process, independently from the kind of strategy or business (FAHEY, 2007).

According to Fahey (2007), there should be an intensive integration between intelligence and management teams within companies, permitting improved efficiency in intelligence work and promoting increased support of business decisions, beyond the enrichment of present and future strategy.

The implementation of competitive intelligence processes requires attention to various factors, since there are distinct steps in order to obtain results. Kahaner (1996) and Dishman and

Calof (2008) point out four representative phases of these factors: the planning cycle, the fact and information collecting, the analysis of the collected material and the dissemination of the intelligence obtained. To represent the stages, the model of Dishman and Calof (2008) includes not only formal components such as infrastructure but also collaborators and organizational culture in order to integrate the phases of CI (Figure 1).

Figure 1 – Model of the competitive intelligence process



Source – Dishman and Calof, 2008

In the Planning and Focus phase two factors are privileged: the recognition of the existence of intelligence and its focus, encompassing the most important problems for executive management, including the goal, the results expected and the resources necessary for the process. The variety of information sources, competitive intelligence regarding the technical aspects and the use of secondary information sources are considered as the most relevant in the Collection phase.

Finally, the Analysis phase emphasizes the capacity for technical and competitive analyses, and the use of advanced analytic techniques. The dissemination of such analyses to the people with authority and autonomy for action is considered a Communication matter, whereas the Decision corresponds to the final step of the process with the decision-making and actions being made by management.

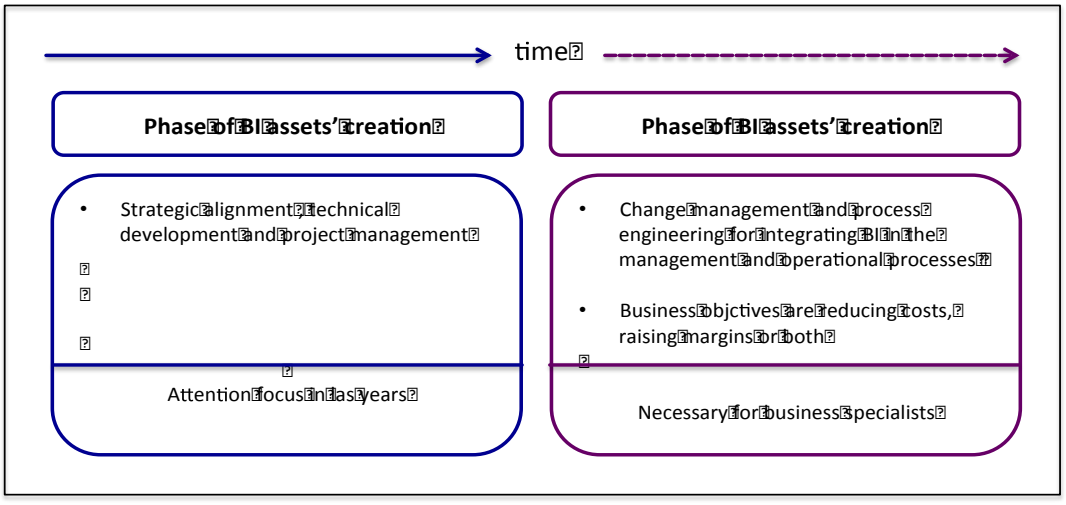
2.2. Business Intelligence

Business intelligence tools enable organizations to understand their external and internal environments by means of systematic acquisition, grouping, analysis, interpretation and exploration of information (CHUNG; CHEN; NUNAMAKER, 2005).

The term "business intelligence" was coined by Luhn (1958), to conceptualize "an automatic system of information dissemination [...], that uses data processing to extract and encode documents and to create interesting profiles for the 'points of action' within the organization." Currently, BI represents a broad category of collected applications and technologies, access and analysis of a large quantity of data in order for the organization to make efficient decisions (COOK; COOK, 2000; WILLIAMS; WILLIAMS, 2003; NEGASH, 2004; REGINATO; BIRTH, 2007). According to the focus of the analysis, BI works with large quantities of data regarding business partners, products, services, clients and suppliers, including the activities and transactions between them (LU; ZHOU, 2000).

The major benefits of BI are flexibility in report creation, rapid access to relevant information and a better visualization of data (LU; ZHOU, 2000). It is worth highlighting that the use of these tools does not predispose competitive advantages. The competitive advantage for the organization is obtained through knowledge management and the strategic use of information (HEINRICHS; LIM; 2005; GOMES; BRAGA, 2001). Quality business decisions come from the use of practical information, and not from the enormous quantity of data, configuring one of the principle challenges for the conception of BI systems.

Figure 2 - Phases of BI in the organizations



Source - Williams and Williams (2003)

Discussing BI advantages, Williams and Williams (2003) point out that only effective utilization can provide business value, observing that many companies have given greater importance to the technical implementation. In this context (Figure 2), BI needs to advance in order to permit value creation from BI assets.

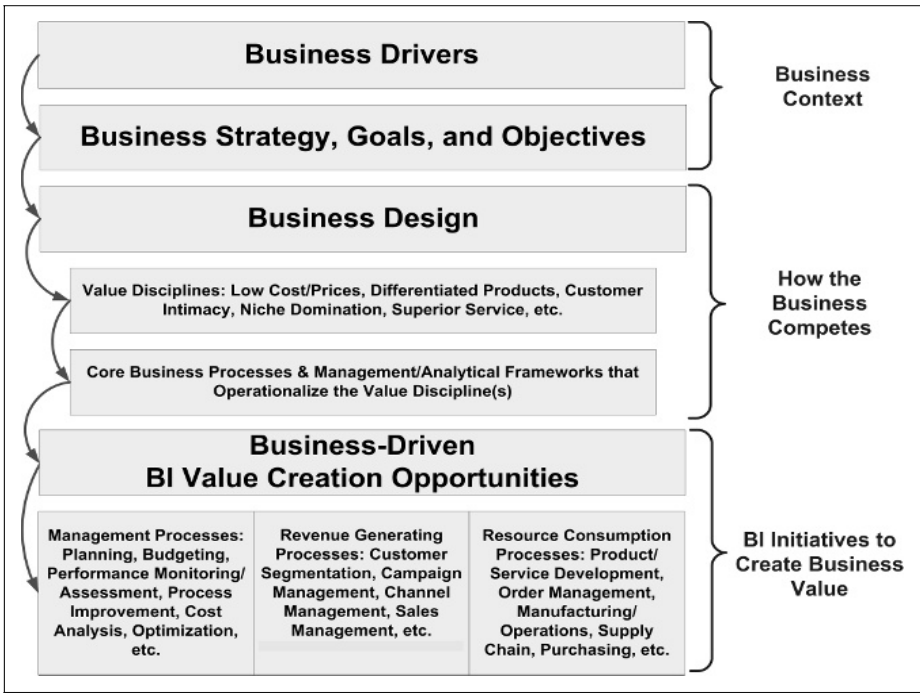
3. Methodological procedures

A qualitative research was conducted, with exploratory purpose to obtain data through documentary investigation, bibliographical research and a case study.

3.1. Model of the Conception of BI Application

BI systems need to align business and IT to become functionally useful to the organization's goals (SEKINE et Al., 2009). A structured approach is necessary (Figure 3) to align the strategic business directions and the BI application, from which the variables necessary are mapped in the conception of the BI systems.

Figure 3 - Model for evaluating and designing opportunities



Source - Williams and Williams (2007)

3.2. Research Questions

Due to incorporating characteristics of mental methods related to decision-making, the proposal of BI systems presents difficulties in trying to reproduce a business management model. Consequently, there are few methods and guidelines, and the creation of BI becomes a cycle of activities that require more time, investments, and efforts (OLSZAK; ZIEMBA, 2007). In that context, the following research question is proposed:

How the design of BI activities was structured in order to obtain a better alignment with the competitive intelligence planning?

3.3. Case Study

To investigate the proposal of the article and discuss the theoretical concepts, a unique case study was conducted. This methodological choice can be useful enough in the straight observation of contemporary events, by means of interviews with the persons involved, in addition to the collection of various types of evidence (YIN, 2005; MIGUEL, 2007).

A large-scale media graphic conglomerate was chosen as a research universe. The case was chosen specially due to the existence of a BI system with good enough utilization on the part of its users. It is already integrated in the business management processes and permits a capture of effective value (WILLIAMS; WILLIAMS, 2003), allowing a detailed analysis of information, from the point of view of technology and business.

The field research was based on a protocol developed from a literature review, using the *Model for the Evaluation of Design of BI Opportunities* (WILLIAMS; WILLIAMS, 2007). In order to grasp most of the business and technology perspectives, semi-structured interviews were carried out with the responsible for:

- The *BI Solutions Center*, that accumulates the responsibilities of development and maintenance for the BI systems and the conception of performance indicators;
- The *Business System Management Area*, that promotes and supports the assistance of line managers to obtain improved performances in each of the functional areas.

The study was carried out between the months of June to August 2012, in the IT area and in the graphic conglomerate. In addition, various documents were analyzed, which permitted a more detailed and formal process.

4. Case analysis

In 2011, Brazilian graphic industry was responsible for less than 0.5% of the Gross National Product; 97% of the companies were considered small scale (between 1 to 19 employees), 2.6% were considered as middle-size (between 20 to 249 employees) and barely 0.4% were categorized as large, with over 250 employees (ABIGRAF, 2012).

4.1 The Company

A large-scale graphic district was the object of study. The company employs over a thousand people and occupies an area of 45,000 m². It attends various clients in Brazil and operates high volumes, having produced over 550 millions publications in 2011.

The printing plant is entirely integrated into the logistics and distribution areas, enabling a strong level of productivity and competitiveness. The company operates with advanced processes and technologies that shorten the release time of publications and guarantee an improved printing quality, required to attend clients' demands.

The technological infrastructure is organized in order to produce magazines, books and catalogues, and the printing process is characterized by: wide circulation; large quantities of pages per publication; strictly on-time publications; short-deadline process; and the need for a prior organization regarding a complex distribution.

The organizational structure of the company is composed of nine functional areas: Sales, Clients Service, Printing, Finished Products, Logistics, Maintenance, Engineering, Quality Control and Quality Management and Processes.

4.2. Capacity Management

Capacity management is considered as an essential competence, and four fundamental dimensions are continuously managed to maintain its competitiveness:

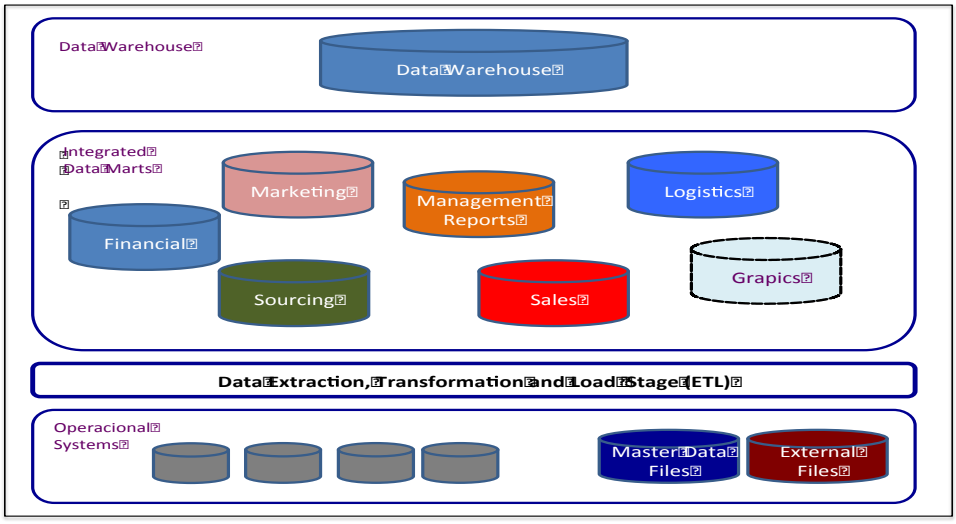
- *Nominal Capacity*, defined as the total income capacity and representing how much would be produced in an idealized situation, considered as the total production during all chronologic hours, with all of the equipment functioning at full speed and without waste;
- *Real Capacity*, that is the ratio between Real Output and Nominal Capacity, and is symbolized by the acronym OEE – *Overall Equipment Effectiveness*. The OEE should be studied in relation to the components of Availability, Velocity and Quality;
- *Internal Demand*, composed by the graphic services delivered to the companies' group members. That demand is, primarily, foreseeable in terms of volumes and deadlines;
- *External Demand*, originated by clients outside the corporation, and arising from the market, also known as "third party clients".

4.3. BI System in the Graphic Company

Initially, a draft was carried out in order to understand the business requirements, to present the technology and to evaluate the data extraction feasibility. Subsequently, a prototype system was developed, in order to facilitate the understanding of platform potentials, anticipating the users routine aspects of work and permitted analyses. The prototype was also used with the purpose of estimating values with suppliers.

The draft evaluation is part of the BI application development methodology of the *Business Intelligence Center of Competence*, where the creation and maintenance of these types of solutions are concentrated. The objectives of the draft were to disseminate BI concepts, present examples and development potential, familiarize those involved with the technology and propose applications that support the process of competitive intelligence in a company, reducing the risks of underused systems.

Figure 4 - Data warehouse and data marts of the corporate BI system



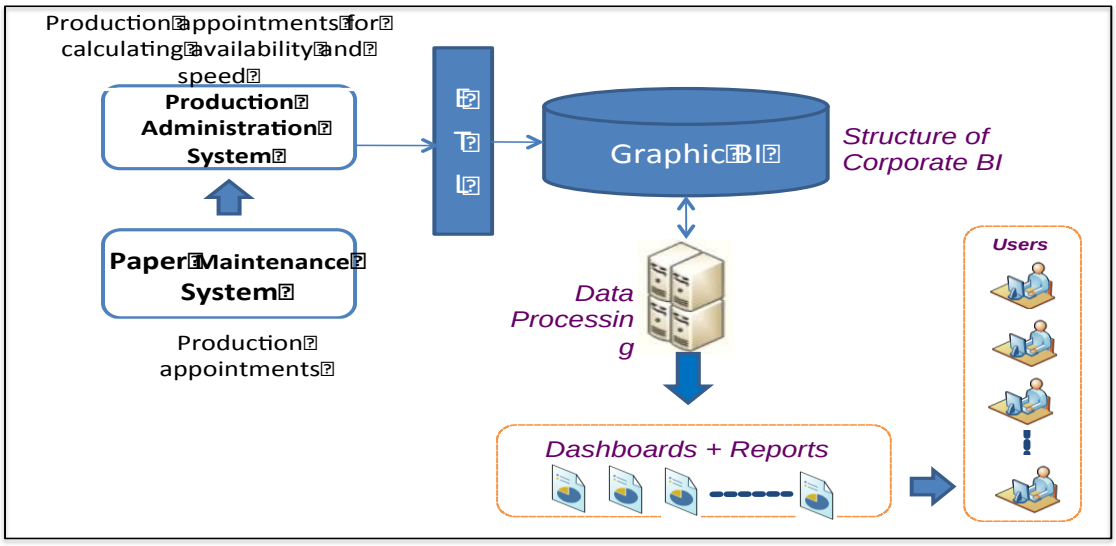
Source – Proposal of the authors

The BI system draft was developed in 2010. After the entire process of analysis and choice indicators, the capacity of graphic management was defined with a system purpose (Figure 4).

The development of BI methodology involves (Figure 5) the design of the central data repository, the *data warehouse*, as in specific databases, *the data marts*, that are integrated according to business need. The project also carried out the following processes:

- Automation of the processes for analyzing the Overall Equipment Effectiveness Complete and Operational, in the Printing plant;
- Automation of the extraction, transformation and shipment of the data originating from the Output Management System (Availability and Velocity) and from the Paper Movement System (Finished Product and Losses);
- Construction of indicator panels and analytic reports validated in the draft, with weekly publication;
- Acquisition and development of data storage for four years;
- Definition of management reports and mailing list for email circulation;
- Development of dashboards of indicators for access via tablets and smartphones.

Figure 5 - Schematic representation of the BI Graphic Solution



Source – Proposal of the authors

Among the benefits of the system, the following stand out: a freedom from time spent in preparing data for analysis; improved agility in anticipation of troubleshooting; improvement in the quality of information; facility of navigation and analysis of indicators (*dashboards*); facility in the creation of reports and graphics through models; and automatic data updating process for presentations.

5. Analysis and arguments

The analysis of the results is based on the models of Dishman and Calof, 2008), with a focus on the Planning and Collection phases, and on the proposal of Williams and Williams, 2007. A consolidation of the analysis will bring subsidies to the research question: *how the design of BI activities were structured in order to obtain a better alignment with competitive intelligence planning?*

5.2. Analysis of the competitive intelligence process (Dishman and Calof, 2008)

Existence of a formal intelligence infrastructure

The area of Quality and Processes Management, responsible for the advisory and support of the line managers, provides competences characterized as non-specific, but complementary, aiming at on-going improvement. Among those complementary competences, are improved

methods of management; quality and productivity tools; new business models; aid methodologies and troubleshooting; and a set of performance indicators. The graphic management stimulates improved interaction in employee groups and the exchange of business knowledge, contributing to a good level of involvement, and there is a search towards continued performance improvement. In the specific case of intelligence processes, activities are consolidated in the area of Quality and Processes Management.

In spite of having a managerial analyses culture and historical series of performance indicators, the company was not familiar with the utilization of BI systems. Due to the importance given to the management tools and improvement of processes, the area in charge was well positioned to utilize, coordinate and disseminate the obtained results.

Planning, focus and collection

The efforts directed to the competitive intelligence process, formalized principally in the structure of Quality and Processes Management, characterize the existence of the intelligence function. Additionally, the area is organizationally positioned in order to provide support to all business managers and to the Supervision. A wide range of data, both internal and external, is utilized in the creation of reports, presentations and *insights*. The information can be structured, like those derived from production systems, semi-structured or unstructured, as *benchmarking* derivatives, *holdings* reports, sector analyses, competitor observations, commercial and specialized media, etc.

5.3. Analysis of the conception of BI opportunities (Williams and Williams, 2007)

Business guidelines, strategy, goals and objectives

The most important competences of the business are flexibility, differentiation and responsibility. In the long term, however, a situation of strong competition and reduction of demand persists, imposing a "price war" in which clients have a bigger bargain power. In this scenario, the differentiating competences are not valued, and clients are sensitive in relation to basic competences: price, quality, and deadline, which, combined with the differentiation, become the drivers for strengthening competitiveness.

The graphic company specializes in large volumes with high circulations and multiple print structures, in an inversed line with segmented printing, characterized by a reduction of

circulations and diversification of the content. Attending client requirements of quality and punctuality, it requires large-scale, costly and highly specialized equipments, and a short *lead time*. Due to those factors, the company is pressed by a combination of high fixed costs and low variable costs. The strategy aims to efficient capacity occupation, seeking third party clients (external demand) to reduce periods of idleness generated by seasonal variation within internal demand.

Business Model and strategy implementation

Internal clients represent approximately 70% of the demand and offer high circulations, in spite of the seasonal variation characteristic in the publication market: annually, with higher volumes during the second semester; monthly, with first and fourth week hot spots; and weekly, with peaks on Friday. Additionally, the *setup* has to be limited to guarantee the rigorous respect of deadlines. The Graphic company, in order to answer the demand, operates with large-scale equipment, with a low automation level, and requires the involvement of numerous specialized laborers.

Considering the larger strategic objective of effective occupation capacity, three fields of business value are identified:

- Adequate management of the existing capacity, to guarantee the internal demand compliance and facilitate the sale of capacity to third parties, improving the level of use throughout the year;
- Productivity improvement, to reduce the waste of paper and to adjust the product combination and configuration of the machines;
- Improvements in the margin by product, to optimize production and sales costs and adjust the selling prices.

Business Processes and Models of Management

The key business processes are:

- Preparation of printing matrices, considered as the quality sector and the most technologically advanced process. It works with the additional capacity to absorb the seasonal variation and the strictness of deadlines;

- Printing, considered as the most complex and costly process. That is the capacity and cost sector, where the highest risk of delay can occur;
- Finishing, considered as the flexibility sector, that works with the additional capacity to recover eventual printing delays.

Opportunities for value creation in BI driven by business

Some BI development opportunities were analyzed: financial analyses (profitability, waste, investments, revenue x planning), operational analyses (production capacity, planning load, OEE, performance, maintenance) and strategic analyses (*Balanced Score Cards*).

Based on the industry, the strategic drivers, the strategy and its implementation, and the business model, the development of the BI system was chosen based on the relevant general competences for capacity management, with a focus on the analyses of the OEE.

The monitoring of OEE and its components (Availability, Velocity, and Quality), that reflect universal printing indicators, permits direct management guidelines in the principle strategic challenges of the Graphic company, which is the maximum occupancy capacity. The potential benefits are: a reduction of failures, breaks and the speed of maintenance of the equipment; reduction of setups; reduction of waste and defective products; and improvement of machine configurations and product combinations.

6. Final considerations

This paper described the conception of a BI system aligned with the competitive intelligence planning. Supported by a revision of literature regarding systems of *business intelligence* and competitive intelligence, the article emphasized the need for structured analyses regarding the strategic aspects of a company in the phase of BI conception and creation.

The case study of a large-scale Brazilian graphic company showed the design of a BI system that supports the decision-making in a key business process, such as capacity management. This BI application was designed from the strategic drivers of the business, and structured according to the competitive intelligence planning.

The frameworks from Dishmann and Calof (2008) and Williams and Williams (2007) reinforce the need for understanding the vital aspects of the business, providing: a facilitated

context for strategic alignment; a partnership between the BI competence center and the business area; and a culture of improvement and continuous commitment in relation to managerial analyses.

In spite of differences in business context, the analysis approach can be used in various BI solution development situations, since it provides sufficient elements for the development of analyses that can direct applications, which are related to key business competences. Further studies should deepen the investigation about the main aspects pointed in this paper.

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