# Pervasive Business Intelligence: a key success factor for business

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# Pervasive Business Intelligence: a key success factor for business

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**Abstract** Today the strategic significance of information is fundamental to any organization. With the intensification of competition between companies in open markets and often saturated, companies must learn to know themselves and to the market through the collection and analysis of quality information. The strategic information is seen as a key resource for success in the business, which is provided by Business Intelligence systems. A successful business strategy requires an awareness of the surrounding (internal and external) environment of organizations, including customers, competitors, industry structure and competitive forces. Managing the future means not only is able to anticipate what will happen outside the organization, but also be able to represent the events through their own actions timely. To make it possible, Pervasive Business Intelligence arises as a natural evolution of business intelligence applications in organizations, allowing to companies achieve and maintain a sustainable competitive advantage, helping managers react proactively in a timely manner to threats and opportunities.

## 1 Introduction

Increasingly there are a greater number of organizations that provide Business Intelligence (BI) to their decision makers (internal and external). Internally, reinforces the responsibility of all the collaborators and the improve management stability. Externally, relations with suppliers and business partners can be strengthened through effective sharing of performance indicators for mutual benefits [1].

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It is very important and also difficult for organizations to make the right decisions. Companies know that the ability to make the right decisions is often essential for increased profits, for risk management and for good overall performance. Due to uncontrollable factors such as the fast-moving markets, the economic and regulatory changes, and new sources of competition, making the right decision is not a peaceful issue.

BI can be understood as the use of different sources of information to define the competitive strategies of an organization [2]. BI goes from the process of collecting large amounts of data, its analysis, and consequent production of reports that summarize the essence of actions on the business, which will assist the managers in the decision making of the day-to-day business [3,4]. Thus, we can consider that BI is the process through which users obtain accurate and consistent data from the storage of organizational data environment. The data obtained from various business contexts, allow users to identify, analyze and detect trends, opportunities, threats and anomalies, and make predictions. BI systems and tools play a key role in organizational strategic planning process. These systems allow collect, store, access and analyze data in order to support and facilitate decision making process [5]. The organizations develop their strategies to maintain or achieve a sustainable competitive advantage, thus being hostages of BI systems and tools.

Pervasive Business Intelligence (PBI) is a management concept that refers to a collection of tools and technologies that provide capabilities to collect analyze and process data the organization data. Regardless of the size of the organization, the main objective of PBI is to assist in decision-making process, all levels of the organization timely.

The intensification of competition between organizations in nowadays saturated markets, makes organizations hostages and dependent of the information with strategic significance, which includes know themselves, the stakeholders and to the market. A successful business strategy requires an awareness of the internal and external environment of organizations, including their customers, competitors, industry structure and competitive forces.

This chapter presents a framework for Pervasive Business Intelligence as a key factor to enable organizations to gain or maintain a sustainable competitive advantage. The chapter is organized as follows. In this introductory section is dedicated to the presentation. The 2$^{nd}$ section discusses PBI. The next section (3$^{th}$) is dedicated to presents the propose PBI framework for achieving competitive advantage. In 4$^{th}$ section, are presented the final remarks and future research options.

## 2 Pervasive Business Intelligence

The ability to make the right decisions timely is essential for increased organization profits and a good performance. Companies are emerged in an environment of uncontrollable factors: economics, regulatory, markets, competition and others; and decide correctly at the right time is not a peaceful task.

Based on existing studies, we found three different approaches to BI: a management approach, a technical approach and a value-added approach. The management approach addresses the BI as a integration process of data collected from the organizational environment (internal and external) in order to be able to extract the relevant knowledge for management decision making [6,7,8,9]. In the case of technical approach, BI is presented as a set of tools that support the process outlined by the management approach. The emphasis is given to the technology used, not to the process itself [10,11,12]. In the value-added approach, BI systems provide added value in the acquisition of competitive advantage [13,14,15].

In the current situation, the markets are mature and saturated, and exposed to fierce competition; companies are forced to seek alternative ways to increase the value of their BI initiatives, being greater the effort to achieve PBI [16]. The focus will be disseminate BI across all areas of the business, and BI systems become part of business processes, with flexibility to adapt business changes and information needs [17].

There are various definitions of PBI, is the ability to deliver timely manner to all users, the integrated information in data warehouses (DW), providing the necessary visibility, knowledge, and facts for decision making in all business processes [18]; is the improvement of the capabilities of making strategic and operational decision of an organization, through the design and implementation of the organizational culture of business processes and technologies as a whole [19]; is BI across the organization, providing to all people, and at all levels of the organization the analyzes, alerts and feedback mechanisms [20].

The implementation of PBI in organizations is supported by applications that access the data in real time, supporting the actions of supply chain management (SCM), and the actions of customer's relationship management (CRM). The application of PBI is increased when the employees are on the front line contact with customers and can create new sales opportunities, up-sell and cross-sell [18]. The PBI aims to align all processes, to allow the delivery of relevant information to users who need support in decision making.

There are five key factors with great influence in the dissemination of BI [19]: quality of the BI project, level of training, prominence of regulation, non-executive involvement, and use a methodology of performance assessment (Fig. 1). In the first key factor, the quality of the BI project, the expectations of users for the components of BI solutions are satisfied. The next key factors, the level of training, the user's degree of satisfaction with the training in the use of BI tools and analytic techniques to improve the decision making is high. The third key factor, prominence of regulation, it focuses on the importance of regulation and policies regarding data in BI systems. The key factor non-executive involvement represents the involvement of non-executives in disseminating and promoting of the use of BI tools in the organization. The last key factor, using a methodology of performance assessment is focuses in the importance of using a formal methodology for assessing performance within the organization.

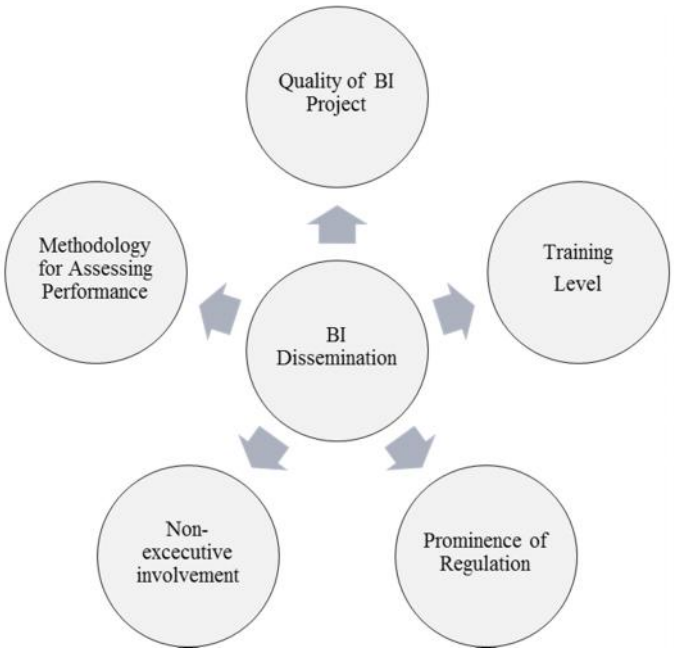


**Fig. 1 Key success factors in BI dissemination.**

A company with BI systems can integrate powerful tools, monitoring system with various metrics, data integration, among other features, analysis, standardized reporting within a service-oriented architecture [21], and that is essential for a good business management, guiding managers for quality information, with the establishment of standards and procedures to ensure compliance with the objectives [22]. It is not guaranteed that a BI system will generate a return on investment, but an adequate and integrated BI, can create the competitive advantage necessary for organizations. Once identified business processes, must be identified key stakeholders, the roles, the system functional requirements, the information needed for reporting, analysis, and presentation delivery should be defined. Companies that have adopted BI systems can compete more effectively in the marketplace, with additional information about their customers, suppliers, concurrence as well as a more efficient financial management. Then, companies should adopt a strategic and active behavior, adjusting strategies and becoming more competitive compared to competitors [23].

PBI arises as a normal evolution of BI applications in organizational scope, with application from the strategic level to operational level, and appears on the last level ($5^{th}$) of maturity of BI, the pervasive level. The $1^{st}$ level of maturity, is characterized by inconsistent data, with a high use of spreadsheets and limited use of adequate communication tools, users have high dependence on IT department. In the $2^{nd}$ level, it can be seen some investment in BI, but the majority of are not sufficiently qualified to take advantage of the system, and managers do not trust in information provided. At the $3^{th}$ level, organization has the first success and therefore the first benefits to the business, although, this level is characterized by the absence of application data inte-

gration. In the 4th maturity level, the organizational already have a defined strategy for develop BI; the strategic information is trustable and is used to support strategic decision making process. Users have the appropriate knowledge to use BI tools, and data quality is supervised constantly. In the last level (5th), BI is disseminated across all organization, crossing all business areas of the business with the organizational culture. BI systems are integrated into the business processes, enabling that organizational changes be adapted to meet the information needs,

PBI is the operationalization of BI throughout the organization enabling BI systems reaches all levels of the organization, at the right time and with the necessary information.

## 3 Achieve Competitive Advantage

We can understand competitive advantage as a core competence that will give to the organization a strong competitive position compared with the competition. An organizations achieves competitive advantage when offer a superior value to customers. The efforts made in search for a competitive advantage are consolidated in the company strategy [24].

Advanced information of the variables present in a scenario of a competitive environment has a high strategic value. If a company is able to anticipate favorable \ unfavorable situations for a particular scenario, then is possible develop an appropriate strategy for action. In this sense, investments in competitive intelligence are always very opportune [25].

Companies need to develop their own strategies to gain competitive advantage over its competitors. Any successful company has one or two functions it performs better than the competition (core competence). If a core competence of a company offers an advantage in the market over the long term, it is called the persistent competitive advantage. For a core competency reach this level will have to become difficult to imitation, single, persistent, higher than the competition, and applicable to many situations.

In today's world with a rapidly adaptive competition, none of these advantages can persist for a long term. The only way of competitive advantage to be truly sustainable is to build an organization so alert and agile that can always detect benefits, opportunities, and threats immediately, regardless of changes in the market, being fundamental the support provided by PBI systems.

We can see BI systems as a set of decision support systems (DSS) that allows decision makers to direct their actions according to the organization strategy. For DSS be successful, decision making process is critically dependent upon the availability high quality information integrated, organized and presented timely [26,27].

To create and maintain competitive advantage, companies need to adapt constantly, changing business processes to meet the needs and expectations of customers, suppliers, stakeholders and changes in the business environment (Fig. 2). To improve business processes, companies have to make the necessary changes, being necessary to redesign processes. In this context, managers need a method that allows them to

determine timely a concise manner to do that, the processes that no longer meet the needs of the business and need to be redesigned. Enterprise systems support business processes, recording the nature of the operations that are performed, being possible to build and understand the real models of existing business processes. Process Mining (PM) refers to the tools and techniques that allow the extraction of knowledge of available event logs in enterprise information systems. These techniques and tools provide new ways to discover, monitor and improve processes. The process mining assumes that it is possible to obtain the flow of activities for a process from execution logs of transactions made in information systems. The initial process mining techniques, allow achieving satisfactory results for well-structured processes, but failed in the case of unstructured or poorly defined processes, which lacked a strong dependency between activities [28]. The processes mapping is vital for companies who wish to align their processes with business strategy activity. The mapping of processes of a company, allows faithfully retract information flows, identify their weaknesses, existing inconsistencies, which support the flow of information (digital, physical). The objective of process mining is the extraction of information from the logs in order to capture the business process, in the way it was executed.

The PBI include technologies and tools. The technologies include data warehousing (DW), and on-line analytical processing (OLAP). A DW is a relational database that is designed for query and analysis, is a repository for all the data that various organization business systems collect. The OLAP processing, deals with the ability to analyze large volumes of information in various perspectives within a DW. The OLAP also refers to the analytical tools used in BI for visualization of management information and supports the functions of the organizational business analysis. The tools include data mining (DM) and PM. DM is a set of methods and techniques for sorting through data to identify patterns and make relationships between the data. PM is a set of techniques and tools that allow the extraction of knowledge from the logs of events available in organizational the information systems. PM purpose is to log the information extraction to capture the business process manner that it runs. PBI technology and tools help end-users in decision make, providing accurate, current and timely information.

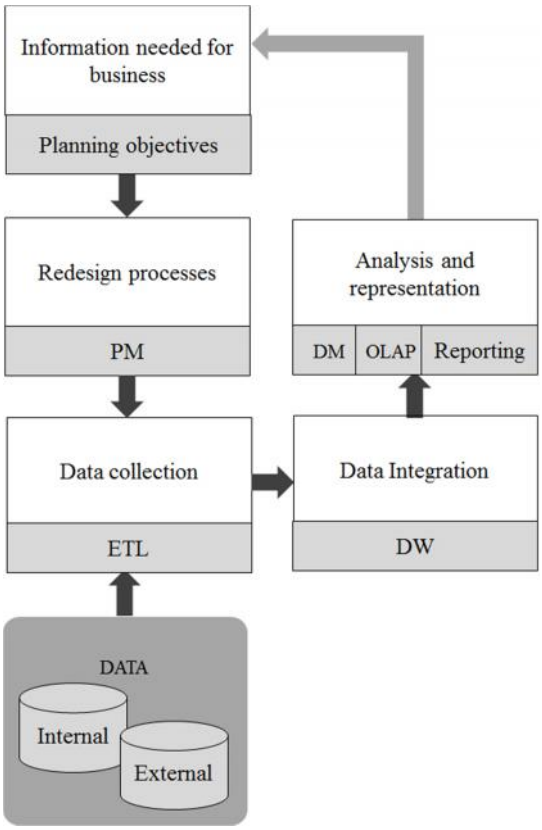


**Fig. 2 Pervasive Business Intelligence Framework.**

## 4 Conclusion

The today's business environment and its complexity forces companies to be agile and proactive in relation to decision making processes [29], it is necessary to understand the information to track the history of sustainable future events, leading many organizations to adopt BI systems in its business processes [30]. Then, one of the keys of business strategy for creating competitive advantages is based on the understanding of the data that companies generate in its own business, and the information processing has gradually become the foundation for achieving competitive advantage, and organization has to believe that have the information needed at the right time [31]. BI systems and tools have a crucial role in decision making process, allowing collect, store, access and analyze organizational data in order to support and facilitate decision making [5]. BI tools have a number of advantages for businesses, emphasizing the reduction of the dispersion of information; improved access to information; real time infor-

mation availability; flexibility and versatility in adapting to the reality of the company and usability useful in the decision making process [32].

PBI emerges from a natural evolution of the BI systems, with an application from the strategic level to the operational level. According Vesset, PBI is the improvement of the strategic and operational decision making capabilities in a organization through the design and implementation of it as a whole, including organizational culture, business processes, and technologies [19]. PBI aims to integrate and align all processes, to enable the delivery of relevant information which assists users in decision making process.

PBI allows decision makers to react in time, to the threats, problems, opportunities, supporting the creation \ maintaining competitive advantage. The only truly sustainable competitive advantage is to build an organization so alert and agile that can always detect benefits, opportunities, and threats immediately, regardless of changes in the market, being fundamental the support provided by PBI systems and tools [33].

Todays, the complexity of internal and external business environment increases the need for pervasive business intelligence. PBI will be achieved only when the BI is integrated into the organization's business processes, and being an integral part of the decision making process too. Just in these circumstances, pervasive business intelligence systems could help managers react in a timely manner to threats and opportunities, being proactive and reactive [34].

In future research options our intention is to improve the framework and test it with ontology models.

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