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Pervasive Business Intelligence: a Marketing Intelligence Framework Proposal

Doctoral Thesis in Information Systems and Technologies

Area of Information Systems and Technology

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STATEMENT OF INTEGRITY

I hereby declare having conducted my thesis with integrity. I confirm that I have not used plagiarism or any form of falsification of results in the process of the thesis elaboration.
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Acknowledgments

RESUMO

Nos últimos anos, o crescimento mundial desacelarou, os mercados têm amadurecido e tornaram-se mais competitivos. O impacto da computação nas organizações fez das tecnologias da informação um elemento estratégico para a aquisição e manutenção da vantagem competitiva, dependendo estas dos sistemas e ferramentas de Business Intelligence (BI).

Hoje, a importância estratégica da informação é fundamental para as organizações. Com a intensificação da concorrência entre as empresas em mercados abertos e muitas vezes saturados, as empresas devem aprender a conhecerem-se a si mesmas e ao mercado, através da recolha e análise de informação de qualidade. A informação estratégica é vista como um recurso fundamental para o sucesso do negócio, a qual é fornecida pelos sistemas de Marketing Intelligence (MKTI). O MKTI é um processo complexo que vai desde a recolha de dados do ambiente competitivo das organizações, ás informações criadas para auxiliar a tomada de decisões de gestão e a estratégia de marketing. Uma estratégia de negócio bem-sucedida requer uma tomada de consciência do ambiente interno e externo das organizações, incluindo clientes, concorrentes, a estrutura da indústria e as forças competitivas. A gestão do futuro não significa apenas ser capaz de antecipar o que vai acontecer fora da organização, mas também ser capaz de representar os eventos através das suas próprias ações.

Com base na revisão de literatura realizada no âmbito do Business Intelligence e áreas relacionadas, os objetivos e motivação para esta tese foram identificados, permitindo a escolha do tema desta.

Apercebemo-nos da inexistência de literatura e estudos suficientes, sobre questões relacionadas com o Pervasive Business Intelligence (PBI) e Marketing Intelligence, e assim o problema de investigação foi identificado, considerando as necessidades dos gestores de marketing na obtenção de informações de apoio à decisão em tempo útil, permitindo-lhes ser proactivos e enfrentar a concorrência, alavancados pelas capacidades dos

sistemas e ferramentas de PBI, que permitem que os sistemas de BI cheguem a todos os níveis da organização, no momento certo e com as informações necessárias.

O objetivo deste estudo é desenvolver um *framework* conceptual para auxiliar os *marketers* no processo de tomada de decisão, alavancado por várias tecnologias, estratégias e recursos para uma inovação sustentável. Pretende-se integrar os processos de MKTI em sistemas Pervasive Business Intelligence através do desenvolvimento de um *framework* com o objetivo de auxiliar na recolha e pré-processamento de dados e sua divulgação de forma sistemática, a fim de auxiliar os marketers na tomada de decisões. O *framework* proposto foi avaliado por um painel de especialistas, tendo sido aplicada a metodologia Delphi na aferição deste. Esperamos que esta pesquisa possa ser considerado como um contributo para uma melhor compreensão da aplicação da MKTI em sistemas PBI, possibilitando ás organizações alcançar e manter uma vantagem competitiva sustentável.

Palavras-chave: Business Intelligence, Pervasive Business Intelligence, Database Marketing, Data Mining, Process Mining.

ABSTRACT

In recent years world growth slowed, markets have matured and become more competitive. The impact of computing in organizations made information technology a strategic element for the acquisition and maintenance of competitive advantage, as those dependent on Business Intelligence systems (BI) and tools.

Today the strategic significance of information is fundamental to organizations. 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 Marketing Intelligence (MKTI). MKTI is a complex process that goes from the collection of data from the organizations competitive environment, to the information generated to assist management decision making and strategic marketing. A successful business strategy requires an awareness of the internal and external environment of organizations, including customers, competitors, industry structure and competitive forces. Managing the future means not only be able to anticipate what will happen outside the organization, but also be able to represent the events through their own actions.

Based on the a literature review, carried under the Business Intelligence and related areas, objectives and motivation have been identified, allowing the thesis theme choice. We realize the lack of sufficient literature and studies on issues related to Pervasive Business Intelligence (PBI) and Marketing Intelligence, and thus the research problem was identified considering the needs of marketers to have information to support timely decision, allowing them to be proactive and face competition, leveraged by the capabilities of PBI systems and tools, that enable BI systems reach all levels of the organization, at the right time and with the necessary information.

The objective of this research is to develop a conceptual framework to assist marketers in decision making process, leveraging various technologies, strategies, and resources for sustainable innovation. We intended integrate the processes of MKTI in PBI system

through the development of a framework with the objective of assisting in the collection and pre-processing of information and its dissemination systematically, in order to assist marketers in decision making..

The proposed framework was evaluated by a expert panel, for that, it was applied the Delphi methodology to assess the framework. We hope that this research will be considered as a contribution to a better understanding of the application of MKTI in PBI systems, which will enable organizations can achieve and maintain a sustainable competitive advantage.

Keywords: Business Intelligence, Pervasive Business Intelligence, Database Marketing, Data Mining, Process Mining.

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Terminology

BI   Business Intelligence is the process by which users obtain accurate and consistent data from the storage of organizational data environment (data wharehouses, data marts), that allow users to identify, analyze and detect trends, anomalies, and make predictions.

CRM   Customer relationship management is an integrated management system for relationship management with customers.

DB   Database is a collection of information that is organized that can be accessed, managed, and updated.

DBM   Database Marketing refers to the use of information databases to support marketing activities in order to obtain useful information to establish and maintain a profitable interaction with the customer.

DBMS   Database management systems is system software for creating and managing databases.

DM   Data Mining is a set of methods and techniques for sorting through data to identify patterns and establish relationships between the data.

DSR   Design Science Research is a set of analytical techniques and perspectives for performing research in Information Systems and is the selected approach and methodology for this study.

DW   Data Warehouse A data warehouse is a relational database that is designed for query and analysis, is a repository for all the data that various organization business systems collect.

ETL   ETL is a process mining process that Extract, Transform and Load, organization internal and external data sources.

FSM   Finit State Machines is a model of behavior using states and state transitions.

IDC   International Data Corporation is an global provider of market intelligence, analysis and advisory firm, specializes in information technology and telecommunications.

IS   Information System is an infrastructure that supports the organization's information flow (internal and external), ie, a set of interrelated components that collect, process, store

and distribute information to support decision making and control in an organization.

IT Information Technology is the set of technological and computing resources to the creation and use of information.

KDD Knowleadge Discovery on Databases KDD is usually defined as a nontrivial process of identifying valid, previously unknown and potentially useful patterns in data (Fayyad 1996).

MKTI Marketing Intelligence is a complex process from the collection of the data of the competitive environment of organizations, to create information (extracted knowledge) to assist in making management decision and the marketing strategy.

ML Machine Learning evolved from the study of pattern recognition and computational learning theory in artificial intelligence, and explores the study and construction of algorithms that can learn from and make predictions on data.

OLAP On-Line Analytical Processing deals with the ability to analyze large volumes of information in various perspectives within a Data Warehouse (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.

PBI Pervasive Business Intelligence is the operationalization of business intelligence (BI) across the organization, reaching all levels of the organization at the right time and with the necessary information.

PM Process Mining is a set of techniques and tools that allow the extraction of knowledge from the logs of events available in the information systems (IS) organizations. The purpose of PM is to log the information extraction to capture the business process manner that it runs.

PMKTI Pervasive Marketing Intelligence is a integration of marketing intelligence systems (MKTI) into pervasive business intelligence (PBI) systems, which will enable organizations can achieve and maintain a sustainable competitive advantage.

SME Small and medium-sized enterprises.

PART I – Presentation

This thesis was developed under the Doctoral Program in Information Systems. This chapter begins with a short introduction, followed by the presentation of the motivation which led to this research, followed by the explanation of the research objectives and contribution, and ending with the presentation of the structure of the thesis.

In this work, we intend to present a framework for the integration of Marketing Intelligence (MKTI) processes in Pervasive Business Intelligence (PBI) systems, which will assist in information gathering and dissemination MKTI systematically. The goal is the proposal, assessment and evaluation of a model of integration MKTI processes in PBI systems.

1.1   Motivation

Today, the ability to collect, process, store and create data, outpaced our ability to make meaningful the data hidden in organizational databases. In today's competitive environment, organizations have to maintain its customers order to remain competitive. The transformation of data into useful knowledge is a complex but promising process, leading to the term ''We are drowning in information but starved for knowledge'' (Naisbitt, 1986). In this context, the Business Intelligence propitious an environment that facilitates access to information necessary for the day-to-day, allowing to analyze the current situation of the business and its performance. Systems and Business Intelligence (BI) tools play a key role in the strategic planning process of organizations. There are many issues that should be envisaged, before the organization operationalize approaches for optimization of marketing activities supported in databases. Considering the large volume of existing data in organizations, it's easy think about great potential they have for the marketer in supporting decisions, and supporting marketing activities. However, large amounts of data itself represents only the occupied space.

The information processing, has gradually become the foundation needed to achieve competitive advantage. The organization has to believe that have the right information, at

the right time, and available to the right people (Palmer & Hartley, 2000; Zeng, Li, & Duan, 2012).

The marketing information systems are an approach to information management, consisting in four interdependent elements: internal data, market research, decision support systems for marketing and Marketing Intelligence (Marshall & LaMotte, 2011).

The internal data are used for the functions of planning and control; market research provides data on the effectiveness of marketing, allowing to react to a threat or opportunity; systems to support marketing decision are composed of a set of models that help drawing up estimates (Palmer & Hartley, 2000; Marshall & LaMotte, 2011); finally the MKTI is based on continuous information meeting, which is used by marketers, claiming to be an indispensable feature to achieve and maintain a sustainable competitive advantage (West, John, & Essam, 2010). The current trend of research centers in the fields of marketing, focuses on the Marketing Intelligence as a likely way to ensure the survival of marketing departments, making them more efficient and competitive in the results obtained.

Then, will be held the approach of some topics related to Pervasive Business Intelligence and Marketing Intelligence. It is intended integrate the processes of MKTI in Pervasive Business Intelligence system through the development of a framework with the objective of assisting in the collection and pre-processing of information and its dissemination systematically. We intend to evaluate and structure the process of MKTI, in order to assist marketers in decision making.

1.2   Research Objectives and Contribution

Pervasive Business Intelligence is a management concept that refers to a collection of programs and technologies that provide resources \ capabilities to collect, analyze and process data access to the organization. In any organization, the main objective of PBI is to assist in decision-making, on time and to all levels of the organization. In a global world where we live, little is done without information with strategic significance. With the intensification of competition between companies in both open and often saturated

markets, companies have to wonder if know themselves and to the market, through the collection and quality of information analysis. Strategic intelligence is seen as a key resource for success in the business, which is provided by Marketing Intelligence. The MKTI is a complex process that goes from the collector of the competitive environment data, until its exploitation, to the information generated auxiliary strategic management and marketing decision-making. A successful business strategy, requires an awareness of the external environment of organizations, including their customers, competitors, industry structure and competitive forces.

Despite the popularity of terms related to intelligence adapted to business publications on marketing intelligence in recent years are few (Graph.1), and many with only a brief concept description. The results of the search on Proquest ABI\Inform, designed to identify items that have approached intelligence in the business context (Calof & & Wright, 2008).
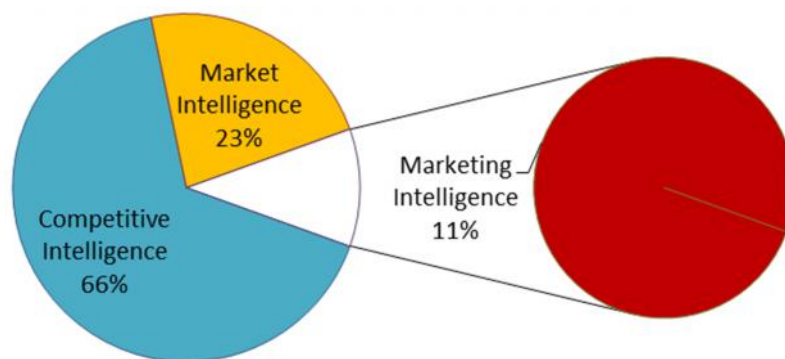
Graphic 1. Proquest ABI\Inform - Intelligence in business context

The management of the future, not only means being able to anticipate what will happen outside the organization, but also be able to represent the events through their own actions. In this surrounding context is intended to present a conceptual framework that integrates the MKTI in PBI systems proactively.

The main general purpose of this research is to develop a conceptual framework to assist marketers in decision making process. In this project, the study of different approaches

and techniques leveraged all the work. Therefore, the main question investigated by this thesis is: Can the MKTI systems improve the decision making process in PBI context?

Besides the main research question and effective contribution, this work also contributes with:

- A Database Marketing framework proposal;

- A Marketing Intelligence conceptual framework proposal;

- Process Mining framework proposal for Pervasive Business Intelligence;

- A Pervasive Business Intelligence framework proposal;

- Pervasive Marketing Intelligence framework proposal.

The research presented can be considered as a contribution to a better understanding of the application of MKTI in PBI systems, which will enable achieve and maintain a sustainable competitive advantage.

1.3 Thesis Organization

The thesis is organized into five parts (Figure 1): introduction, background and related work, research approach and outputs, developed work and contribution and the final conclusions.
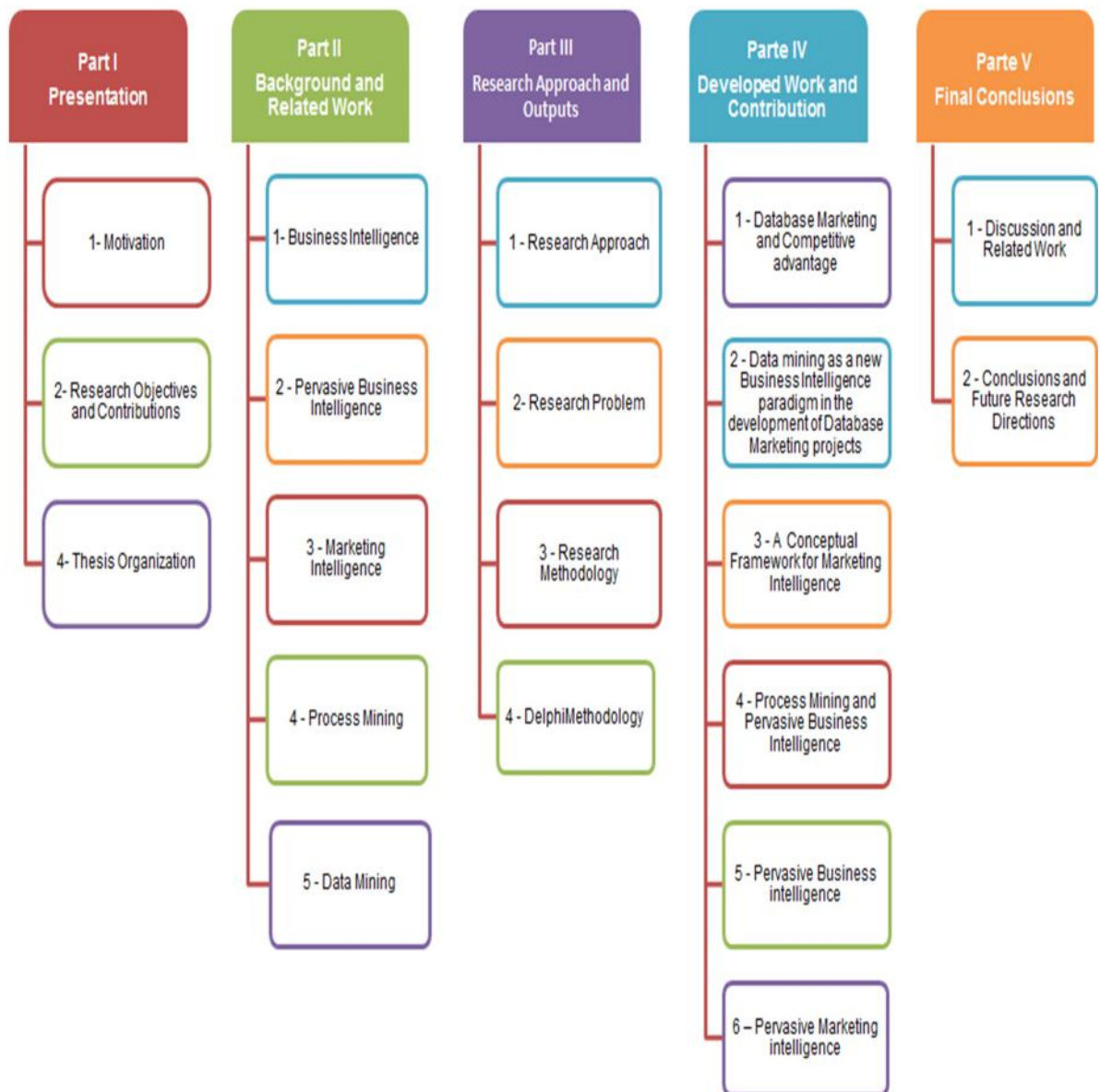
Figure 1. Thesys organization

In the first part (presentation), we have the first chapter, which is dedicated to presenting the main motivation for this work, the objectives and the thesis organization. The second part (background and related work) consists of five chapters, that include background knowledge to related work, dedicated to the following main concepts:

– Business Intelligent;

– Pervasive Business Intelligence:

– Marketing Intelligence;

– and to the techniques and tools: Data Mining and Process Mining.

In the third part (Research Approach and Outputs), the research approach is introduced and justified, and the general developed framework is presented. The fourth part (Developed Work and Contribution) presents the work developed over recent years, throughout the Phd, to present and receive feedback from the scientific community, all of these papers was published in proceedings of international conferences and international journals. Finally, the fifth part (final conclusions) concludes the thesis, where the research questions initially raised, are answered and discussed, and conclusions and future work are presented.

PART II – Background and Related Work

This chapter gives an introduction to the subject matter and to the background of this research work. First Business Intelligence is presented through the different approaches to the concept of BI and its evolution. Following this, we focus PBI as operationalization of BI across the organization, enabling BI systems reach all levels of the organization, at the right time and with the necessary information. Then, Marketing Intelligence state-of-the-art is reviewed, with focus on Database Marketing (DBM) as a key element of MKTI. After, Process Mining and Data Mining as tools will be included (Figure 2). Ending this chapter, related work is presented.
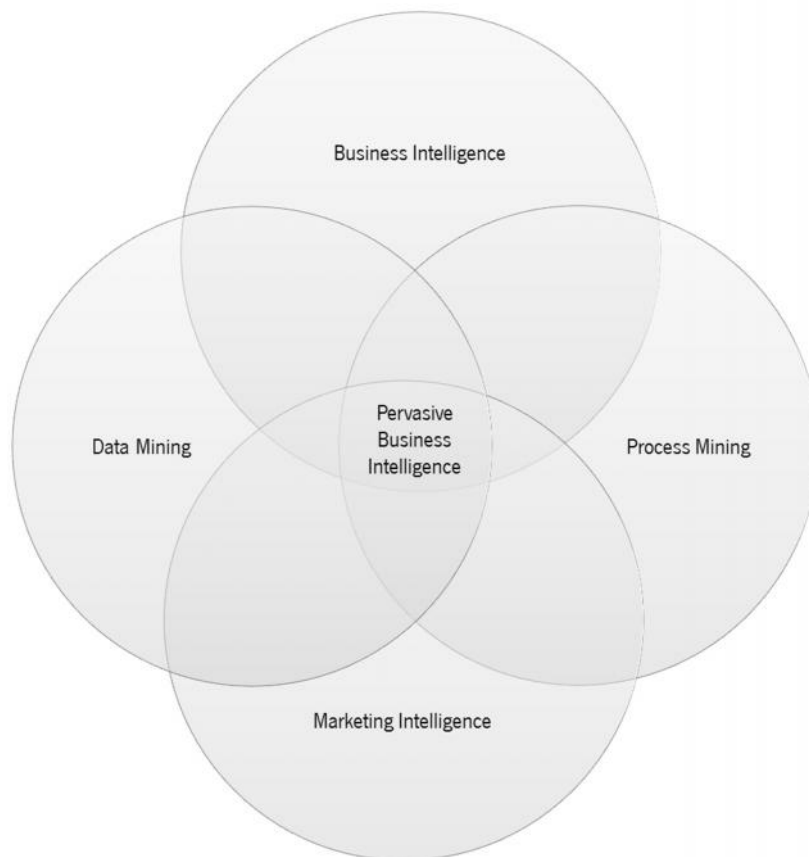
Figure 2.Concepts Map

2.1 Business Intelligence

Is increasing the number of organizations that provide BI to their internal and external decision makers. Internally, leads to greater responsibility of all the collaborators and the improved management stability. Externally, relations with suppliers and business partners can be strengthened through effective sharing of performance indicators for mutual benefits. (Xie, Yang, Liu, Qiu, Pan, & Zhou, 2007).

It is increasingly important and difficult for organizations to make the right decisions for their clients. 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.

The concept of Business Intelligence is used by the Gartner since 1996. It is defined as the application of a set of methodologies and technologies to improve the efficiency of business operations, and the decision management support to achieve competitive advantages. Howard Dresner is considered the father of the term "Business Intelligence", used since 1989 in Gartner, where he was an analyst at the time, but Pete Luhn Hans was the first to use the term in an article entitled "A Business Intelligence System" , published in 1958 by IBM (Luhn, 1958). Dresner was looking for a term to define the best tools for accessing and analyzing quantitative information, and described as a BI concepts and methods to improve decision-making through the use of systems based on facts (Evans, 2010), Luhn in turn defined the BI, as the ability to apprehend the interrelationships of presented facts in order to guide action in order to achieve the desired goal (Kotler P. , 2004). To Barbieri (Barbieri, 2001), the BI can be understood as the use of different sources of information to define the competitive strategies of an organization. Stackowiak et al. defined BI as the process of collecting large amounts of data, its analysis, and consequent production of reports that summarize the essence of the data base actions on the business, which will assist the managers in the decision making of the day-to-day business (Stackowiak & Greenwald, 2007). For Zeng et al., BI is

the process of collecting, processing and dissemination of information, in order to reduce uncertainty in making strategic decisions (Zeng, Xu, Shi, Wang, & Wu, 2006).

BI is the process by which users obtain accurate and consistent data from the storage of organizational data environment (data wharehouses, data marts). The data obtained from various business contexts, allow users to identify, analyze and detect trends, anomalies, and make predictions. Systems and BI tools play a key role in the strategic planning process of organizations. These systems allow collect, store, access and analyze organizational data in order to support and facilitate decision making (Aaker, Kumar, Day, & Leone, 2009).

The three different approaches to the BI concept, are presented in Graph 2 and referenced in Table 1. The approaches are:

- Management approach: a management approach sees BI as the process in which data collected within and outside the organization are integrated in order to create information (knowledge) relevant to the process of decision making, with emphasis on decision making management;

- Technical approach: presents the BI as a set of tools that support the process outlined by the management approach, the emphasis is not given to the process itself, but to the technology used;

- Value-added approach: BI offers added value to achieve competitive advantage.
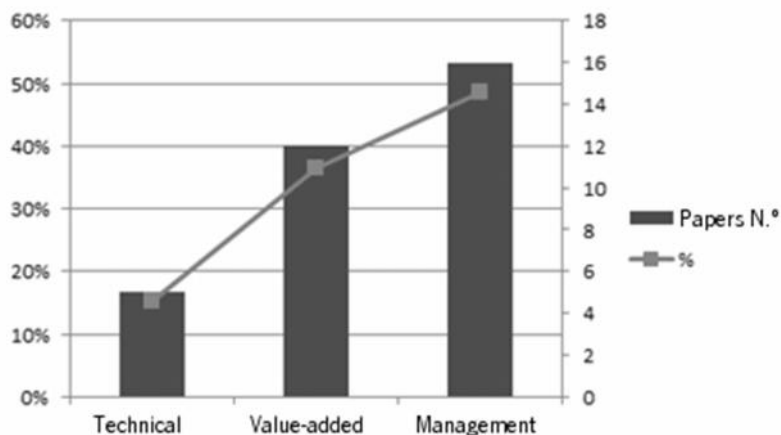
Graphic 2. Papers distribution approach

Analyzing Graphic 2, we can see that most of the articles, 48% of which have a management approach, 36% have a value-added approach and the remaining 15% a technical approach.

Table 1. BI approaches

Authors \ year	Approach
(KPMG, 2000); (Groom & David, 2001); (Rouibah & Ould-ali, 2002); (Hannula & V., 2003); (Petrini & Pozzebon, 2004); (Negash, 2004); (Hill & Scott, 2004); (Gluchowski & Kemper, 2006); (Power D. , 2007); (Bose R. , 2008); (Bucher, Gericke, & Sigg, 2009); (Cheng, Lu, & Sheu, 2009); (Bose R. , 2009); (Kalahasthi & Krishna, 2009); (Lim & Lee, 2010); (Palocsay, Markham, & Markham, 2010).	Management
(Back, 2002); (Van Dyk & Conradie, 2007); (Baars & Kemper, 2008); (Sahay & Ranjan, 2008); (Chen & Wang, 2010).	Technical
(Chen, Soliman, Mao, & Frolick, 2000); (Thomas, 2001); (Williams & Williams, 2003); (Gessner & Volonino, 2005); (Lönnqvist & Pirttimäki, 2006); (Davenport & Harris, 2007); (Wang & Wang, 2008); (Trim & Lee, 2008); (Power D. J., 2008)); (Fleisher, 2008); (Davenport, Harris, & Shapiro, 2010).	Value-added

From analyzed papers presented in Graphic 3, 13% of these were published by ''Information Systems Management Journal,'' a journal with a management vision, focused on decision-making process of management; 10% of the papers appear in the ''European Journal of Marketing,'' also with a management vision, and ''Industrial Management & Data Systems'' with a management and technique vision, intending to provide the knowledge required to exploit the potential of new technologies, in an intelligent way; the remaining 7% were published in ''Business Process Management Journal,'' which analyzes how the processes intrinsic to organizational efficiency and effectiveness are integrated and managed businesses, to achieve competitive success; and ''Expert Systems with Application'', whose focus is technology, and applications of the intelligent systems.
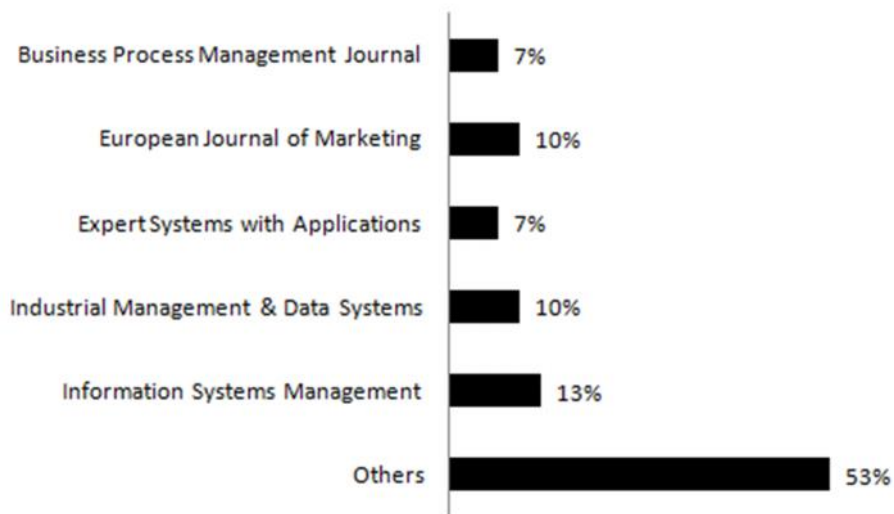
Graphic 3. Distribution of papers by journal

Most of the articles studied presents case studies and proposes models \ frameworks. For Palvia et Al. (Palvia, Mao, Salam, & Soliman, 2003) the case study is one of the most significant methods in research. Chen (Chen & Hirschheim, 2004) concluded that the case study method is gaining importance, and reveals that qualitative research is growing, concluding that researchers in information systems are increasingly interested in obtaining scientific knowledge based on the real world. The case study can be used to build theories and test them, using qualitative or mixed methods. The range of alternatives makes it a very versatile strategy for information systems (Cavaye, 2010).

The construction of the framework is developed through the analysis of key definitions and BI related concepts. It should be understood as analysis in the context of BI, the intensive use of data, statistical and quantitative analysis, and explanatory and predictive models that assist managers in decision making.

2.2 Pervasive Business Intelligence

Currently, customers demand faster and more personalized service. Many organizations are responding to these market needs, driving for a comprehensive business intelligence, improving traditional Business Intelligence with the ability to capture, interpret and act immediately on the data to make faster decisions, so create an environment of proactive and reactive interaction between the stakeholders in the business, and providing appropriate options for decision support to managers based on knowledge discovery in integrated current data.

In the present panorama of economic recession, departments of information technology (IT) are being reevaluated, being forced to become more efficient (Imhoff & White, 2011), which has led organizations looking for alternative ways to increase the value of their BI initiatives. Being increasing the effort of organizations to achieve pervasive BI (Ortiz, 2010).

PBI arises as a natural evolution of Business Intelligence applications in organizations, presenting two directions, vertical (top-down) and horizontal (across departments), with application from the strategic level to operational level. Gartner recognizes five levels of maturity for BI: unconscious, tactical, focused, strategic, and pervasive (Burtin, 2007).
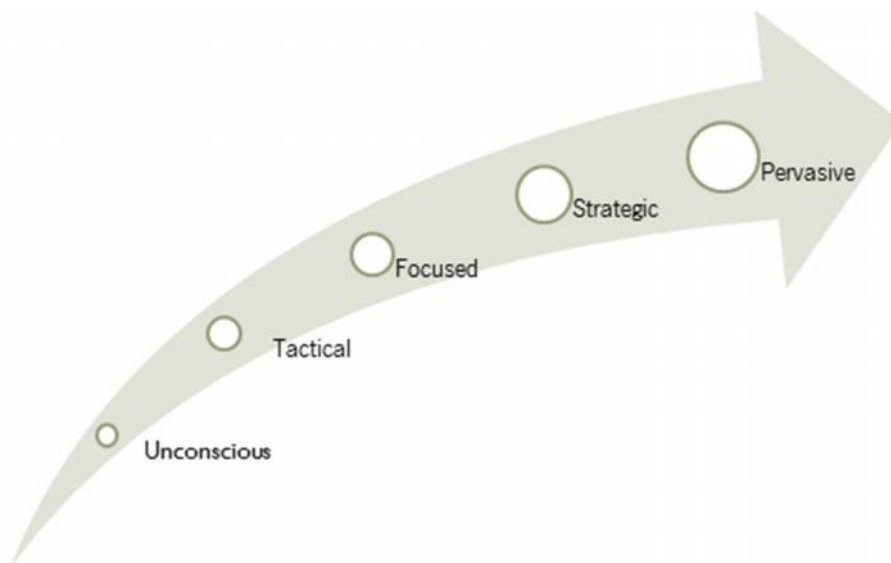
Figure 3. BI maturity levels

The main features of the maturity levels are presented in Figure 3 (Rayner & Schlegel, 2008):

- Unconscious: level characterized by inconsistent data, interpretation of incorrect and inconsistent data, and constant change, either for the needs of individual or departmental information. The use of spreadsheets is high and the use of communication tools is limited. The information management and communication are left to IT department.

- Tactical: at this level organizations begin to invest in BI. Opt to software that does not respond to their needs. Most users are not sufficiently qualified to take advantage of the system. The management does not trust in the quality and consistency of information provided.

- Focused: it is at this level that the organization has the first success, and that BI brings some benefits to the business. The metrics are used most often, only at the level of departments. The objective is to optimize the efficiency of departments or business units, with no relationship with the global business objectives. The inconsistency of metrics \ objectives is common. The data are not integrated at this stage, and are available through applications that cover only part of the business, without the integration of data.

- Strategic: at this level, organizations already have a clear strategy for the development of BI. Some organizations choose to include the BI and business process management in critical business processes. The information is available to all employees of the organization. The policy of data management and data quality metrics are implemented. Data quality is under constant supervision. Strategic information is trusted and is used to support strategic decision making. Users are properly trained in data processing and know how to use them effectively in strategic and tactical decisions.

- Pervasive: BI is disseminated across all areas of the business, and crossed with the organizational culture. BI systems become part of business processes, providing greater flexibility in adapting to changes in business and information needs.

The PBI appears on the last level of maturity of BI. There are various definitions of PBI, is the ability to deliver timely manner to all users, the integrated information in data warehouses, providing the necessary visibility, knowledge, and facts for decision making in all business processes (Markarian, Brobst, & Bedell, 2008); 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 (Vesset & McDonough, 2009); is BI across the organization, providing to all people, and at all levels of the organization the analyzes, alerts and feedback mechanisms (Mittlender, 2005).

The implementation of PBI in organizations, is supported by applications that access the data in real time, supporting the actions of customers relationship management (CRM) and marketing campaigns. 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 (Markarian, Brobst, & Bedell, 2008). 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 (Vesset & McDonough, 2009):

- Quality of the BI project: the expectations of users for the components of BI solutions are satisfied;

- Level of training: the degree of satisfaction with the training in the use of BI tools and analytic techniques to improve decision making;

- Prominence of regulation: importance of regulation and policies regarding data in BI systems;

- Non-executive involvement: involvement of non-executives in disseminating and promoting of the use of BI tools in the organization;

- Using a methodology of performance assessment: the importance of using a formal methodology for assessing performance within the organization.

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

2.3 Marketing Intelligence

Marketing Intelligence is ''a continuous and interactive structure of people, equipment and procedures to gather, sort, and distribute pertinent, timely and accurate information for use by marketers to improve their marketing plans, implementation and control" (Kotler & Armstrong, 1998). The MKTI enables comprehension, analysis, and evaluation of internal and external environment of the company related to customers, competitors, markets, and industry, to improve the process of decision making. What will require the integration of competitive intelligence, research and marketing analysis and analysis of financial and business information (Huster M. , 2005). While marketing focuses on customer needs, the organization has to obtain information about the customer's needs. Marketing Intelligence assists the organization in this process, collecting customer information that may assist in decision making. (Aaker, Kumar, Day, & Leone, 2009).

The concept of general intelligence and MKTI in particular, have been evolving to the academic and business level, being seen as a conductor for strategy and market success (Lackman, 2000). A MKTI system, is a set of procedures and sources used by managers to get their daily information regarding relevant developments in the environment in which they operate (Mochtar & Arditi, 2001). The MKTI system provides data on the market (Kotler P. , 2004). Another definition is a system to capture the information needed for decision making in business marketing (Hutt & Speh, 1989). The fundamental purpose of MKTI is to assist marketing managers in making decisions in their day to day, in various areas of responsibility.

According to some authors, MKTI can be defined as existing knowledge and prior knowledge about the external operating environment, obtained by concerns, opinions, attitudes, behavior and needs of individuals and organizations within the context of economic activities environmental, social and the everyday (Meunier-FitzHugh & Piercy, 2006; Prior, 1998). The ultimate goal of every intelligence process is to facilitate decision making that leads to action (Prior, 1998). It is the key intelligence that motivates some authors to introduce the term competitive intelligence as synonymous with the term MKTI

(Crowley, 2004; Huster M. , 2005). The American Marketing Association defines Marketing as the set of activities and processes for creating, communicating, delivering and exchanging offerings with value for customers, partners and society in general (Keefe, 2007).

Despite market research focus often in response to a need for specific information, or a set of needs, intelligence is indicated, as an ongoing process of developing a holistic view of the operating environment, including competitors, customers and markets.

A process of effective intelligence, contributes to the knowledge base of the organization, and leads to a cumulative organizational learning. Market research is a well-defined discipline with a long history of application in the business world, taking many forms and with the aim of increasing understanding that the company has in the market and its customers, and this is not MKTI (Huster M. , 2005; Mulvenna, Chner, Norwood, & Grant, 1997). The MKTI, is clearly a complex process, whose effectiveness dramatically affect the quality of marketing decisions (Kotler P. , 2004). The MKTI will significantly improve the practice of organizations in the management of market experience, in response to specific customer needs and characteristics of the environment.

In the future, the focus will be to measure the demands of unsatisfied consumers, monitoring their behavior, measuring consumer response to changes in marketing activities, and analysis of customer feedback. This information will be used to identify trends in consumer tastes, identify and eliminate points of friction between the organization and its customers. Modern technology allows that it be done more effectively and at lower cost (Burke, 2006).

The MKTI can be represented by a pyramid with three levels (Figure 4) (Huster M. , 2005):

— The base of the pyramid, has basic information about the internal and external environment of the organization;

— At the secondary level, there is some information that comes from analyzing databases;

— And the top of the pyramid is knowledge, the product of the entire MKTI structure.
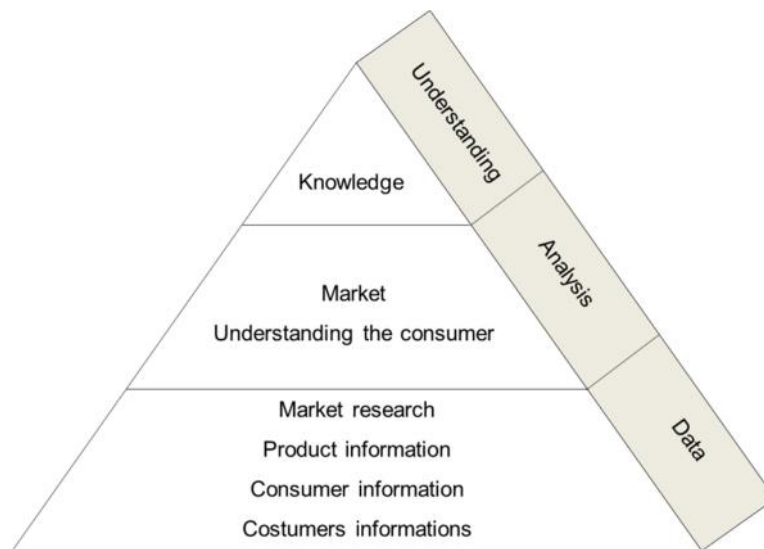
Figure 4. Marketing intelligence information flow

Considering the pyramid of MKTI information flow, there are some links between the three levels, corresponding to others three levels of operational tasks (Huster M. , 2005). At the bottom of the structure, there is the basic knowledge of marketing, in different forms and media (market research or product and customer information); the average level of information, has the common market knowledge and understanding of the consumer (client and prospects). This kind of information is usually the result of analysis of classical data such as queries to simple database or statistical inference; at the top of the pyramid is the information that supports the marketing manager or marketer, in the marketing decision making. This level is the result of MKTI process, which may be understood as the ability to act on the market (for example, develop a new product) or the customer (for example by offering new services) with the knowledge of the advantage.

The MKTI process is a set of procedures and methods for the planned collection, analysis and representation of information for use in marketing decisions processes (Fletcher & Deans, 1998). The design of the MKTI process considers not only the type of information stored in the system, but also how the managers want to receive information (McLeod & Rogers, 1985). Managers can have direct access to this information (reports), through their computer terminals. We propose four core processes for MKTI (Figure 5): planning, collection, analysis and dissemination. At first, in the planning phase, the necessary information is set for making marketing decisions. Then we can identify key variables and

carried out the data collection, in and out of the organization's repositories (data about customers or prospects, market data and competition). This phase may include performing traditional marketing research or evaluation of existing data. Being able to demand the recourse to other organizations, at product development level, finance, and supply chain, to get the required data. The next step is to analyse, the most complex process. This is where all activities should be developed in order to analyze the data, looking for patterns, evaluating information and ideas, allowing design the possible outcomes. In the last phase, the analyst will disclose information to executives, for examination and feedback. Creating a comprehensive holistic view of the problem and the solution.
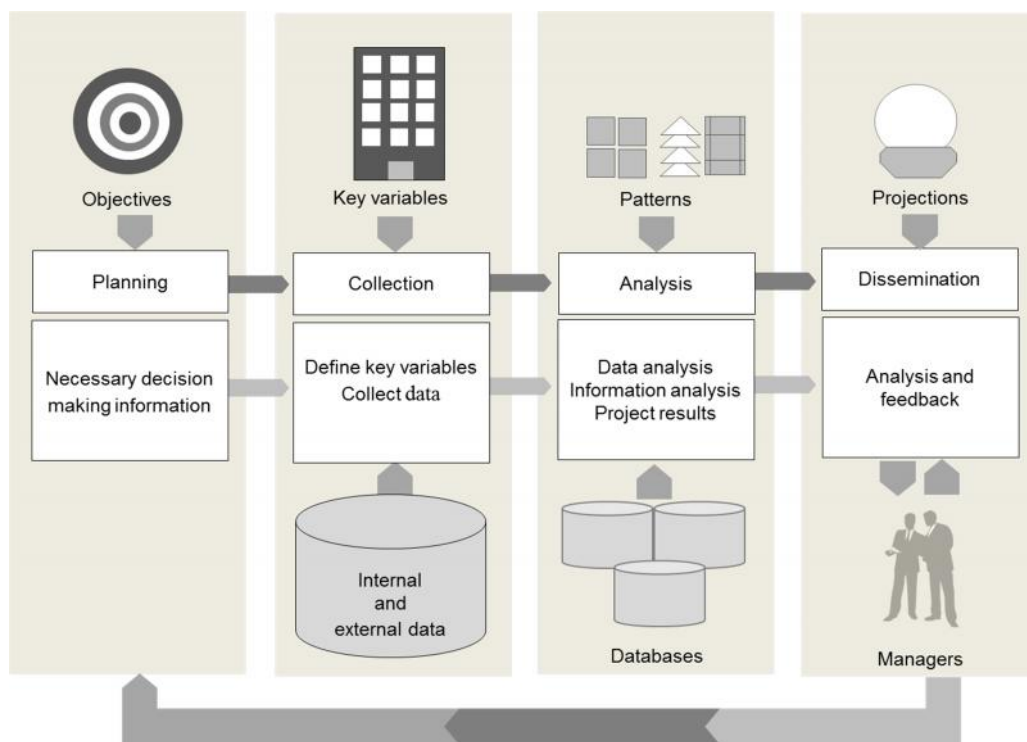
Figure 5. Markting Intelligence Processes

The Database Marketing is a major component of MKTI. Today, the terms marketing one-to-one, personalization, loyalty and database marketing (DBM) are often cited as a medium that allows organizations to differentiate themselves from their competition, in the current competitive environment. The growing number of online transactions, is changing

the way how organizations interpret customer data. The active data integration is vital, enabling increased share of the online market. The databases (DB) emerge as a marketing tool, promoting its appropriate use increased customer satisfaction, providing better performance of the organization. The DBM enables organizations to ensure their survival and to ensure competitive advantage in the digital economy. Organizations that do not have information with the characteristics and history of their customers, incur serious risk of succumbing to competitive action.

The use of databases in marketing has given rise to the concept Database Marketing in the late 70s. The limitation of interaction of actors, marketers, and technicians of databases (DB), the concept itself has become hostage since neither the marketers had knowledge in technology or DB technical knew the business. Another limitation to the more natural proliferation of DBM, is the fact that many of the projects being performed within private organizations, which may explain in part the abundance of scientific articles published in academic literature dealing with issues of DBM (Blattberg, 1987; Bult & Wansbeek, 1995; DeTienne & Thompson, 1996).

DBM is now an essential part of marketing in many organizations. The basic principle of DBM, is that at least part of communication between organizations and their customers (consumers) is direct (Bond, Foss, & Patron, 2004). From this simple beginning has grown a new discipline, but without the maturity expected by some authors (Drozdenko & D., 2002; Hughes, 1994).

Currently DBM is mainly dealt by classical statistical inference, which may fail when the data available are complex, multidimensional, and incomplete. The DBM refers to the use of database technology to support marketing activities. Being a marketing process-driven information and managed by databases technology, which enables marketers develop and implement better programs and marketing strategies.

There are different definitions of DBM with different perspectives or approaches, showing some evolution along the concepts (Detlev & Dholakia, 2004). From the perspective of marketing, "DBM is an interactive approach to marketing communications, which uses addressable communication media '' (Hughes, 1994; Stone & Robert, 1987), or "a strategy that is based on the premise that not all customers or prospects are equal, and

with the collection, maintenance and analysis of detailed information about customers or prospects, marketers can modify their marketing strategies" (Shani & Sujan, 1992). Were being introduced some statistical approaches, "database marketing is the application of statistical analysis and modeling techniques to process individual data sets" (Roberts, 1997), emphasizing some data types. The DBM involves gathering information about the past, current and potential customers, to build a database that will improve the marketing effort. The information includes: demographics; what consumers like and dislike; taste; purchase behavior and lifestyle (Shani & Sujan, 1992; Gama, 1997).

With the advancement of information technology, either at the level of processing speed, or at the level of storage space, the flow of data in organizations has grown exponentially, suggesting different approaches to the DBM, "Generally, it is the art of using the data already collected, to create new ideas to make money" (Rowe, 1989; Tucker, 1997) or "...add other user information (lifestyle, transaction history, etc.) in an electronic database, and use them as the basis for customer loyalty long-term programs, to facilitate future contacts and allow the planning of any marketing. " (Stone & Robert, 1987; Shani & Sujan, 1992; Fletcher, Wright, & Desai, 1996) and "...DBM can be defined as collect, store and use the maximum of useful knowledge about customers and prospects, to their benefit and profit." (Gama, 1997; Schoenbachle, Gordon, Foley, & Spellman, 1997).

Some authors have referred to the DBM as "a marketing tool database's oriented , being increasingly, the central point of the strategies of organizations" (Swift, 2001; Greenberg, 2002; Cross & Janet, 2004).

All definitions have in common a main idea, the DBM is the process that uses the data stored in database marketing, in order to extract relevant information to support marketing decisions and activities, through the knowledge of customers, that will satisfy their needs and anticipate their desires.

2.4 Process Mining

To create and maintain competitive advantage, companies need to adapt constantly, changing business processes to meet the needs and expectations of customers, and changes in the business environment. 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 and timely and concise manner, 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.

The term 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 (van der Aalst & Giinther, 2007). 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).

Many of the information systems that support business processes, record the events associated with the execution of the actual flow of processes (logs). In many of the logs, it is possible to identify patterns that can be used in the knowledge discovery. Through the logs is possible to identify how processes are structured, their relationships, and the people involved.

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.

Process mining has emerged as a way to analyze systems and their effective use, based on the events logs produced by these systems. PM has been investigated in recent years (van der Aalst, van Dongen, Herbst, Maruster, Schimm, & Weijters, 2003; van der Aalst, Reijers, Weijters, van Dongen, Alves de Medeiros, & Verbeek, 2007; Rubin, van der Aalst, Kindler, & Schafer, 2007; Gu & Yi, 2007) .

PM has close relation with the classical concept of data mining. For Han et al. (Han, Kamber, & Pei, 2006), Data Mining (DM) refers to the "extraction of knowledge from large amounts of data, by automatic or semiautomatic means, in order to discover significant patterns and rules." Similarly, the process mining focuses on pattern extraction. However, it is concerned with the relationship between sequence and competition events. While data mining focuses on the trends evident in the data and relationships between attributes, with the processes mining we seek to understand how a particular process is executed, based on the analysis of each of its occurrences. The process mining begins with a events logs . Such records are produced by the majority of information systems. Generally a log records the start and / or conclusion of events and the execution time (timestamp), and in some systems it is also recording the responsible for activity execution and other additional data.

In recent years, the information systems of organizations began to be guided by business processes, making it important to the management of processes, which allows the improvement of them.

In the 90s, are the first steps in the development of PM, with the aim of developing a technique for extracting the important data for the control of software development processes (Rubin, van der Aalst, Kindler, & Schafer, 2007). At the beginning of XXI century, there was an appreciable increase in the scientific development in this area, with several publications, which had to contribute new approaches to the technique of PM, and tools for their implementation.

PM emerges with the aim of resolving this situation, intending to obtain objective information about the way the process is executed, since it uses the actual data of process execution produces direct and tangible results. (Weijters & Van der Aalst, 2001).

One of the first tools was EMIT, which considered only the flow of processes, and making the extraction of knowledge from event logs of workflow systems, to create a model using PETRI nets, of the process executed (Van Dongen & van der Aalst, 2004). Subsequently, came PROM, a suitable tool for the PM, allowing the application of several algorithms in use for analysis and conversion of various process modeling languages (Van der Aalst, Van Dongen, Gunther, Mans, & Medeiros, 2007).

Some authors classify PM in perspective and purpose (Russell, Ter Hofstede, & Mulyar, 2006; van der Aalst, van Dongen, Herbst, Maruster, Schimm, & Weijters, 2003). Depending on the explored data, process analysis can be performed through three perspectives'' (Gu, Chang & Y, 2007):

– Perspective of flow control: analysis of dependency relationships between different events or activities of the process, and are used for the representation the PETRI nets, or the FSM model;

– Organizational perspective: understanding the collaborative relationships between those involved in the process, people and systems;

– Perspective of information: understanding the contents of the data involved in each instance.

The PM can be conducted in three areas: discovery, compliance analysis, and the extension (Figure. 5).

The aspect of discovery, is when does not exist a formal process model, this can be extracted from the data produced during the execution of the process. The compliance analysis presupposes the existence of a previous model, verifies that the process coincides with the model. This compliance analysis allows detection of deviations, and perceive their causes and possible impacts. Finally the extension, is the improvement of an existing model based on data analysis of its execution.

The greater the complexity of the processes, the greater the difficulty in understanding them. Thus, when processes involve distributed activities, it is very hard workers of organizations sharing common or have a global perspective of the processes, especially if

they are constantly changing (Vasconcelos, Mendes, & Tribolet, 2004), such as is the case of MKTI processes.
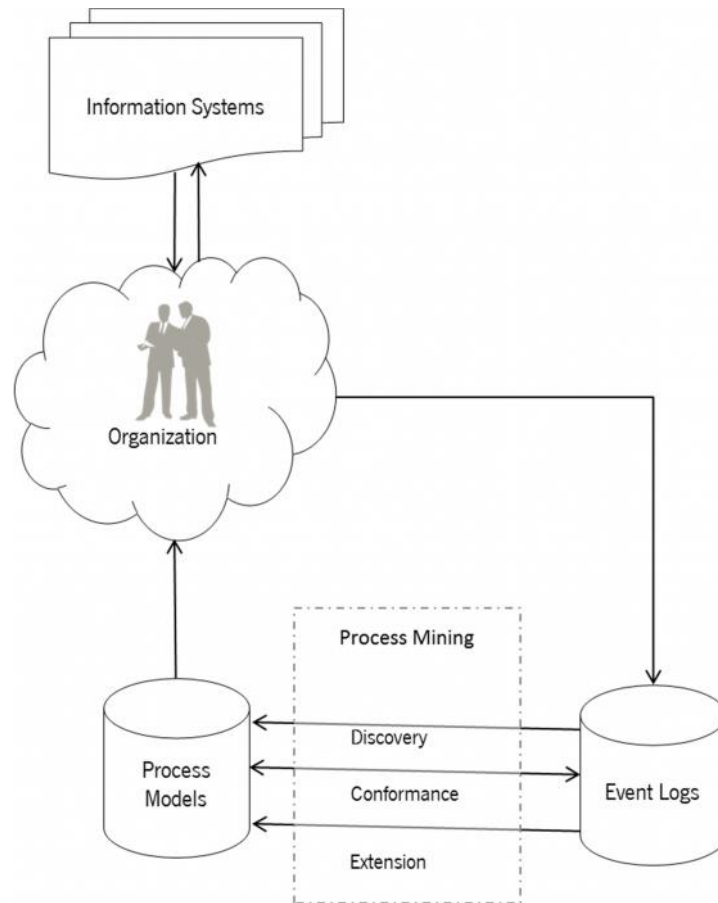
Figure 6. Aspects of PM (Adapted from van der Aalst (van der Aalst, 2007))

2.5 Data Mining

Data Mining concerns the non-trivial extraction of identifying patterns in the data, valid, new, potentially useful and understandable from data in databases (Fayyad, Smyth, & Uthurusamy, 1996).

The main difference between the DM and other tools for data analysis, is in how they explore the relationships between the data. While the various analysis tools available the user builds hypotheses about specific relationships and can corroborate them or refute

them through the output produced by the tool used, the process of DM is responsible for creating hypotheses, ensuring greater speed, autonomy, and reliability of the results.

The DM aims to build data models. There are many algorithms available, each with specific characteristics. The principal activities of the DM are (Povel & C., 2001):

– Predictive modeling: these models are built starting from the set of input data (independent variables) for the output values (dependent variables) which may be developed in two different ways depending on the type of output;

– Classification: a learning function that allows associating each data object one of a finite set of pre-defined classes and user (example: client profile);

– Regression: learning a function that maps each data object in a continuous value (example: value of the transaction);

– Descriptive modeling: discover groups or categories of data objects that share similarities and help in the description of data sets in given space (example: customer segments);

– Dependencies modeling: is a model that describes relevant associations or dependencies between certain data objects (exemple: content of the order, market basket analysis);

– Deviations modeling (analysis and detection): tries to detect the most significant deviations from measurements and / or past behaviors considered as reference (exemple: fraud detection).

The selection of data mining activities is directly dependent on the marketing objectives set initially.

Marketing activities relate to the exchange of goods and services, being driven by marketing objectives. There is an important set of questions, to which marketing activities must be capable of responding (Suther, 1999):

– Who should I target?

– Reach them with what?

– When should I do it?

- – Which channel of promotion should I use?

- – As the promotion should be done?

Finding the "How" means using the techniques of DM for segmenting the likely responses, repeat users, acquisition targets, clients, increasing costs, and likely defectors. The question "what" suggests finding the key characteristics of customers with more value for the company. This objective can be achieved by analyzing the data on products and consumer behavior. Associated to the question "How" is a set of prediction activities (example: how many customers are likely to leave the company). The time activity in marketing activities is represented by the question "When", which includes all marketing activities that refer to temporal tasks (example: when does the company must send promotional emails to customers). The purpose of "What" is one of the most used keyword in the definition of marketing activities, due to the selection of the characteristics associated (example: based on the analysis of the market basket, marketers want to know what products associated). By their nature all marketing issues include some prediction in the results, so its possible assign each one a predictive DM activity. As shown in Figure 7, the descriptive model of DM are better to answer the questions "Who" and "How", not only for their classification characteristics, but also by the type of desired results. The analysis models dependencies have a wide application in marketing activities and can be included in these objectives "When," "Who" and "What". Finally, the variance analysis model can be used to answer questions of marketing "How", "When" and "Who".

Data Mining Activites	Marketing Questions				
	Who	What	When	Which	How
Prediction	Φ	Φ	Φ	Φ	Φ
Descriptive	Φ				Φ
Dependence	Φ		Φ	Φ	
Desviation	Φ		Φ		Φ

Figure 7. Activities of data mining applied to marketing questions

Part III – Research Approach and Outputs

Along this chapter we present the general research guidelines that we have followed in order to achieve the research objectives. Firstly, we introduce the main developed research focus, and then, each main research focus is detailed in order to provide a full understanding the developed work.

3.1 Research Approach

This research holds three different scientific areas: business intelligence, pervasive business intelligence, and marketing intelligence.

BI is the process by 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, anomalies, and make predictions. PBI is a management concept that refers to a set of programs and technologies that provide resources \ capabilities to collect, analyze and access the data of organizational processes in real time. In any organization, the main objective of PBI is to assist in decision making, timely and at all levels of the organization. With the intensification of competition between businesses in open and often saturated markets, companies must learn to know themselves, and the market through the collection and analysis of quality information. Strategic information is seen as a key resource for success in the business, which is provided by Marketing Intelligence. The MKTI is a complex process, that goes from the data collection in the competitive environment of the company, until its exploitation in the sense of the information generated to assist management and strategic decision making in marketing. A successful business strategy requires a raising awareness about the external environment of organizations, including customers, competitors, industry structure and competitive forces. The management of the future, not only means being able to anticipate what will happen outside the organization, but also be able to represent the events through their own actions.

The general developed work framework is presented in Figure 8, which supports research undertaken in the thesis.
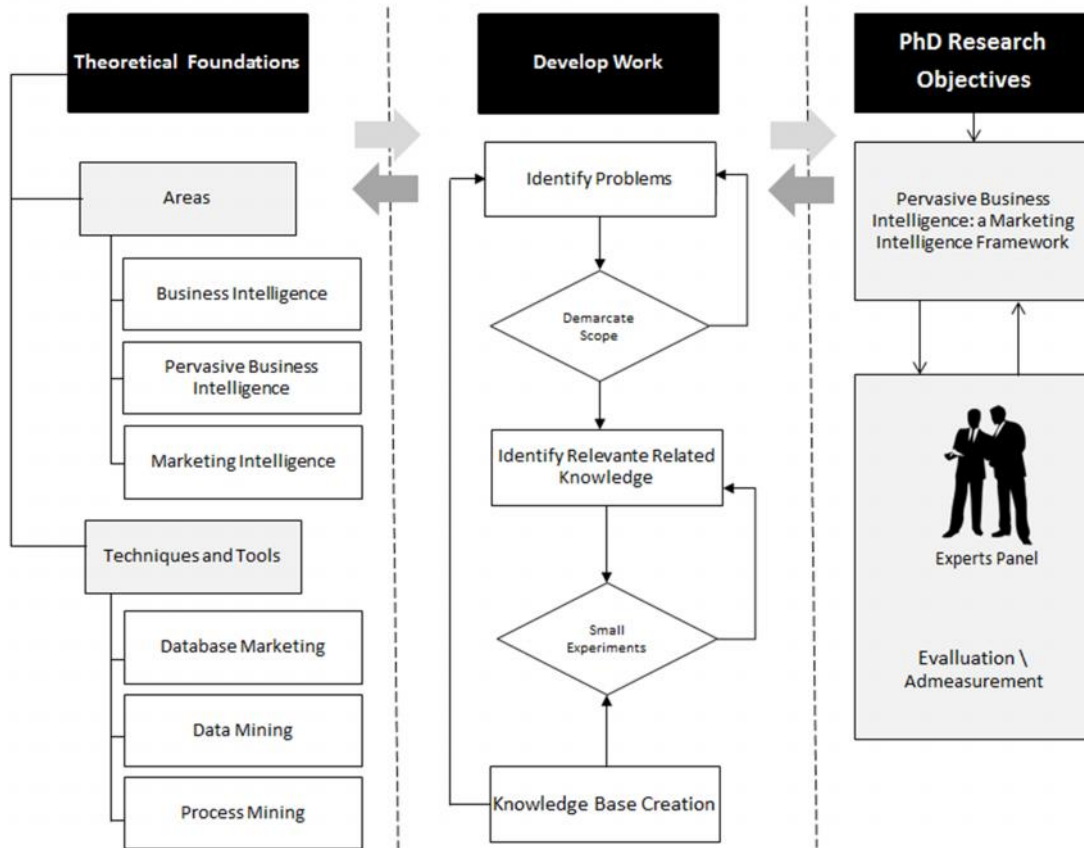
Figure 8. General developed work framework

3.2 Research Problem

In recent years, global growth slowed, markets have matured and become more competitive. For many organizations, the only way to grow is at the expense of its competitors. Companies are dependent on the evolution of marketing, to better adapt their strategies. Being a dissertation that crosses several areas, it is intended at the end of it, the construction of a framework for integration of Marketing Intelligence in the Pervasive Business Intelligence systems, providing greater flexibility in adapting to changes in business and information needs, and providing better support for marketers in the decision-making process.

The research problem was identified considering the needs of marketers to have information to support timely decision, allowing them to be proactive and face competition, and the capabilities of PBI, that enable BI systems reach all levels of the organization, at the right time and with the necessary information.

The objective of this research is to develop a conceptual framework to assist marketers in decision making process, leveraging various technologies, strategies, and resources for sustainable innovation.

This study develops a research framework that can assist decision makers in emerging economies. The research will explore different strategies in information systems development, and find efficient pathways to allocate various input resources for innovation. This research will be achieved through exploring prospective information systems areas, strategic factors, and measuring related judgments from expert panels.

Given the complexity of MKTI and its integration into PBI systems, it is intended exploit the best form to improve the approach of PBI to MKTI. In this context the following research question was defined: Can the MKTI systems improve the decision making process in PBI context?

3.3 Research Methodology

According to Hevner *et al.* (Hevner, March, Park, & Ram, 2004), "design science creates and evaluates IT artifacts intended to solve identified organizational problems". Peffers et al. (Peffers, Tuunanen, Rothenberger, & Chatterjee, 2008; Peffers K. e., 2006) structured six processes for design science: identify problem, define objectives of a solution, design and development, demonstration, evaluation, and communication. To improve the transparency and rigor of design science research, Piirainen and Briggs (Piirainen & Briggs, 2011) demonstrated who integrate the framework in Hevner et al. (2004) and Peffers et al. (2008).

The selected approach and methodology for this study was Design Science Research (DSR), such methodology, this approach provides a guide with the ideal structure for the proposed framework.

The Design Science Research is structured in with six processes, as shown in Figure 9 (Hevner & Chatterjee, 2010):
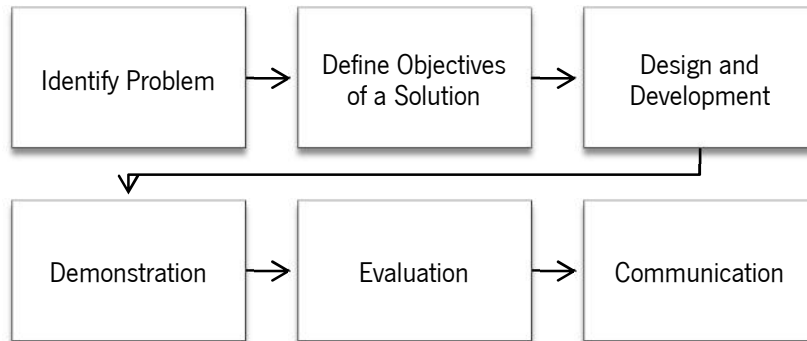
Figure 9. Design Sience Research Processes

In the first process, the problem is identified and presented the motivation that supports it. After, in the second process, definitions of the objectives for a solution, infer the objectives of a solution, based on the objectives of the previous phase. The third process, the artifcat is designed and developed, the artifact creation. Then, in the fourth process, demonstrates the use of the artifact in the solution of one or more instances of the problem. In the fifth process, is observed and evaluated how the artifact supports a solution to the problem. Finally, in the sixth process, communication, is reported the problem and its importance. All these processes are part of this study (Figure 10).
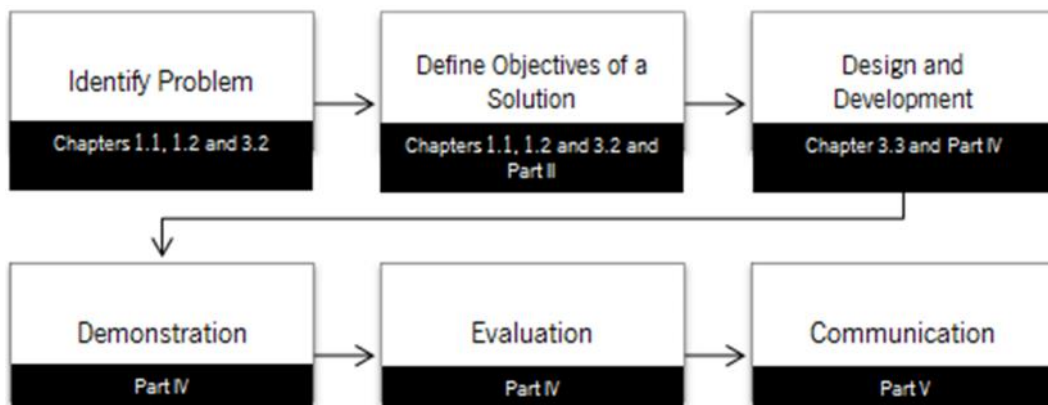
Figure 10. Design Sience Research Processes structure

3.4 Delphi methodology

We apply the Delphi method to assess the proposed framework. This method is suitable as a research tool in incomplete knowledge of situations on a phenomenon or problem, but it is not suitable for all kinds of problems in information systems (IS) and works well when the goal is to improve the understanding of the problems, opportunities, solutions, and also develop forecasts.

The Delphi methodology is used for the identification of future events and trends, operationalized by consulting a group of experts. The Delphi method is one of the most popular qualitative methods, is effective as structured and independent surveys of experts do not provide biased estimates of alternative futures (Delurgio, 1998). This is a decision-making method in a group that is characterized by the fact that each member of the group present their ideas independently, each element isolated from the rest of influence.

The Delphi method is normally used to structure a group communication process to deal with and to build consensus about a particular and complex topic. The method works based on an expert panel group who answer to proposed questions and formulate a set of hypotheses about it (Linstone & Turoff, 2002; Chu & Hwang, 2008); must be preserved the anonymity, no expert knows who is else is on the panel. Then, the method is developed on the dialectical inquiry approach: the researcher introduces a set of questions in order to establish an opinion or view from the expert panel; then the expert panel individually answers, reporting their personal point of view. After, the researcher has to generate a resume with a new agreement or consensus, and submit it again to the expert panel. This loop only ends when the researcher achieves a consensus with all expert panel members. We can say that this method follows three main principles: anonymity; iteration and retroaction (feedback).

Nowadays Delphi is considered a useful method to elicit and aggregate expert opinion, being defined as a medium-term qualitative forecasting method which is based on building consensus within a group of experts (Green, Armstrong, & Graefe, 2007).

Many variations of the Delphi method have been used in the fields of information (Brancheau, Janz, & Wetherbe, 1996; Schmidt, Kalle, & Keil, 2001; Mulligan, 2002; Okoli & Pawlowsk, 2004; de Bruin & Rosemann, 2007).

The Delphi method's validity is initially based on a rigorous selection of experts whose combined knowledge and expertise must reflect the full scope of the problem area (Armstrong, 2006). The method's validity relies on a strict implementation of the process: three iterations are usually needed to obtain a satisfactory consensus (Rowe G. , 2007; Armstrong, 2006; Abramowicz, 2004).

Part IV – Developed Work and Contribution

The developed work was organized in terms of key concepts, studied in Part II. allowing the publication and, consequently, the discussion of self-contained research parts. This chapter introduces developed work and presents the achieved contribution. The research work is introduced in the form of some original articles published in journals and proceedings of international conferences. Each part and correspondent contributions have been subject to validation by the international research community in conferences and journals where the works were published. The work developed will be presented as a list of published papers related to the above identified parts:

– Competitive advantage in e-Commerce: The case of Database Marketing (section 4.1);

– Data mining as a new Business Intelligence paradigm in the development of Database Marketing projects (section 4.2);

– A Conceptual Framework for Marketing Intelligence (section 4.3);

– Process Mining: a framework proposal for Pervasive Business Intelligence (section 4.4);

– Pervasive Business intelligence: a framework proposal (section 4.5);

– Pervasive Marketing intelligence (section 4.6).

The first study (section 4.1) had its beginning in a survey about the database marketing as a crescent usefulness tool for connecting businesses and consumers in the context of new market settings. The database marketing not being a tool for the exclusive use of the area of marketing, is a strategic tool, which used properly can help effectively in achieving competitive advantage, and the ideal scenario would be that all areas of the organization to work seamlessly, providing and using information and acting in a convergent way, promoting the improvement of organizational performance. The study was the first step, and has created the need to go further ahead, the necessity to develop a unified view to

guide marketers in their search for relevant knowledge. If the organizations using DBM can identify valuable customers, predict future behavior, and make decisions based on knowledge, we may improve the processes including systems and business intelligence tools. So, in the second study (section 4.2), to resolve that, becomes necessary to have a structured approach with a unified view to guide marketers, in their search for relevant knowledge. In this context we propose a Database Marketing framework that combines the activities of DBM with the appropriate DM techniques, and to guide the development of DBM projects, contributing to its efficiency and effectiveness. It was used a KDD approach to DBM projects, looking for the systematization of the whole process in order to facilitate its use in support of marketing activities. The systematic application of data mining techniques enriches the process of knowledge management and it provides to marketers a better understanding of their customers, allowing provide them a better service. It is also clear that Web technology will have a major impact on the practice of data mining and knowledge management, and will present interesting challenges for future research in information systems. This gave rise to the study of Marketing Intelligence and Pervasive business intelligence (section 4.3). With the intensification of competition between companies in open markets, organizations must learn about themselves and to the market, through the collection and analysis of data. The pervasive impact of business computing has made information technology (IT) an essential part of regular operations and a strategic element or key to all organizations. This study was based on the literature review presenting the Pervasive Business Intelligence state of the art and related areas. It was proposed a conceptual framework to guide the development of activities of Marketing Intelligence. If the management of the future means not only being able to anticipate what will happen outside the organization, but also be able to represent the events through their own actions, how to facilitate \ improve the process?

In the following study (section 4.4), the response to the previous study, based on the literature review in the related areas of Business Intelligence and Process Mining, is a proposal of a framework for improving the decision-making processes in organizations. The aim of this study is to integrate the process mining in BI systems through the development of a framework with the goal of assisting in the collection and pre-processing of information and its dissemination, to assist managers in the decision-making process.

The PBI systems has to reflect the real time concept to a particular business (the right time), empowering peoples at all organization levels, with analytics, alerts and feedback instruments timely. The PBI framework is a complex process that goes from user's objectives (information needs), collection of internal\external data from the organizations environment, data analysis, until the dissemination of generated quality information to assist decision-making. The overall vision of the organization is achieved through the redesign process models, being the key allowing the organization to be proactive and reactive.

The previous study focused on the integration of process mining in BI systems, being the starting point for a proposal of a conceptual framework for Pervasive Business Intelligence (section 4.5). PBI allows managers to react in a timely manner to issues and\or opportunities, creating a competitive advantage. This framework will culminate with the integration of the various frameworks presented in this project, which will be presented and evaluated in the following study.

Finally, in the last study (section 4.6), in the absence of sufficient and useful literature in the area of Marketing Intelligence Systems, this study seeks to propose and infers a MKTI conceptual framework, through consensus, of a group of information systems (IS) and Marketing system This study intends to take that first step in filling a gap in the MKTI, by proposing a conceptual framework for Marketing Intelligence systems in the context of PBI systems, that can assist decision makers in emerging economies. This theoretical framework should be followed for implementing Pervasive Marketing Intelligence (PMKTI) as an enabler for their competitiveness. The participants in this Delphi process achieved consensus on a generic quality criteria list. The adoption of this core set by the expert panel may be the first step toward a minimum reference standard of quality measures, for the framework quality criteria.

4.1 Competitive advantage in e-Commerce: The case of Database Marketing

Abstract: In the contemporary competitive environment, the way that organizations generate, manipulate, select and make use of information about its customers has gained increasing importance for its potential to give the company an edge over competitors. Consumers demand a treatment increasingly personalized and products\services that better suit their needs, being receptive to actions that allow for greater interaction in the purchase process. The aim of this paper is to analyze the database marketing as a crescent usefulness tool, connecting businesses and consumers in the context of new market settings. With the appropriate structure can improve the integration and availability of data for customers, improving the company's performance, giving a more solid support at the level of decision making in business marketing activities and development strategies to acquire new customers, or ultimately helping to keep customers. These benefits become more significant in the digital economy.

Keywords: Competitive advantage, Database Marketing, e-Commerce.

1. Introduction

Currently, the terms marketing one-to-one personalization, loyalty and database marketing are often cited, as a means that enables organizations to differentiate themselves from the competition in the new scenarios of the current competitive environment. The growing use of online transactions is changing the way organizations interpret customer data. The active integration of data is vital, enabling the increase of market share on line. Thus, the

database appears as a marketing tool that is used properly, will increase the degree of customer satisfaction, leading the organization to better performance.

The database marketing (DBM) enables organizations to ensure their survival and gain competitive advantage in the digital economy. Organizations that do not have information with the features and characteristics of their clients have serious risk of succumbing to the action of competition.

This paper presents an overview of the contributions of several researchers, in order to discuss relevant issues of database marketing as a source of information for the development of strategies to enable organizations to gain a sustainable competitive advantage, and analyze all aspects of e-commerce that justify the use of database marketing as a tool to support strategic decision making.

2. Database Marketing

DBM is an important strategic tool to support relationship marketing, as the main authors argue Gummesson (Gummesson, 1999), McKenna (McKennA, 1995), Vavra (Vavra, 1993). Tucker and Brown (Tucker & Brown, 1994) argue that, although significant benefits arising from their application, it is an underutilized resource, due to be circulated among some marketers. The DBM is focused primarily on the development of databases of consumer characteristics, including identification data, data relating to purchase history, demographics, and psychographics, and other useful information that enable the organization to build a foundation for the establishment of strategies targeted to an ever more specific to the development of new products, as is the case, communication, pricing, promotions. DBM aims to promote the integration of the profiles of consumers and their buying behavior (Christopher, Payne, & Ballantyne, 1991), providing guidelines for the organization to adapt their activities to the profile of the target market in order to better meet their needs and gain a competitive position. DBM is an information-driven marketing process, managed by database technology that enables marketers to develop, test, implement measure and appropriately modify customized marketing programs and strategies (Ananyan & Kiselev, 2004). DBM is being accepts as a fundamental marketing tool in a growing variety of business – from giant multinational corporations to local

retailers offering a new product to their customer lists. The concept was introduced in the 80's, those who started using it made a wealth of money since then, but the real benefits of DBM remain to be discovered by the general public yet. The number of organizations utilizing DBM has been growing at an amazing rate lately. On the other hand a transition from simple accumulation of data to a serious analysis of this data just has started recently. We are going to see more and more stress put on the data analysis in the years to come. The technology to propel this process is denominated as data mining.

Some effects of a DBM can be summarized as follows (Batra, 1995): it allows marketers to know more about various types of costumer and prospects, and to grade prospects by determining if a customer is willing to buy goods or services; it enables the organizations to reach customers with the right product and the right offer at the right time; it allows marketers to continually incorporate new information and results back into the database. So they can develop future strategies and executions from the collective results of previous efforts; DBM can be used by enterprising third-party marketers in order to bring together companies and customers; DBM can also develop special services to help easy customers to buy more, and offer the ability to establish a two-way communication with the customer through a variety of channels.

The DBM is a complex process that integrates the basic elements of strategic marketing, ie, targeting, targeting, positioning and communication (Davies, 1993). We can use it in various ways, one being the analysis of information stored, in order to build detailed profiles of consumers, from a variety of characteristics. Appearing as a source of building customer loyalty, allowing the reduction of maintenance costs for the customer, enabling the company to build a sustainable competitive advantage in the area in which it operates.

According to Vavra (Vavra, 1993), the objective of DBM is to create an electronic link between the organization and the consumer. A database of well designed can be very useful in implementing the activities of customer retention: enabling the marketer to identify the most important customers, to target promotions and offers of products and \ or services which are appropriate to your profile; allowing a clear monitoring of changes in terms of buying patterns; enabling marketers to interact in a more personalized way with customers; assisting in the establishment of programs to reward the most loyal

customers, with the aim of strengthening their loyalty; being a good indicator for the development of new products from the characteristics of clients of the organization.

The DBM can be used in marketing activities (Vavra, 1993): the appropriateness of marketing activities to individual customers; in the segmentation of customers according to the frequency of purchase, recency, and purchasing preferences; in the service of customer support through the provision of the database (DB) employees responsible for care of these.

Hedgcock (Hedgcock, 1998) considers the DBM as part of a system where marketing activities are interrelated, and the core client and there is a continuous interaction between the remaining elements of the system and customers, promoting the improvement of the service.

The greater the volume of data, the higher the quality of customer information, the greater the capacity of care, monitoring and recommending products \ services by the organization, the DBM is a resource that can be used strategically.

According to Seiler (Seiler, 2000), there are several factors that promote the use of DBM by organizations to gain competitive advantage: a market orientation is the most important factor for the effectiveness of DBM, since it places the consumer as the centerpiece of the efforts of the organization. According to a survey by the National Center for Database Marketing, 86% of the differences in the levels of competitive advantage achieved through the use of database marketing are explained by the degree of business direction for the market; the placement of database marketing from a strategic perspective. Organizations prepared to make use of this tool should align the goals of the database with its strategic objectives and ensure that they are clear to the entire organization; the development of will and skill of cooperation between the departments and database marketing efforts; awareness that the use of external resources to build a marketing database does not remedy the lack of skills, capabilities and skills within the organization; the promotion of cultural and structural changes within the company to accommodate the database marketing; the encouragement of guidance for company information, which should enhance the manipulation of data in an effective manner and in the pursuit of results; the use of system data and allocating resources to programs for database marketing to gain

competitive advantage. The well-established companies are able to extract information from data they have and turn them into marketing intelligence.

Shaw and Stone (Shaw, 1993) suggest three methods of application of database marketing: creation of loyalty programs; creation of programs focused on prospecting for new customers; creation of an integrated approach to dealing with prospects and old customers.

The process of implementation and use of database marketing is dynamic. Thus, the company needs to continuously update and monitor the data to keep in line with the changing environment variables. If necessary the organization to assess their skills and resources, and take an orientation to the market.

3. Database Marketing and Competitive Advantage

Organizations seeking to develop their strategies in order to gain competitive advantage over their competitors. The concept of competitive advantage was treated first by Ansoff (Ansoff, 1965). Competitive advantage can be understood as seeking unique opportunities that will give the company a strong competitive position. Based on this definition, several authors have proposed various devices for achieving a competitive advantage, since quality improvement to the construction of barriers to entry for new competitors in a given sector.

According to Porter (Porter, 1982), competitive advantage is achieved when a company can offer a superior value to customers by setting prices lower than their competitors, coupled with equivalent benefits, or the provision of benefits only at a price slightly higher than the average of competitors (differentiation). Efforts to search for an advantage are consolidated in the company's strategy.

To Lambin (Lambin, 2000) the competitive advantage is the set of characteristics or attributes inherent in a product or brand, which gives it a certain superiority over direct competitors. These characteristics may refer to products, services that are aggregated, or the means of production, distribution or sale, own the product or the company. A multitude of factors can determine the superiority of the company relative to competitors

priority. The value chain is a particularly useful mechanism to identify these factors, which can be organized into two categories based on the source of the advantage that they allow access: advantage foreign and domestic advantage.

The competitive advantage of foreign origin is based on the distinctive qualities of the product which is value for the buyer, producers and lower costs or improve performance within the company. In this case, the company may adopt a higher sale price than the competition. External competitive advantage gives the company a greater market power. The strategy based on competitive advantage foreign resembles the strategy of differentiation of Porter.

The international competitive advantage is sustained by a superior company in terms of matrix production costs, administration or distribution, providing a cost level lower than the leading competitor. The international competitive advantage is associated with increased productivity, allowing the company to achieve greater profitability and ability to resist a price drop imposed by the market or competition. A strategy based on international competitive advantage is similar to leadership in charge of Porter, and is supported by the technological know-how and organizational business.

Porter (Porter, 1982) believes that technology has a role in the structural change of a sector and the creation of new sectors, and may take the equalizer, neutralizer or balancer, annulling the competitive advantage of even healthy companies and leading others to take the lead.

Advanced information on the future state of the variables present in a scenario of a competitive environment have a high strategic value. The sooner a company can anticipate situations favorable or unfavorable to a particular scenario, the sooner she can develop an appropriate strategy for action. Therefore, investments in competitive intelligence are always very timely (Porter, 1982).

For Schaars (Schaars, 1991) there are two alternatives for obtaining competitive advantage. The first is to serve consumers better than competition. This advantage is based on the belief that the probability of repurchase is proportional to the satisfaction of consumers. The second is to be more agile than the competition, satisfying customers

more quickly and creating barriers to the actions of competitors. The database marketing company can help in this task.

According to Albrecht and Bradford (Albrecht, 1989), the success of a company is closely linked to the sale of products that fit customers' needs. For the company to have access to these requirements, it is necessary to adopt a systematic approach to gain access to customers, so that the knowledge gained on them can lead to obtain a competitive advantage.

These considerations reinforce the idea of the importance of database marketing in the digital economy to obtain competitive advantage. Exploring e-commerce, Internet and database marketing for transporting to new contexts.

Turban (Turban, D., Lee, & Viehland, 2006) defines e-commerce from various perspectives: communications (e-Commerce is the delivery of information, products or services, or payment by mail); business process (it is the application of technology to automate business transactions and workflow); service (It is a tool that meets the desire of businesses and consumers to cut service costs while helping to improve the quality of goods and speed up service delivery); on-line (Electronic commerce provides the ability to buy and sell products and information on the Internet and other online services).

To Foo & Lim (Foos & Lim, 1997) the popularity of the Internet comes from a variety of factors: accessibility, ease of use, ability to obtain immediate global connectivity, quickly receiving and sending information, marketing opportunities and carrying out of business economies of scale and low entry barriers and equal opportunities it offers.

Peppers & Rogers (Peppers & Rogers, 1997) claimed that the global market and on-line has led to new attitudes of professionals and redefinition of the marketing activities. With the help of technology, nowadays there is the possibility to manage a database of consumers and competitors, promoting an interactive dialogue with the market, facilitating mass customization.

The emergence of electronic commerce has helped to see the creation of value from a new angle. The new and emerging business models are centered in intangible assets, such as relationships, knowledge and systems. For the company can gain competitive

advantage, it is necessary that these resources are managed in some way, and database marketing figure as an indispensable tool in this task (Boulton, Libert, & Samek, 2000).

The advent of Internet and convergence with advanced database technologies allows organizations to remain competitive in the market and become more connected to consumers (McKenna, 2000).

Evans and Wurster (Evans & wurster, 1997) analyzed the fundamental change in the information economy and its potential impact on strategy. Featuring two important features: reducing the capacity of organizations and individuals to monopolize control of information; and opportunities to improve access to information to reduce the time needed to implement a strategy.

Organizations continue to seek new ways to cut costs, increase productivity and improve customer service, technology becomes a facilitator rather efficient. The new technology will help not only to automate existing processes and improve resource utilization but also to redefine what work should be undertaken and how this should be done.

The growth of electronic commerce is changing the way organizations look at the data of their customers. The integration of databases has been an increasingly more important, the need to consolidate the company's image in the case on line. Marketers belonging to the economy of traditional organizations still has problems to handle the complexities and new data are being incorporated with the wave of mergers and acquisitions and with the advent of the Internet (King, 2000).

In view of Cox (Cox, 2000), the increasing demand of databases in electronic commerce include the following requirements: unprecedented ability to handle a larger amount of data; the need to obtain a support increasingly sophisticated; the ability to work closely with software, other databases and legacy applications.

4. Electronic commerce (e-commerce)

E-commerce is to share information, maintain relationships and conduct business transactions via telecommunications networks inside and outside the enterprise. Thus, e-

commerce is the way in which sales and purchases are generated, their achievements and activities of marketing-sales, all done on line. The Internet is one tool of undeniable importance in electronic commerce, since it has a technology easy to understand, has publicly, and anyone, anywhere can access it just by a computer and a phone line. This facility started to advise companies on the sale to the final customer, without the need for investment. With the Internet, the person or company interested in buying or selling something, they can interact in finding information of interest, and need not be limited to what it initially appears. Following the opportunities opening up to mass customization, the Internet technology now enables the low cost, an increasingly more significant customization of services and care (Chleba, 1999).

As observed by Albertin (Albertin, 1998) e-commerce is the realization of the entire value chain of business processes in an electronic environment through the intensive application of communication technologies and information. The processes can be performed in whole or in part, including transactions business to business, business to consumer. Thus, electronic commerce covers any electronic business between two partners, or between a business and its customers.

According to Turban et al. (Turban, D., Lee, & Viehland, 2006) the Internet is promoting changes in the traditional physical market (marketplace), which is slowly being forced to coexist with the virtual market (marketspace). The latter is identified as an electronic marketplace, where goods are delivered directly to buyers to complete the purchase. The changes, which are reflected in greater efficiency of the marketing process.

The Internet is a valuable tool in marketing strategy because it allows a company will boost its presence and brand value in the market. In this context, the use of websites offers marketing managers the opportunity to communicate the mission of the company and brand, provide information about the attributes of products and services offered, as well as performance reports and future projects to a larger audience.

The database marketing organization is constantly updated with data from various sources, and the Internet plays a key role in this process. It is through this tool that marketing managers can monitor the behavior of customers, competitors and thus keep the information available within the company's up-date.

5. Conclusion

The database marketing not being a tool for the exclusive use of the area of marketing, is a strategic tool, which used properly can help effectively in achieving competitive advantage. The ideal scenario would be that all areas of the organization to work seamlessly, providing and using information and acting in a convergent way, promoting the improvement of organizational performance.

Large volumes of data does not necessarily mean useful information, since data alone may not be meaningful. The database is not the only marketing tool to support decision-making, updating the data is crucial and they must be integrated and converted into useful information when it is integrated, thus enabling support for strategic decision-making process. The role of database marketing has a strategic nature, to be able to approach their customers, the organization has the know, what is most evident in the digital marketplace, where there is a growing standardization of products, and that marketers have a notion increasingly clear that a good relationship with customers can lead to the emergence of competitive advantage and value creation.

The competitive advantages based on reliable information, provide the organization with knowledge of its customers. Technological advances and the emphasis given to help maintain customer relationships and customer loyalty, generating economic and financial benefits to the organization. The greater the knowledge of the organization to customers, the more likely that more efficient mechanisms for their loyalty and consequently to improve their performance.

The Internet is still a very recent phenomenon with implications for various segments of society. However, it is clear that the World Wide Web represents an important and integral tool of the marketing strategies of companies.

Marketing on the Internet, possibly, in some aspects, complement, can overcome traditional means, or replace the intermediaries more efficiently. In this context, some traditional distributors recognize the need to adjust their strategies to include online transactions in their operations. Internet marketing, as well as complement, may supplant traditional means, or replace the intermediaries more effectively. In this context, some

traditional distributors recognize the need to adjust their strategies to include online transactions in their operations.

In the context of database marketing the Internet is essential as a source of primary and secondary data. The database marketing is a strategic tool that if used correctly, can assist the company in promoting and achieving strategies, since it provides relevant information about the market and customers.

The database marketing is not the only tool to support decision making, in this way, you should always update the data, integrate them and convert them into meaningful information to support decision making in operational and strategic levels.

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4.2 Data mining as a new Business Intelligence paradigm in the development of Database Marketing projects

Abstract: Database Marketing (DBM) refers to the use of information databases to support marketing activities in order to obtain useful information to establish and maintain a profitable interaction with the customer. This work focuses the failures of traditional approaches to the DBM, proposing the use of techniques from artificial intelligence, in the context of Business Intelligence in the areas of marketing. Reviewing the literature, is explored a vision for the systemic use of methods and techniques of Data Mining (DM) in projects of DBM. It proposed a framework that combines the activities of DBM with the appropriate DM techniques, and to guide the development of projects of DBM, contributing to its efficiency and effectiveness.

Keywords: Database Marketing, Data Mining, Business Intelligence, Knowledge Discovery from Databases

1. Introduction

It is estimated that the amount of global information doubles every 20 months and the amount and size of databases grow rapidly (Dilly, 1999). The volume of data grows every day in organizations challenging the storage capacity in the databases (DB) and obtaining access to these. This growing volume of data has created urgent needs of new techniques and tools capable of turning in an intelligent and automatic data into meaningful information and knowledge. This information is valuable for planning, for the management

and decision making, are not easily identified by conventional databases management systems (DBMS). The Data Mining emerges as response to this need.

The ability to capture and retain customers for many authors represents a major challenge in the field of marketing in organizations (Bretzke, 2009; Peppers & Rogers, 1997). With advances in information technology and communication organizations can obtain and store transactional and demographic data of customers at reasonable cost (Naik & Tsai, 2003).

The challenge is how to extract important knowledge from these large databases in order to gain competitive advantage (Cohen, 2004). In many organizations, the use of databases is still complex and sometimes not available, not only because the database management systems (DBMS) require knowledge relevant, but also because the data is not ready to be used outside of the purposes these DBMS.

Currently, organizations have a clearer understanding of the importance of customer data, and critical decisions of decision models in business intelligence (BI), are being built on the analysis of such data. The emphasis on the management of customer relations makes the function of the marketing an ideal area of application that can greatly benefit from using the tools of Data Mining (DM) for decision support in the context of BI.

Using Database Marketing (DBM) organizations can identify valuable customers, predict future behavior, and make decisions based on knowledge, or by calculating the statistical model development database queries for marketing. However, this approach is not structured and there is a need for a unified view to guide marketers in their search for relevant knowledge. This includes understanding of customer preferences and behavior through the analysis of their data. Many researches have been done in this direction, and DM techniques have been used successfully in several areas such as bankruptcy prediction (Cielen, Peeters, & Vanhoof, 2004), fraud detection (Wheeler & Aitken, 2004), critical care medicine (Silva, Cortez, Santos, Gomes, & Neves, 2004) and engineering (Santos, Quintela, & Cruz, 2003), among other areas. In fact, the old model of "design-build-sell" is being replaced by the model "sell-build-redesign" (Drozdenko & Drak Perry D, 2002), the oriented management model for the product is being replaced by customer-

oriented. The traditional process of mass marketing is being challenged by the new approach to marketing one-to-one.

The definition of DBM as a strategy for marketing support has changed significantly in recent years. The current approach is based on estimated models of response to customer segmentation for submission of offers. These models accurately estimate the probability of a client responding to a specific supply and can significantly increase the response rate of a product offered. Their use in supporting marketing decisions highlights issues of interest, such as the management of customer relations, marketing, interactive real-time customer profiles and managing cross-organizational knowledge (Shaw, 2001).

Have been published some of the contributions to overcome these constraints, particularly with regard to data manipulation (Pinto, Santos, Cortez, & Quintela, 2004), and aspects of the data quality (Oliveira & Fátima, 2004; Povel & Giraud-Carrier, 2001), among others. Still, there remain many aspects that still remain unresolved, such as data integration and preprocessing in marketing activities.

Most contributions in the field of DBM refer to simple methods of use in specific cases, such as management of customer relationships (Shaw, 2001), activities of cross-selling and up-selling (Cohen, 2004), or analysis the shopping basket (Chen & Tang, 2005), or else to a specific set of techniques to improve specific outcomes, for example, segmentation, or one-to-one marketing activities (Drozdenko & Drak Perry D, 2002).

In order to help marketers to make use of knowledge obtained through the approach of Knowledge Discovery in Databases (KDD) in their marketing activities and improve their results, we propose a framework for systematic and efficient integration of involved processes.

This paper is organized as follows: first, we present a brief description of the DBM and relevant issues concerning the process of KDD, we will continue with the marketing activities and objectives of data mining, a framework that integrates marketing activities and DM techniques, ending up with a proposal for a methodical approach with the DBM will of Knowledge Discovery in databases (KDD).

2. Database Marketing and KDD

2.1 Database Marketing

In this paper, the DBM is presented as the use of technology databases to support marketing activities, while the marketing databases are referred to as the database system itself. Coopers & Lybrand (Coopers & Lybrand Consulting, 1996) proposed three levels of DBM in order to better organize these concepts:

Direct marketing: organizations manage lists and conduct performance reviews of basic promotions;

Marketing customer relationship: companies apply, adapted a more sophisticated approach, and technological tools to manage your customer relationships;

Relationship management customer-focused: customer information guide business decisions across the enterprise, enabling resellers to talk directly with individual customers and thereby ensure a relationship of loyalty.

The DBM is defined as the creation of a database of customers and prospects that enables organizations to communicate with each in a personalized way (Wolf & Copulsky, 1999). There others that consider DBM as a way to use information on consumers for the purpose of increasing the effectiveness and efficiency of marketing activities (Povel & Giraud-Carrier, 2001). Finally, DBM can be defined as the use of customer information with benefits for both the organization and the customer (A & Smith, 2001).

All these definitions emphasize the technologies of databases to support marketing activities, and impose the definition of DBM, a set of processes based on marketing databases for analysis and data exploration, seeking new knowledge (Pinto, Santos, Cortez, & Quintela, 2004).

2.2 Knowledge Discovery in databases

The term Knowledge Discovery in Databases references the process of discovering knowledge from data stored in databases, this process culminated in the implementation of Data Mining techniques.

In a systemic approach to knowledge acquisition, can be defined through the system changes that allow re-do in the future tasks more effectively and efficiently. In view of mathematics, knowledge acquisition can be seen as the perception of data sets (Adriaans & Zantinge, 1996). The acquisition of knowledge becomes feasible to rely on the experience and being supported by the understanding of the data set.

The process of KDD depends on a new generation of tools and techniques for data analysis. It is composed by a set of process that are the nuclear process of Data Mining.

2.3 Objectives of Data Mining

The term Knowledge Discovery in Databases references the process of discovering knowledge from data stored in databases, this process culminated in the implementation of Data Mining techniques.

DM is one of the components with more notoriety of KDD with which is often confused (Zaïane, 1999). The knowledge discovery in databases allows you to transform data into quality information, allowing to make strategic decisions for the best performance of organizations in the face of growing competition and globalization of the market. DM refers to the extraction of non-trivial identification of patterns in the data valid, new and potentially useful and understandable from the data in databases (Fayyad, Smyth, & Uthurusamy, 1996).

The main difference between the DM and other data analysis tools, it's how they explore the relationships between data. While the various analysis tools available you build hypotheses about specific relationships, it may corroborate or refute them through the outputs produced by the tool used, the process of DM is responsible for creating hypotheses, providing greater speed, range and reliability to the results.

The DM aims to build data models. There are many algorithms available, each with specific characteristics. The main activities are the DM (Povel & Giraud-Carrier, 2001):

- *Estimation modeling*: These models are built starting from the set of input data (independent variables) to the output values (dependent variables) which can be developed in two ways depending on the type of output: *Classification*: learning a

function that allows you to associate with each data object a of a finite set of classes and pre-defined user (example customer profile) *Regression*: learning a function that "maps" each object in a data value continuous (example value of the transaction).

— *Descriptive modeling*: discover groups or categories of data objects that share similarities and helps in the description of data sets provides a space (example customer segments);

— *Dependencies modeling*: is a model that describes dependencies or associations between certain relevant data objects (example content of the order of the market basket analysis);

— *Deviations modeling*: tries to detect the most significant deviations from measurements and / or past behavior considered as a reference (example fraud detection).

The selection of data mining activities is directly dependent on the marketing objectives initially set.

2.4 Data Mining models

Marketing activities refer to the exchange of products and services, being driven by marketing goals. There is an important set of questions to which marketing activities must be capable of responding (Suther, 1999):

— Who do I achieve?

— Achieve them with what?

— When should I do it?

— Which promotional channel should I use?

— How should be promoting?

The DBM is a process-oriented for marketing objectives (Pinto, Santos, Cortez, & Quintela, 2004), which will determine the whole process of gathering information. From here, and adopting the above model, it is possible to suggest at least one task of DM for each objective. Find the ''How'' means using DM techniques to segment the likely responses, repeated users, acquisition targets, customers with increasing costs, and potential defectors. The question ''what'' suggests finding the key characteristics of customers with more value for the company. This can be achieved by analyzing the data on products and consumer behavior. A set of prediction activities are associated to the question ''How'' (example: How many clients may come to leave the company). The time activity on marketing activities is represented by the question ''When", which includes all marketing activities that refer to temporal tasks (example: when the company must send promotional emails to customers). The question ''What'' is one of the key word most used in the definition of marketing activities, due to the selection of the characteristics associated (example based on the analysis of the market basket, marketers want to know which products are associated). By their nature all marketing questions include some prediction of its results, so it is possible to assign each a DM prediction. The descriptive models of DM are better to answer the questions ''Who'' and ''How'', not only for its characteristics of classification but also by the type of desired results. The dependency analysis models have a wide application in marketing activities and may be included in these objectives ''When", ''Who'' and ''What''. Finally, the model variance analysis can be used to answer questions of marketing ''How", ''When'' and ''Who''.

3. KDD framework based in DBM

Data mining may be useful in addressing the questions of marketing, ''Who,'' ''What,'' ''When,'' ''What,'' and '','' On the other hand, data mining is not enough by itself, requiring a set of related activities to ensure quality results.

An approach to the development of DBM must adopt a certain set of steps to follow and requirements to fulfill. We presents a proposed framework for exploration of the concepts and features of the KDD process and its intersection with marketing activities and questions related to the integration of data mining models.

The database marketing framework (see Fig.11) has three phases: collection of information, knowledge discovery, evaluation and implementation. Initially, the data are collected from various sources, external sources, internal and market research. After your registration and analysis is established a database marketing, in order to support the whole process of knowledge discovery. The KDD process is part of the proposed second phase, and includes a set of steps that allow the data to extract new knowledge from databases of marketing: selection of data: it consists in selecting a subset of data on which the algorithms used in modeling will work ; preprocessing and data transformation: the selected data is processed appropriately for the extraction process of knowledge (Cabena, Hadjinian, Stadler, & Zanasi, 1998), and modeling: crucial step in which various techniques are applied to discover potentially useful patterns. These techniques are used to achieve the initial objectives such as the segmentation and classification. The third phase, the evaluation and implementation, refers to the integration of the knowledge obtained from the process models KDD marketing. Since the answers to marketing issues supported by these models.
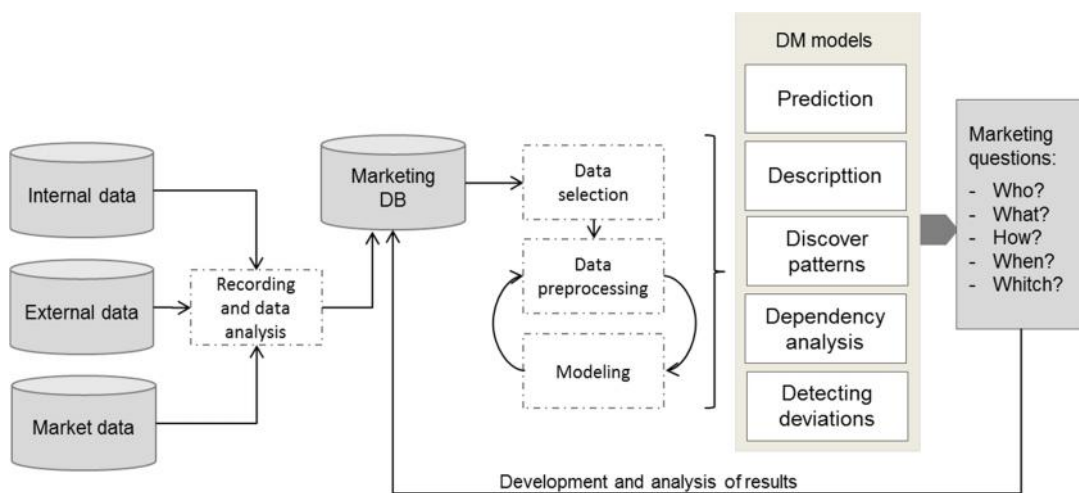
Figure 11. Database Marketing framework.

4. Conclusion

In this work, we used a KDD approach to DBM projects, looking for the systematization of the whole process in order to facilitate its use in support of marketing activities. In today's customer-centric business environment, it is our belief that there is need for a deep understanding of the use of DM and KDD as a decision support for marketing.

To this end, we showed how the DM can be integrated into the framework of knowledge management marketing. The availability of large volumes of data, enabled by modern information technology, one of the main problems is to filter, sort, and process, analyze and manage these data, in order to extract the relevant information to the user. The growth in size and number of existing databases is much superior to the human capacity to analyze the data using traditional tools, which creates the need and opportunity for use of data mining tools. With the shift from mass marketing to relationship marketing one-to-one, one area that could benefit greatly from data mining is its own marketing function.

The systematic application of data mining techniques enriches the process of knowledge management and it provides marketers a better understanding of their customers, allowing provide them a better service. For us, it is also clear that Web technology will have a major impact on the practice of data mining and knowledge management, and will present interesting challenges for future research in information systems.

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4.3 Conceptual Framework for Marketing Intelligence

Abstract: Nowadays, customers demand faster customer service, and expect that organizations know them and provide appropriate services and recommendations for products quickly. Many organizations are reacting to these market needs by driving toward pervasive business intelligence, augmenting traditional business intelligence (BI) with the ability to capture, interpret and act immediately on data to make faster decisions. With pervasive business intelligence, organizations data warehouse changes to a system that can proactively and reactively interact with the business stakeholders, and it provides appropriate decision options to help marketers to respond and take action based on knowledge discovery in current integrated data. This work based on the literature review presents the Pervasive Business Intelligence state of the art and related areas, leaving open for proposing a conceptual framework to guide the development of activities of Marketing Intelligence.

Keywords: Business Intelligence, Marketing Intelligence, Pervasive Business Intelligence, Database Marketing.

1. Introduction

The pervasive impact of business computing has made information technology (IT) an essential part of regular operations and a strategic element or key to all organizations. It is not difficult to realize that organizations have accumulated large amount of data. This data has different origins and reaches the organizations through a range of channels. It is

strategically important to make these data available for decision making, even because customers demand faster customer service. The growing volume of data generated every day in organizations and the crescent competitiveness of the market, leads to the need to use tools capable of generating knowledge from stored data. In the global market where competition is fierce, companies increasingly need to reduce their profit margins to remain competitive. Thus, it is essential to use the information proactively.

The fierce global competition leads organizations to consistently obtain accurate information for decision-making in order to sustain its competitive advantage. It's crucial for an organization to be proactive, acting before its competitors, by having a constantly updated vision of market development, then the Information processing becoming the platform that enhancing competitive advantage (Lackman, Saban, & Lanasa, 2010).

The analysis of large volumes of data is impossible without resorting to the appropriate software tools, making it essential to develop frameworks that help to automatically and intelligently, analyzing, interpreting and correlating data, enabling the development and selection of strategies for action (Goldschmidt & Passos, 2005). In order to assist companies in this exploration of data, concepts and tools for organizing information are critical, highlighting the Pervasive Business Intelligence (PBI) and Marketing Intelligence (MKTI) as pillars to support the decision-making. The economic decline is impelling organizations to examine ways of retaining customers, speed up their services, spending less capital be more efficient regarding their budgets, and observing regulations. Business intelligence (BI) is the ability to access data from multiple sources in an organization and deliver it to appropriate business users for analysis. Manage the performance of the business means know what questions to ask and have the facts at hand at time to answer them, and this is what business intelligence delivers. With pervasive business intelligence, organizations data warehouse changes to a system that can proactively and reactively interact with the business stakeholders, and it provides appropriate decision options to help marketers to respond and take action based on knowledge discovery in current integrated data. Pertinent and accurate information from relevant and reliable sources entails to be successfully processed. This implies that a company needs to be confident it has the right information, at the right time, and dissembled to right people (Palmer, 2000).

We propose a framework to guide the development of activities of Marketing. A framework of satisfying information needs for decision-making is complex and is compound by different activities to be exploited. This paper is organized as follows: after this introductory part we present related background concepts. Then, the main contribution is presented in terms of a framework proposal. Finally we draw some conclusions.

2. Background Concepts

2.1 Business Intelligence

An increasing number of organizations are making BI more largely available to all decision makers inside and outside the organization. Internally, leads to greater responsibility by all employees and greater management stability. Externally, relation-ships with supplier and partners can be reinforced through effective sharing of key performance indicators for mutual benefits. However, it is not easy to implement (Xie, Yang, Liu, Qiu, Pan, & Zhou, 2007) in SMEs because of the following factors: high price; high requirements for a hard-ware infrastructure; complexity for most users; irrelevant functionality; low flexibility to deal with a fast changing dynamic business environment; and low attention to difference in data access necessity in SMEs and large-scaled enterprises. But it's more important (and difficult) than ever today for organizations to make the right customer decisions. Companies know that the ability to frequently make the right customer decisions is essential to profitable growth, risk management and general performance. Due to non-controllable factors like fast-moving markets, economic and regulatory change, and new sources of competition, the right decision isn't a peaceful matter.

Although Howard Dresner being considered the father of the term "Business Intelligence" since he used the term in 1989, at the time an analyst at Gartner, Hans Pete Luhn was the first to use the term "business intelligence" in a paper with the title "A Business Intelligence System", published in 1958 by IBM (Luhn, 1958). Dresner was looking for a term to define the best tools that enabled access to information and quantitative analysis of the same, and describe the area as "concepts and methods to improve business

decision-making by using fact-based support systems" (Evans, 2010), for Negash (Negash, 2004) "Business Intelligence is a data-driven DSS that combines data gathering, data storage, and knowledge management with analysis to provide input to the decision process.", Luhn defined business intelligence as "the ability to apprehend the interrelationships of presented facts in such a way as to guide action towards a desired goal." (Kotler, 2004). According to Barbieri (Barbieri, 2001), the BI can be understood as the use of various sources of information to define the competitive strategies of an organization.

Business Intelligence bridges between different systems and users wishing to access information. Provides an environment that facilitates access to information needed for day to day activities, allowing analyze the current situation of the business and its performance. Systems and BI tools have a key role in the strategic planning process of organizations. These systems allow collect, store, access and analyze organizational data in order to assist decision making (Aaker, Kumar, Day, & Leone, 2009).

2.2 Pervasive Business Intelligence

Pervasive Business Intelligence (PBI) emerges as a natural evolution of the application of BI in organizations, with a movement in two directions, vertical (top-down) and horizontal (cross-Departments), with an application from the strategic level to the operational level. There are various PBI definitions, is the ability to deliver integrated right-time data warehouse information to all users, providing the necessary visibility, insight, and facts to make decisions in all business processes (Markarian, Brobst, & Bedell, 2008); PBI is the improvement of the strategic and operational decision-making capabilities of an organization, through the design and implementation of it as a whole (organizational culture, business processes, and technologies) (Vesset & McDonough, 2009).

The implementation of PBI in organizations is supported in applications that access the data in real time, supporting the actions of CRM and marketing campaigns. The application of PBI is enhanced when the front-line employees are in contact with the client and can generate new sales opportunities, up-sell and cross-sell (Markarian, Brobst, &

Bedell, 2008). PBI aims to integrate and align all processes to enable the delivery of relevant information to users who need to support decision making. According IDC there are five key factors with large influence on BI pervasiveness (Vesset & McDonough, 2009):

1. Design quality: users' expectations about BI solution components are met.

2. Degree of training: satisfaction level with training on use of BI tools, and the use of analytics to improve decision making.

3. Prominence of governance: importance of data governance and associated data governance policies in BI system.

4. Nonexecutive involvement: nonexecutive management involvement in promoting and encouraging use of the BI tools at the organization.

5. Prominence of performance management methodology: importance within the organization of a formal performance management methodology.

2.3 Marketing Intelligence

According to Mackenna (Mackenna, 2002), the information technologies are an essential key component to react to market changes and satisfy customers, helping marketers in decision making and implementation of marketing plans. A well-known example was the application made by a major U.S. supermarket chain, where it was discovered a universe of buyers of diapers also bought beer on the eve of the weekend in which games were broadcast on television. This knowledge has been used, thus increasing their sale.

The concept of general intelligence and MKTI in particular has evolved, being seen as a driver for strategy and market success (Lackman, Saban, & Lanasa, 2010). A MKTI system is a set of procedures and sources used by marketers to get their daily information on relevant developments in the environment in which they operate (Mochtar & Arditi, 2001). Another definition, MKTI is a system to capture the information needed for decision making in marketing (Hutt & Speh, 1989). The fundamental purpose of MKTI is to help marketing managers to take the decisions they face every day in their various

areas of responsibility, including pricing. Huster (Huster, 2005) define MKTI as the ability to understand, analyze and evaluate data from internal and external environment, related to the organization, customers, competitors, markets and companies to improve decision-making tactical and strategic, and the integration of competitive intelligence, marketing research, market analysis and analysis of business and financial information. The MKTI is a complex process, whose efficiency affects the quality of marketing decisions, including pricing (Kotler, 2004).

For some authors, the MKTI can be defined as existing knowledge and prior knowledge about the external operating environment, obtained by concern opinions, attitudes, behavior and needs of individuals and organizations within the context of economic activities, environmental, social and everyday (Meunier-FitzHugh & Piercy, 2006; Prior, 1998). The ultimate goal of every process of intelligence is to facilitate the decision making that leads to action (Prior, 1998). Is the key intelligence that motivates some authors to introduce the term as a synonym for competitive intelligence MKTI (Huster, 2005; Crowley, 2004). The American Marketing Association defines marketing (Keefe, 2007) as the set of activities and processes for creating, communicating, delivering and exchanging offerings with value for customers, partners and society in general.

Although market research focus often in response to specific information need or set of needs, intelligence is indicated as a continuous process of developing a holistic view of the operating environment, including competitors, customers and markets. An intelligence process effectively contributes to the knowledge base of the organization and leads to a cumulative organizational learning. Market research is a well-defined discipline with a long history of application in the business world, taking many forms and with the goal of increasing understanding that the company has in the market and its customers, and this is not MKTI (Huster, 2005; Mulvenna, Chner, Norwood, & Grant, 1997).

In the future, efforts should be aimed at measuring the demands of not satisfied consumer, through their behavior, measuring consumer response to marketing activities, and analysis customer's feedback. Allowing identify trends in consumer tastes, and points of friction between the organization and customers. With modern technology can be done on a larger scale, with lower cost (Burke, 2006). MKTI seeks to transform data into

information, and information into intelligence. The data are the basis of all structure, from which we perceive and record a given reality (Markarian, Brobst, & Bedell, 2008).

2.4 Database Marketing

The use of databases in marketing has given rise to the concept Database Marketing (DBM) in the late '70s. A limitation of the interaction of actors, technicians and marketers of databases, the concept became hostage since neither the marketers had knowledge in technology, nor the technical know Database's business.

Another limitation to the proliferation of DBM, is the fact that many of the projects being conducted within private organizations, which may explain in part the abundance of scientific articles published in academic literature dealing with issues of DBM (Blattberg, 1987; Bult & Wansbeek, 1995; DeTienne & Thompson, 1996).

The DBM is now an essential part of marketing in many organizations. The basic principle of DBM, which is at least part of the organizations communication with customers, is direct (consumers) (Bond, Foss, & Patron, 2004). From this simple beginning has grown a new discipline, but without the maturity expected by some authors (Drozdenko & Drak Perry D, 2002; Hughes & A.M., 2000). Currently the DBM is mainly addressed by classical statistical inference, which may fail when data are complex, multidimensional, and incomplete. The DBM refers to the use of database technology for supporting marketing activities. Being a marketing process-driven information technology and managed by the database, which allows marketers to develop and implement better programs and marketing strategies.

There are different definitions of DBM with different approaches or perspectives, showing some improvement over the concepts (Detlev & Dholakia, 2004). In marketing perspective, ''the DBM is an interactive approach to marketing communications, which uses addressable media'' (Hughes & A.M., 2000; Stone & Robert, 1987), or ''a strategy that is based on the premise that not all customers or prospects are equal, and that the collection, maintenance and analysis of detailed information about customers and

prospects, marketers can modify their marketing strategies'' (Shani & Sujan, 1992). Statistical approaches have been introduced, ''database marketing is the application of statistical analysis and modeling techniques to process individual data sets'' (Roberts, 1997), emphasizing some data types. ''Put simply, the DBM involves gathering information about past, current and potential customers, to build a database that improve the marketing effort. The information includes: demographics, what the consumer likes and dislikes, tastes, purchasing behavior and lifestyle.'' (Stone & Robert, 1987; Gama, 1997).

With the advancement of information technology, processing speed, storage space, and the data flow in organizations has grown exponentially, suggesting different approaches to the DBM. ''Generally, it is the art of using the data already collected, to create new ideas to make money'' (Tucker, 1997; Rowe, 1989) or ''... save this response, and add other user information (style life, transaction history, etc..) on an electronic database, and use it as the basis for customer loyalty programs in the long term, to facilitate future contacts and to enable planning of all marketing.'' (Stone & Robert, 1987; Shani & Sujan, 1992; Fletcher & Deans, 1998) and ''... the DBM can be set to collect, store and use the maximum of useful knowledge about customers and prospects, to their benefit and profit. '' (Gama, 1997; Schoenbachle, Gordon, Foley, & Spellman, 1997).

Some authors have referred to the DBM as a ''marketing tool oriented databases, being increasingly, the focus of the strategies of organizations'' (Swift, 2001; Greenberg, 2002; Cross & Janet, 2004).

All definitions have in common a main idea, the DBM is the process that uses the data stored in database marketing, in order to extract relevant information to support marketing decisions and activities by understanding customers' which will satisfy their needs and anticipate their desires.

3. Conceptual framework proposal

The MKTI process is a complex approach, being important find a structured way for information processing, and being crucial that it are available in time for the decision-making process. It is also essential that the right people have access to information

throughout the process of collection and analysis, provide feedback to the intelligence (information analysis) required. So, as it is vital to know where the information should be collected and how it should be organized. Which leads to the formulation of the following problem: How can the process MKTI are organized in a systematic way to improve the process of decision making?

To solve the problem, using a top-down approach, this will be fragmented into three problems:

1. How to organize the flow of information and intelligence within the organization in order to facilitate the process of decision making?

2. How must be organized and managed internally MKTI?

3. How can contribute to the process MKTI customers, information sources (internal and external), stakeholders and competition?

A process of satisfying information needs for decision-making is complex and is compound by different activities to be exploited. Our challenge is to propose a conceptual framework to guide the development of activities of Marketing Intelligence based in data modeling, as an add-on to PBI. Pervasive business intelligence provide support to managers decision-making with the tactical and strategic information they need for understanding, managing, and coordinating the processes in organizations (Tseng & Chou, 2006).

It is intended evaluate, structure the process MKTI to improve decision making. The benchmarking process MKTI is measured either by the ability of logical abstraction on the environment and internal factors in order to identify and collect relevant data for their analysis. The process MKTI is a set of procedures and methods planned for collecting, analyzing and representation of information for use in making marketing decisions (Fletcher & Deans, 1998). The design process MKTI considers the type of information stored in the system, and how decision-makers want to receive the information. Managers can have direct access to this information (reports), through their computer terminals.

The MKTI framework assessment process is measured either by the ability to identify and collect data relevant to analysis, and extracting relevant knowledge to support decision making in marketing. The MKTI process comprises two primary activities: data in and data

out, and a set of procedures and methods for collecting, analysis and representation of information for use in making marketing decisions (see Fig. 12). Getting data in, usually is referred as data warehousing, and includes the flow of data from a set of source systems and its integration into a data warehouse. The source systems represent internal and external data. We can say that getting data in is the most challenging aspect of BI, and it can requires about 80 percent of the time and effort and generating (Watson & Wixom, 2007). Getting data in delivers (data out) is the focus of attention of organizations, and consists of business users and applications accessing data from the data warehouse to perform enterprise reporting, OLAP, querying, and predictive analytics (Watson & Wixom, 2007).

The MKTI process consists of a set of procedures and methods planned for collecting, analysis and representation of information for use in making marketing decisions (Fletcher & Deans, 1998). We propose five basic processes for MKTI:

1. Planning,

2. Collection,

3. Analysis,

4. Representing,

5. Projections.

In planning process are defined the objectives and the necessary information for marketers marketing decisions. Then, the collection process, extract, transforms and load organization internal and external data sources, that include CRM, prospects data, market data and competition. The analysis process is the more complex and difficult, all activities should be developed in order to analyze the data, looking for patterns, and loaded organized and coded information on marketing data mart, as subset of the data warehouse. The representing process, access mart data and apply marketing metadata models for representing information from marketing perspective. In the projection process, results will be distributed to marketers for review and posterior feedback if needed.

In MKTI conceptual framework one of the components presented is the metadata. The metadata model describes fields, values, sizes, ranges, field's definitions, data owners, latency, and transformation processes. Metadata provides transparency as data moves from sources to the warehouse to end users (Watson & Wixom, 2007).
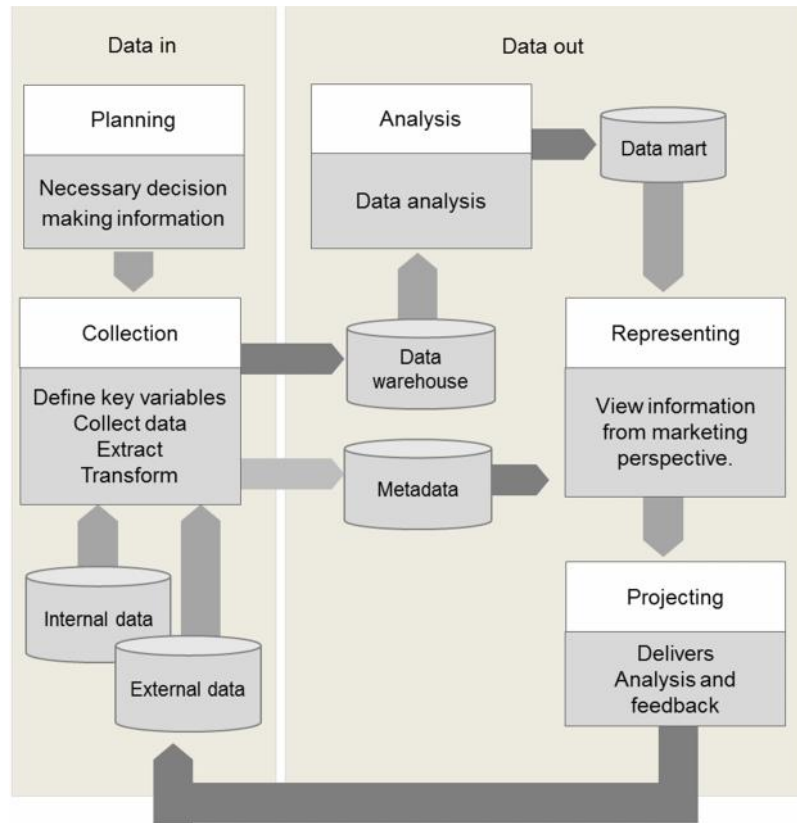
Figure 12. Marketing intelligence conceptual framework.

4. Conclusions

BI is a management concept that refers to a set of programs and technologies that provide features \ capabilities for collecting, analyzing and accessing data on processes of organizations. In any organization, the main objective of BI is to assist in decision making, timely and at all levels of the organization.

With the intensification of competition between companies in open markets, organizations must learn about themselves and to the market, through the collection and analysis of data.

The strategic information is seen as a key resource for success in the business, this being provided by Marketing Intelligence.

The MKTI is a complex process that goes from the collection of data from the organizations environment, until the generated quality information to assist marketing and strategic decision making. Organizations must to avoid invade customers with the highest rankings, and the marketers must remember that customers with low rankings should not be neglected, but instead should be cultivated to become better customers.

The management of the future means not only being able to anticipate what will happen outside the organization, but also be able to represent the events through their own actions.

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4.4 Process Mining: a framework proposal for Pervasive Business Intelligence

Abstract: In recent years, global growth slowed, the markets have matured and become more competitive. The impact of computing in organizations made information technology a strategic element to the acquisition and maintenance of competitive advantage. Based on the literature review in the related areas of Business Intelligence (BI) and Process Mining (PM), is presented a framework for improving the decision-making processes in organizations.

Keywords: Business Intelligence; Pervsive Business Intelligence ; Process Mining; Competitive Advantage

1. Introduction

Business Intelligence promotes an environment that facilitates access to information needed for daily activities o the organization, allowing analyzing the current situation of the business and its performance. The systems and BI tools play a key role in the strategic planning process of organizations. Information processing has gradually become the basis for achieving competitive advantage. The organization has to believe it has the right information at the right time and available to the right people (Palmer & Hartley, 2000).

Initially one of the purposes of the BI was the easy distribution of information to the no specialist end user. For implement in small and medium enterprises (SME) there are increased difficulties, BI is not easy to implement in SME due to the following factors (Xie, Yang, Liu, Qiu, Pan, & Zhou, 2007): high prices; demanding requirements in terms of

hardware and software infrastructure; complexity use for most users; irrelevant functionalities; low flexibility to deal with a wild change business environment; and not given due attention to the different needs of data access of SMEs and large firms.

Nowadays, the number of organizations that provide BI to their decision makers is increasing. It is increasingly important and difficult for organizations make the right decisions for the business. Companies know that the ability to make the right decisions frequently is essential for increased profits; for risk management and for good overall performance. Due to uncontrollable factors, such as fast-moving markets, the economic and the regulation changes, and new sources of competition, making the right decision is not peaceful.

This paper is organized as follows: after this introductory part we present related background concepts. Then, the main contribution is presented in terms of a framework proposal for PM integration on Pervasive Business Intelligence (PBI). Finally we draw some conclusions.

2. Background

2.1 Business Intelligence

The exponential growth of data volumes generated by organizations forced the development of BI applications very sophisticated, and also expanded the type of tools that classic BI systems normally use. The BI market is growing, and large companies still need new solutions to new business needs.

Stackowiak et al. was defined BI as the process of collecting large amounts of data, its analysis, and consequent production of reports that summarize the essence of the business data actions that will assist the manager in business decision-making (Stackowiak & Greenwald, 2007). For Zeng et al. BI is the process of collection, processing and dissemination of information, in order to reduce uncertainty in strategic decision making (Zeng, Xu, Shi, Wang, & Wu, 2006). The BI is the process by which users obtain accurate and consistent data from the storage environment of organizational data (data warehouses, data marts). Data obtained from various business contexts, allow users

to identify, analyze and detect trends, anomalies, and make predictions. The systems and BI tools play a key role in the strategic planning process of organizations. These systems allow collect, store, access and analyze organizational data in order to support and facilitate the decision making (Aaker, Kumar, Day, & Leone, 2009).

The BI has several approaches, among these we may refer: the management approach; the technique approach and the value added approach. The management approach views the BI as the process in which data collected within and outside the organization are integrated in order to create relevant knowledge to the decision-making process, emphasizing the management decision-making (Petrini & Pozzebon, 2004; Power, 2008; Bucher, Gericke, & Sigg, 2009; Cheng, Lu, & Sheu, 2009; Kalahasthi & Krishna, 2009; Lim & Lee, 2010). On the other hand the technical approach presents the BI as a set of tools that support the process shown in management approach, with the emphasis on the technology used, and not in the process (Back, 2002; Van Dyk & Conradie, 2007; Baars & Kemper, 2008; Sahay & Ranjan, 2008; Chen & Wang, 2010). While for the value-added approach, BI offers added value to achieve competitive advantage (Wang & Wang, 2008; Trim & Lee, 2008; Power, 2008; Fleisher, 2008; Davenport, Harris, & Shapiro, 2010).

BI uses several tools, like Data Warehouses (DM), Data Mining (DM), OLAP tools, among others, that will be used in the collection, analysis and extraction of information that will help the process of management and decision making.

Gartner recognizes five levels of maturity for BI: unconscious, tactical, focused, strategic, and pervasive (Burtin, 2007). The main features of the maturity levels are (Rayner & Schlegel, 2008):

- Unconscious: Level characterized by inconsistent data, data interpretation incorrect and inconsistent, and constant changes either for the needs of individual or departmental information. The use of spreadsheet is high and the use of communication tools is limited. The information management and communication are left to the IT department.

- Tactical: In this level organizations begin to invest in BI. Choose software that does not respond to their needs. Most users are not sufficiently qualified to take advantage of the system. The management does not trust in the quality and consistency of information provided.

— Focused: Is the level at which the organization has the first success, and that BI brings some benefits to the business. The metrics are used mostly only at the departments level. The aim is to optimize the efficiency of the departments or business units, with no relationship to the overall business objectives. The inconsistencies of metrics are common. The data are not integrated at this stage and are available through applications covering only part of the business.

— Strategic: Organizations now have a clear strategy for the development of BI. Some organizations choose to include the BI and business process management in critical business processes. The information is available to all employees of the organization. The policy of data management and data quality metrics are implemented. Data quality is under constant supervision. The strategic information becomes reliable and is used as support for strategic decision making. Users are trained in data processing and know how to use them effectively in strategic and tactical decisions.

— Pervasive: BI is pervasive across all areas of business and cross referenced with the organizational culture. BI systems become part of business processes, providing greater flexibility in the adaptation to the changes of business needs and information.

The higher the maturity level of BI, greater the value to the business.

2.2 Pervasive Business Intelligence

In the current scenario of economic recession, the departments of information technology (IT) are being reevaluated, being forced to become more efficient (Imhoff & White, 2011), what has led organizations looking for alternative ways to increase the value of their BI initiatives. In this sense, it is increasing the effort of organizations to achieve pervasive BI (Ortiz, 2010).

The Pervasive Business Intelligence (PBI) appears as the natural evolution of Business Intelligence applications in organizations, presenting two directions, vertical (top-down) and horizontal (across departments), with application from strategic to operational level.

The PBI appears on the last level of BI maturity. There are several definitions of PBI, is the ability to deliver timely manner to all users, the integrated information in data warehouses, providing the necessary visibility, knowledge, and facts for decision making in all business processes (Markarian, Brobst, & Bedell, 2008); is the improvement of the capabilities of strategic and operational decision-making of an organization, through the design and implementation of organizational culture, business processes and technology as a whole (Vesset & McDonough, 2009), is the BI for the whole organization, available to all people, at all levels of the organization, analysis, alerts and feedback mechanisms (Mittlender, 2005).

PBI implementation is supported by applications that allow access the data in real time, supporting the actions of CRM and marketing campaigns. The application of PBI is reinforced when front line employees are on contact with customers and can create new sales opportunities, up-sell and cross-sell (Markarian, Brobst, & Bedell, 2008). The PBI aims to align all processes to allow the delivery of relevant information to users who need support in decision making.

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

2.3 Process Mining

To maintain and build competitive advantage, organizations need to adapt constantly changing business processes to meet the needs and expectations of the business, and the changes in the business environment. To improve business processes, enterprises have to make the necessary changes, being necessary redesigning processes. In this context, managers need a method that allows them to determine in a concise and timely manner, the processes that no longer meet the needs of the business and need to be redesigned.

The term process mining refers to the techniques and tools that enable the extraction of knowledge from event logs available in enterprise information systems. These techniques and tools provide new ways to discover, monitor and improve processes. The PM assumes that it is possible to get the flow of activities for a process from execution logs of transactions undertaken in information systems. The initial process mining techniques allowed reaching satisfactory results for well-structured processes, but failed in the case of

ill-structured processes or poorly defined, where there wasn't a strong dependency between activities (van der Aalst & Giinther, CSD 2007, 2007). Many of the information systems that support business processes record the events associated with the execution of the actual flow of processes (logs). On many of the logs, it is possible to identify patterns that can be used in the discovery of knowledge. Through the logs is possible to identify how the processes are structured, their relationships, and the people involved. The aim of process mining is the extraction of information from the logs of events in order to capture the business process as it was implemented. The process mining has emerged as a way to analyze systems and their effective use, based on log events generated by these systems. The PM has been investigated in recent years (van der Aalst, van Dongen, Herbst, Maruster, Schimm, & Weijters, 2003; Rubin, van der Aalst, Kindler, & Schafer, 2007; Gu & Yi, 2007). The subject has a close relationship with the classical concept of data mining. According Han et al. (Han, Kamber, & Pei, 2006), data mining refers to the knowledge extraction of large quantities of data, for automatic or semiautomatic means in order to discover meaningful patterns and rules. Similarly, the PM focuses on pattern extraction. However, it is facing the relationship of sequence and competition between events. While data mining focuses on highlighting trends in data and relationships between attributes, PM seeks to understand how a given process is executed, based on the analysis of each one of its occurrences.

In the beginning of the century, there was a considerable increase of scientific development in this area, with several publications, which had contribute to new approaches to PM techniques and tools for its implementation. PM emerges intending to obtain objective information about how the process is run, since it uses actual data from the execution of the process, produces direct and tangible results (Weijters & Van der Aalst, 2001).

The more complex the process, there will be greater difficulty in understanding them. So when the cases involve distributed activities, is very difficult to the organizations employees, share or have a common vision of processes, especially if they are constantly changing (Vasconcelos, Mendes, & Tribolet, 2004).
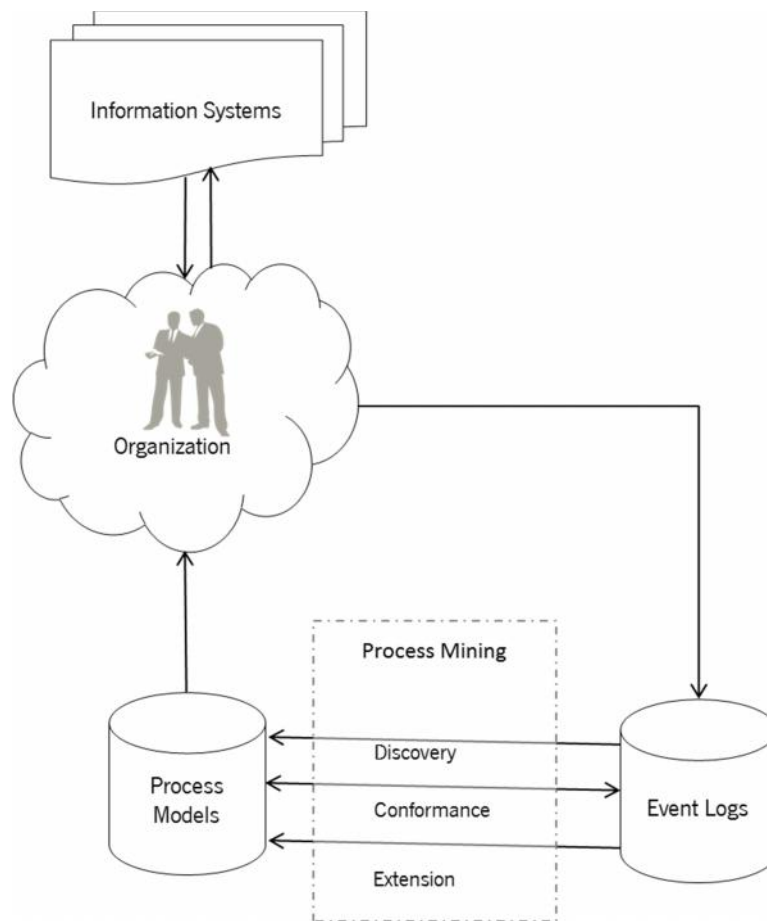
Figure 13. Process Mining (Adapted from van der Aalst (Van der Aalst, Van Dongen, Gunther, Mans, & Medeiros, 2007)

The PM may be performed in three perspectives: discovery, conformity analysis and extension (Fig.13). The discovery occurs when there is a formal model of the process, and it may be extracted from the data produced during the execution of the process. The conformity analysis presupposes the existence of a previous model, is verified if the process coincides with the model. The compliance analysis allows detection of deviations, and perceives their causes and possible impacts. Finally the extension is the improvement of an existing model based on data analysis of their execution.

3. Framework proposal

The aim of this paper is to integrate the process mining in BI systems through the development of a framework with the goal of assisting in the collection and pre-processing

of information and its dissemination, to assist managers in the decision-making process. The construction of the framework is developed through the analysis of key definitions of BI, PM and related concepts. It will be understood as a reactive and dynamic analysis made by PM over running processes, allowing respond to information needs, driven by the restructuring process models, which will enable the data-intensive analysis in the context of BI, with statistical and quantitative analysis, and predictive and explanatory models that assist the manager in decision-making.
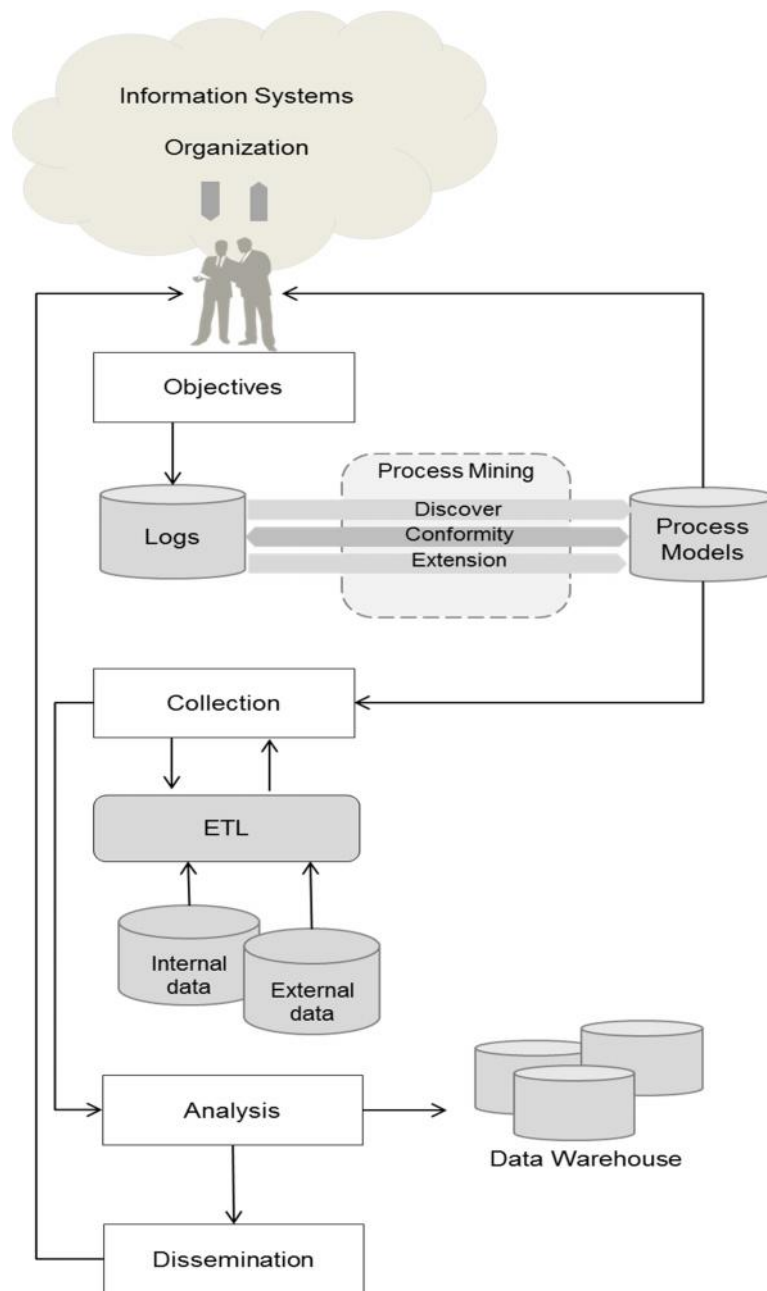
Figure 14. Process Mining framework for PBI

The process for satisfying user's information needs is complex and composed by different activities to be exploited. The propose framework (Fig.14) comprises four basic processes: objectives, collection, analysis and dissemination. Initially are defined the objectives regarding users' information needs for decision-making process. This process is leveraged by the PM for evaluation and suitability of process models to the requirements defined in the initial process. Then the collection process, oriented by the appropriate process model, extract, transforms and load (ETL) organization internal and external data sources. The ETL is a process for extracting data from a database system, where the data are processed, modified, and then inserted into another database. In the next process, analysis, all activities should be developed in order to analyze the data, looking for patterns, and loaded organized and coded information on the data warehouse data marts. In the disseminations process, results will be distributed to end-users for posterior feedback if needed.

4. Conclusions

BI can help companies in reducing costs and in the increase revenue through optimizing business processes. PBI empowers peoples at all organization levels, with analytics, alerts and feedback instruments timely. PBI system has to reflect the real time concept to a particular business, i.e., the right time. The right time concept, defines the information to be collected. The PBI framework is a complex process that goes from user's objectives (information needs), collection of internal\external data from the organizations environment, data analysis, until the dissemination of generated quality information to assist decision-making. The overall vision of the organization is achieved through the redesign process models. And this is the key to acquiring or maintaining competitive advantage, allowing the organization to be proactive and reactive.

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4.5 Pervasive Business Intelligence: a framework proposal

Abstract. Globalization, mergers, fierce competition, innovations and technological advances, are among the factors that lead companies to rethink their business strategy, being increasing the effort of organizations to achieve Pervasive Business Intelligence (PBI). In this context dominated by the organizations needs to adjust the business strategy in this competitive environment, PBI offers an important role in supporting of the decision making process, to increase competitiveness, creating a symbiosis between business and Information Technologies (IT) strategies. This work based on the literature review proposes a conceptual framework for Pervasive Business Intelligence.

Keywords: Pervasive Business Intelligence, Business Intelligence, OLAP, Data Mining, Metadata.

1. Introduction

With PBI organizations data warehouse changes to a system that can proactively and reactively interact with the business stakeholders, and it provides appropriate decision options to help managers to respond and take action based on knowledge discovery in data. We propose a framework to guide the development of Pervasive Business Intelligence systems. This paper is organized as follows: after this introductory part we present related background. Then, the main contribution is presented in terms of a framework proposal. Finally we draw some conclusions.

2. Background

The 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 (Guarda, Santos, Pinto, & C., 2012). The PBI technologies include data warehousing (DW), on-line analytical processing (OLAP), data mining and process mining tools. PBI technology help end-users in decision make, providing accurate, current and timely information.

Pervasive Business Intelligence is the ability to deliver the right information at the right time to business users across all levels of the organization, allowing make better decisions in all areas and processes in time (Han, Shen, & Farn, 2014). The end-users of different functional areas have the necessary visibility of the key business metrics, as defined by their strategic objectives (Watson & Wixom, 2007; Voe & Neal, 2005).

Pervasive Business Intelligence emerges as a natural evolution of the application of business intelligence in organizations, with an application from the strategic level to the operational level. There are various PBI definitions, is the ability to deliver integrated right-time data warehouse information to all users, providing the necessary visibility, insight, and facts to make decisions in all business processes (Markarian, Brobst, & Bedell, 2008); PBI is the improvement of the strategic and operational decision-making capabilities of an organization, through the design and implementation of organizational culture, business processes, and technologies as a whole (Vesset & McDonough, 2009).

3. Framework Proposal

There is no a generic model for PBI implementation success, and one of the reasons is the fact that different implementations processes are unique in their own way. This theoretical framework should be followed for implementing PBI as an enabler for their competitiveness.

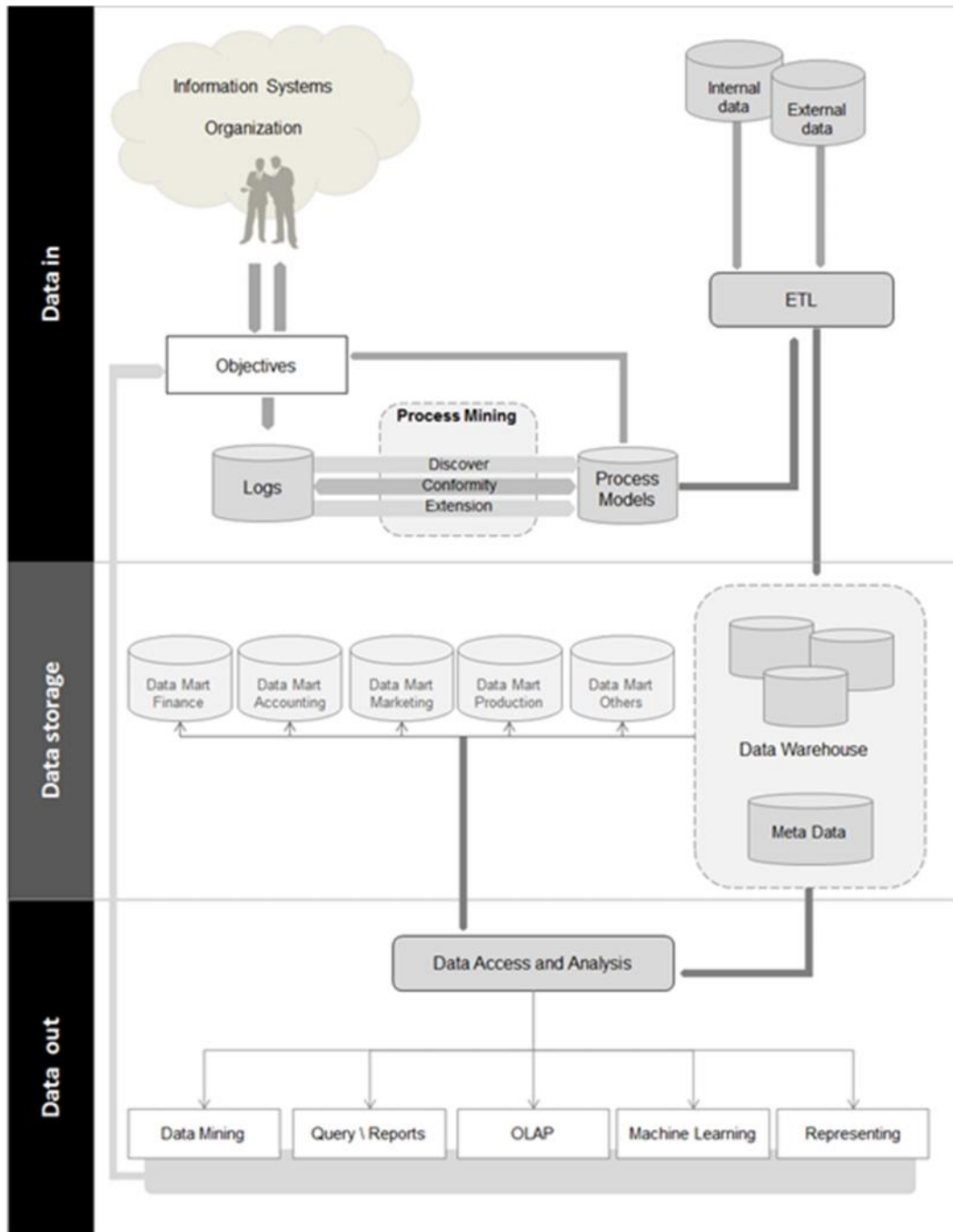Figure 15. Pervasive Business Intelligence Framework

We can structure the PBI into three main dimensions (Fig.15): Data in; Data storage and Data out. The first dimension refers to data acquisition. Data is collected from internal and external sources. The internal sources of data are the organization organizations operational database and data warehouse, and the external data sources include the data

from customers, suppliers, market research, government, competitors, and others. The second dimension starts after collecting data from internal and external sources, the data are stored in a data warehouse after extract, transform and load (ETL) processes. Finally in the third dimension, the data stored in the data warehouse is accessed and analyzed to assist in decision making.

3.1. Data in

The process for satisfying user's information needs is complex, initially are defined the objectives regarding users' information needs for decision-making process, is necessary to define what data is needed, which will form the basis of PBI. Data is collected from internal and external sources. Usually is referred as data warehousing, and includes the flow of data from a set of source systems that represent internal and external data and its integration into a data warehouse (Guarda T. , Santos, Pinto, Silva, & Lourenço, 2012). Data acquisition is the most challenging aspect of BI, and it can require about 80 percent of the time and effort and generating (Watson & Wixom, 2007).

Data is entered\ processed by a daily business process based on OLTP environment and stored in operational database (Farrokhi, 2012). Before data is loaded from operational database and external sources into the data warehouse, it needs to be processed by ETL processes. ETL processes are responsible of extracting, transforming and loading these heterogeneous data (Gadu & El-Khameesy, 2014). During data extraction data is acquired from multiple sources, and the selected data is consolidated and cleaned to correct inconsistent, missing or invalid values (Kimball & Ross, 2011), after data are integrates into standard formats and applied the business defined rules that map data to the warehouse schema, and for finished the cleansed data are loading into the data warehouse (van der Aalst W. M., 2009; Farrokhi, 2012).

3.2. Data storage

After ETL processes, data is stored in data warehouse or data marts, being the basis for future analysis. The data warehouse is a copy of transaction data specifically structured for query and analysis and is informational, analysis and decision support oriented (Lenzerini, Vassiliou, & Vassiliadis, 2003). Inmon argues that a data warehouse is a subject oriented, integrated, time-variant, non-volatile collection of data that is used primarily in organizational decision making (Inmon, 1996). The data is organized, stored, and made available for direct querying, in a series of integrated data marts. A data mart presents the data from a single business process (Kimball & Ross, 2011), are small sized data warehouses, generally created by individual departments to facilitate their own decision support activities.

To locate and understand data in the data warehouse, users need information about metadata, i.e. the data warehousing system and its content. Metadata is the data about data, including format, definitions of the data, business definitions, business rules, encoding/decoding algorithms, data quality alerts, and domain constraints, as other items of business interest (Gadu & El-Khameesy, 2014).

3.3. Data out

Data for distribution \ deliver is the focus of attention of organizations, and consists of business end-users and applications accessing data from the data warehouse to perform enterprise reporting, OLAP, querying by end-users, and other analytical and predictive applications (Watson & Wixom, 2007).

Online Analytical Processing and data mining techniques, make available to the end-users the means to explore and analyze large volumes of data. OLAP tools are a combination of analytical processing procedures and graphical user interface, providing multidimensional views of data, and a quick and flexible access to data and information. (Blanco, de Guzmán, Fernández-Medina, & Trujillo, 2014; Khan & Quadri, 2012). The main difference between the Data Mining (DM) and other tools for data analysis is in how they explore the relationships between the data. While the various analysis tools available the user builds

hypotheses about specific relationships and can corroborate them or refute them through the output produced by the tool used, the process of DM is responsible for creating hypotheses, ensuring greater speed, autonomy, and reliability of the results. The DM aims to build data models. There are many algorithms available, each with specific characteristics. Machine Learning (ML) is part of an emerging Artificial Intelligence (AI) technology that over the past has been employed by an increasing number of disciplines to automate complex decision making. ML is a set of methods that attempt to allow machines to acquire knowledge for problem solving by based on the history of past cases. In this dimension all activities should be developed in order to analyze the data, looking for patterns, and loaded organized and coded information on the data warehouse data marts, after, results will be distributed to end-users for posterior feedback if needed.

4. Conclusions

Today's organizations are deriving more value from PBI by extending actionable information across organization, maximizing the use of existing business data. The rapidly market environment changing will increase the need for PBI. From organization to organization the use of PBI is distinctive, and what one organization might consider being pervasive business intelligence might vary significantly from the next organization's definition of PBI. PBI is achieved rom the time the BI becomes an integral part of the decision making activities that occur within the business. PBI allows managers to react in a timely manner to issues and\or opportunities, creating a competitive advantage.

In the near future, the framework will be tested empirically. Questionnaires were sent to several experts in information systems, in various country or countries and different companies, for evaluate the framework.

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4.6 Pervasive Marketing Intelligence

Abstract: In the absence of sufficient and useful literature in the area of Marketing Intelligence Systems (MKTI), this study seeks to propose and infers a MKTI conceptual framework, through consensus, of a group of information systems (IS) and Marketing system experts. This research assumes that expert opinion can be of significant value in situations where knowledge or theory is incomplete, as in the case of MTKi systems in a Pervasive Business Intelligence (PBI) context. The Delphi method is used to conduct this study; this method is particularly suitable for this research situation where personal contact is not desirable among participants, annihilating the existence of opinion leaders, and ensuring democratic participation. This paper intends to take that first step in filling a gap in the MKTI, by proposing a conceptual framework for Marketing Intelligence systems in the context of PBI systems.

Keywords: Business Intelligence systems, Pervasive Business Intelligence, Marketing Intelligence, Pervasive Marketing Intelligence, Delphi method.

1. Introduction

In the business world, knowledge comes from information, and the information comes to the data. Knowledge assists managers in making timely and assertive decision. In any organization, it is critical to have a good understanding of the internal environment (processes, products, services, employees, customers, suppliers, and partners) and

external of it (competitors, stakeholders, regulatory authorities). The rapid growth in the volume of information in organizations may become a problem due to lack of capacity to handle this information. Data is raw and unorganized, while information is the result of organized, structured and processed data.

At present, organizations are faced with an aggressive competitive environment, which will make difficult to maintain competitive advantage. According Guarda et al. (Guarda, Augusto & Silva, 2012) competitive advantage can be understood as seeking unique opportunities that will give the enterprise a strong competitive position.

Marketers and analysts need to dig deep into their data in order to rightly understand the impact of marketing campaigns, in order to be successful, the operationalization of BI throughout the organization is required, enabling business intelligence systems (BI) reach all levels of the organization, at the right time and with the necessary information (Guarda T. , Santos, Pinto, Silva, & Lourenço, 2012), being pervasive.

2. Research and Outputs

2.1 Motivation

In recent years, global growth slowed, markets have matured and become more competitive. For many organizations, the only way to grow is at the expense of its competitors (Aaker, Kumar, Day, & Leone, 2009). Companies are dependent on the evolution of marketing, to better adapt their strategies (Malhotra, 2012). This study crosses several areas; it is intended the construction of a framework for integration of Marketing Intelligence in the Pervasive Business Intelligence systems, providing greater flexibility in adapting to changes in business and information needs, and providing better support for marketers in the decision-making process.

2.2 Research Objective

The research problem was identified considering the needs of marketer's to have information to support timely decision, allowing them to be proactive and face competition, and the capabilities of PBI, that enable BI systems reach all levels of the organization, at the right time and with the necessary information.

The objective of this research is to develop a conceptual framework to assist marketers in decision making process, leveraging various technologies, strategies, and resources for sustainable innovation.

Given the complexity of MKTI and its integration into PBI systems, it is intended exploit the best form to improve the approach of MKTI to PBI, taking the first step to the pervasive marketing intelligence (PMKTI).

3. Methodology

The Delphi method was used for gathering and analyzing data for this study. We apply the Delphi method to assess the proposed framework. This method is suitable as a research tool in incomplete knowledge of situations on a phenomenon or problem, but it is not suitable for all kinds of problems in IS and works well when the goal is to improve the understanding of the problems, opportunities, solutions, and also develop forecasts. The Delphi methodology is used for the identification of future events and trends, operationalized by consulting a group of experts. The Delphi method is one of the most popular qualitative methods, is effective as structured and independent surveys of experts do not provide biased estimates of alternative futures (Delurgio, 1998). This is a decision-making method in a group that is characterized by the fact that each member of the group present their ideas independently, each element isolated from the rest of influence. Many variations of the Delphi method have been used in the fields of information (Brancheau, Janz, & Wetherbe, 1996; Schmidt, Kalle, & Keil, 2001; Mulligan, 2002; Okoli & Pawlowsk, 2004; de Bruin & Rosemann, 2007).

To do this, we invited experts from different areas with interests in the areas of BI, PBI and MKTI such as companies in the area of information technology, online sales companies, teachers, and researchers. On the 1st round 21 candidates agreed to read de framework description and give feedback to the presented questions. The final expert panel is composed by 21 personalities, which are distributed in different areas: information technology companies; online sales companies; marketing researcher and information systems researcher. All the communication process with the expert panel was made by e-mail. Whole process was conducted in the absence of any dialogue between members of the expert panel. This qualitative research was developed by questionnaire, through a set of multiple choice questions and open questions questionnaire.

4. Descriptive framework dimensions

There is no a generic model for PBI implementation success, and one of the reasons is the fact that different implementations processes are unique in their own way. In spite of its complexity, we can see the PBI as a framework for organizing the data, information management and tools and technologies that are used to build BI across all organizational departments, for reporting and data analytics (Pirttimäki, 2007; Borking, 2011), and when it's well implemented produces positive results for the end users (Watson & Wixom, 2007).

The process for satisfying user's information needs is complex and composed by different activities to be exploited. The propose framework has been designed primarily to assess the outputs of qualitative inquiry (Fig.16), and comprises three dimensions: data in, data storage and data out. The 1st dimension defines the information needs of the end user. Then in the 2nd, based on the information requirements defined in the previous dimension, data is acquired from multiple sources (internal and external), extracted, cleaned and transformed into information. Finally, in the 3rd dimension, are used analytical tools that transform information into knowledge that will be delivered to the end user for evaluation and possible further feedback if necessary, representing a three-

dimensional iterative cycle. The cycle begins again or continues, as the information needs until the decision makers meet their needs appropriately.

The first dimension is leveraged by the process mining (PM) for evaluation and suitability of process models to the requirements defined in the planning of necessary decision making information. Then the collection process, oriented by the appropriate process model, extract, transforms and load (ETL) organization internal and external data sources, and that include CRM, prospects data, market data and competition. The ETL is a process for extracting data from a database system, where the data are processed, modified, and then inserted into another database (Weijters & Van der Aalst, 2001; van der Aalst, 2009).

In the second dimension, data from the first dimension are loaded, organized and coded information on the data warehouse data marts, specifically in marketing data mart, and is made available for direct querying. The metadata provides transparency as data moves from sources to the warehouse, and from DW to end users (Watson & Wixom, 2007), and helps to create a common way of describing information assets across the organization, integrating the several metadata models in use in organization.

In the third dimension, the data access and analysis process, access marketing data mart applying the marketing metadata models to process organization reporting, querying, and other analytical and predictive applications for representing information from marketing perspective, and the results, or valuable intelligence produced (Pirttimäki, 2007), will be distributed to end-users (marketers) for review and posterior feedback if needed, and the results must be clear and understandable enough for the required decision-makers (Thomas, 2001).

Figure 16. Pervasive Marketing Intelligence framework

5. Expert Panel Evaluation

The Delphi process was applied in three rounds. In order to close each interaction with expert panel members, after all answers received, we have made a resume and which then was validated by the expert panel. The objective of the 1st round was to test the desirability and feasibility of the framework, the questionnaire was designed to evaluate framework in terms of its comprehensiveness, conciseness, completeness, applicability and usability. We used the 5 points Likert scale (1. Strongly disagree, 2. Disagree, 3. Neither agree nor disagree, 4. Agree, 5. Strongly agree). Analysing the reaction of participants (n = 21), it was found that 38.10% do not agree with the structure of the three

dimensions, arguing that the 2nd and 3rd dimension complement each other, not being necessary for their division. Regarding the general assessment of the framework, were not detected major reservations. Based on Cronbach's Alpha, = ,829, it can be concluded, that results indicates good reliability. It should be noted that an alpha of .8 is probably a reasonable goal. In the 2nd round, we sent the results to the participants, and have been sent a new questionnaire to evaluate the processes that compose each of the three dimensions, in terms of completeness, correctness, maintainability, interactivity, accuracy. After analysing the results, in the analysis of all dimensions it was verified that = ,848, reflecting a slight increase, and values per dimension do not exhibit great variance (= ,897; = ,888; = ,724). The consensus holds up among the participants. In the last round, the results were sent to participants, leaving open the possibility of revising. No further changes were observed.

6. Conclusion

This research was achieved through exploring some prospective information systems areas, strategic factors, and measuring related judgments from expert panels. This study develops a research framework that can assist decision makers in emerging economies. This theoretical framework should be followed for implementing PMKTI as an enabler for their competitiveness. The participants in this Delphi process achieved consensus on a generic quality criteria list. The adoption of this core set by the expert panel may be the first step toward a minimum reference standard of quality measures, for the framework quality criteria.

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4.7 Proposal framework

Over last years, throughout the PhD, the developed work was being published in conferences proceedings and journals with peer-reviewed (chapter 4.8). Along this pathway, everything was designed to be possible to build and assess the framework proposed in this study. The penultimate paper proposes the framework (chapter 4.5), and the last (chapter 4.6) infers the same.

In this chapter we present the process of measurement used, which is based on the Delphi methodology. To do this, we invited forty experts from different areas with interests in the areas of PBI and MKTI such as companies in the area of information technology, online sales companies, teachers, and researchers. The final expert panel is composed by twenty-one personalities. All the communication process with the expert panel was made by e-mail. Whole process was conducted in the absence of any dialogue between members of the expert panel.

This qualitative research inquiry was developed by questionnaire, through a set of open questions and multiple choice questions. In order to close each interaction with expert panel members, after all answers received, we have made a resume and which then was validated by the expert panel.

The first step of this process was send an invitation email to selected participants (Apendix A.1 - Delphi Method – Invitation email). The Delphi process was applied in three rounds in order to close each interaction with expert panel members, after all answers received, we have made a resume and which then was validated by the expert panel.

The objective of the 1st round was to test the desirability and feasibility of the framework, the questionnaire (Apendix A.2 - Delphi Method – Round 1) was accompanied by the framework and a description of the framework, and was designed to evaluate framework in terms of its comprehensiveness, conciseness, completeness, applicability and usability. We used the 5 points Likert scale (1. Strongly disagree, 2. Disagree, 3. Neither agree nor disagree, 4. Agree, 5. Strongly agree).

Received the answers, after analysing the reaction of participants (n = 21), it was found that 38.10% do not agree with the structure of the three dimensions, arguing that the 2nd

and 3rd dimension complement each other, not being necessary for their division (Table.2).

Table 2. Descriptive statistics round 1

	You agree with the three dimension structure?	N	Mean	Std. Deviation	Std. Error Mean
Question 1: How do you classify the framework in terms of Comprehensiveness. Is the scope adequate?	1 Yes	13	4.69	.480	.133
	2 No	8	4.50	.535	.189
Question 2: How do you classify the framework in terms of Conciseness. Is understandable?	1 Yes	13	4.38	.506	.140
	2 No	8	3.63	1.061	.375
Question 3: How do you classify the framework in terms of Completeness. It has all the necessary components?	1 Yes	13	3.77	.599	.166
	2 No	8	3.00	.926	.327
Question 4: How do you classify the framework in terms of Correctness. There are any errors?	1 Yes	13	4.00	.000	.000
	2 No	8	3.38	.744	.263
Question 5: How do you classify the framework in terms of Applicability. Can be applied?	1 Yes	13	4.31	.630	.175
	2 No	8	3.50	.926	.327
Question 6: How do you classify the framework in terms of Usability. It is useful?	1 Yes	13	4.23	.599	.166
	2 No	8	3.63	.744	.263

There are significant differences between the rating of participants who agree and disagree with the three-dimensional structure of the framework (Table.3), specifically in questions 4 and 5, with $x^2(1) = 7.58$, $x^2(1) = 4-26$, e $p < 0.05$.

Table 3. . Kruskal Wallis Test– round 1

	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6
Chi-Square	.740	3.249	3.632	7.583	4.265	3.635
df	1	1	1	1	1	1
Asymp. Sig.	.390	.071	.057	.006	.039	.057

Grouping Variable: You agree with the three dimension structure?

Regarding the general assessment of the framework, were not detected major reservations (Graphic.4). Based on Cronbach's Alpha, = .829, it can be concluded, that results indicates good reliability. It should be noted that an alpha of .8 is probably a reasonable goal.
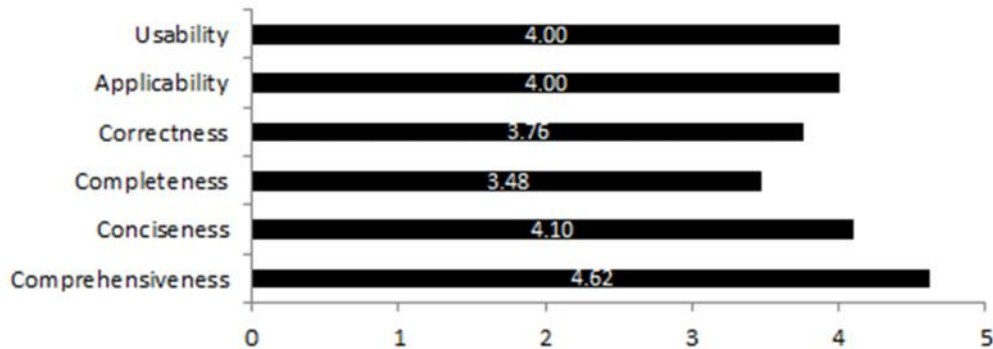
Graphic 4. Expert panel scores

In the 2nd round, we sent the results to the participants, and have been sent a new questionnaire (Apendix A.2 - Delphi Method – Round 2) to evaluate the processes that compose each of the three dimensions, in terms of completeness, correctness, maintainability, interactivity, accuracy.

Received the answers, after analyzing the reaction of participants (n = 21), there are no significant differences between the rating of participants for each dimension of the framework (Table.4, Table. 5), $p > 0,05$.

Table 4. Kruskal Wallis Test – round 2

	Question 1	Question 2	Question 3	Question 4	Question 5
Chi-Square	.156	.193	1.137	1.519	.241
df	2	2	2	2	2
Asymp. Sig.	.925	.908	.566	.468	.886

Grouping Variable: Dimension number

Table 5. Dimensions ranks

	Dimension	N	Mean Rank
Question 1: How do you classify the dimension in terms of Completeness. It has all the necessary steps?	1 Dimension 1	21	31.21
	2 Dimension 2	21	31.64
	3 Dimension 3	21	33.14
	Total	63	
Question 2: How do you classify the dimension in terms of Correctness. There are any errors?	1 Dimension 1	21	30.88
	2 Dimension 2	21	32.33
	3 Dimension 3	21	32.79
	Total	63	
Question 3: How do you classify the dimension in terms of Maintainnability. Can iformation be organized and updated as required?	1 Dimension 1	21	28.81
	2 Dimension 2	21	34.14
	3 Dimension 3	21	33.05
	Total	63	
Question 4: How do you classify the dimension in terms of Interactivity. Can the information process be adapted to users needs?	1 Dimension 1	21	31.31
	2 Dimension 2	21	35.45
	3 Dimension 3	21	29.24
	Total	63	
Question 5: How do you classify the dimension in terms of Accuracy. Is the information precise enough?	1 Dimension 1	21	31.24
	2 Dimension 2	21	33.48
	3 Dimension 3	21	31.29
	Total	63	

It was also observed, in the analysis of all dimensions that   = .848 (Table.6), reflecting a slight increase, and values per dimension do not exhibit great variance (= .897;   = .888;   = .724).

Table 6. Cronbach's Alpha per dimension

Dimension	Cronbach's Alpha	Mean	Variance	Std. Deviation
1	.897	19.10	9.890	3.145
2	.888	19.67	9.333	3.055
3	.724	19.38	6.548	2.559

The consensus holds up among the participants. In the last round, the results were sent to participants, leaving open the possibility of revising. No further changes were observed.

It can be concluded that the participants in this Delphi process achieved consensus on a generic quality criteria list, and the adoption of this core set by the expert panel may be the first step toward a minimum reference standard of quality measures, for the framework quality criteria.

4.8 Publications

Over recent years, throughout the PhD, to present and receive feedback from the scientific community, some work was published:

Teresa Guarda, Manuel Filipe Santos and Filipe Pinto. *Pervasive Marketing intelligence:*. In 2nd International Conference *on on Computer Information Systems and Industrial Applications. CISIA, 2015*

Teresa Guarda, Manuel Filipe Santos and Filipe Pinto. *Pervasive Business intelligence: A framework proposal*. International Conference on Computer Science and Information Engineering (CSIE2015). Bangkok, Thailand. 2015

Teresa Guarda, Maria Augusto and Carlos Silva. *Database Marketing Tools for SMEs The case of RFM Model* . In International Conference on Logistics Engineering, Management and Computer Science . LEMCS 2014, 2014

Teresa Guarda, Manuel Filipe Santos, Maria Augusto, Filipe Pinto and Carlos Silva. *Process Mining: a framework proposal for Pervasive Business Intelligence*. In 8ª Conferência Ibérica de Sistemas e Tecnologias de Informação. CISTI 2013, 2013

Teresa Guarda, Manuel Santos, Filipe Pinto, Maria Augusto, and Carlos Silva. *Business Intelligence as a Competitive Advantage for SMEs*. In International Journal of Trade, Economics and Finance. ICBER 2013, 2013

Teresa Guarda and Carlos Silva. *Database Marketing as competitive advantage in small and medium-sized enterprises*. In International Congress on Social Sciences and Business. ICSSB 2013, Taipei, Taiwan, 2013

Teresa Guarda, Maria Fernanda Augusto, Filipe Pinto and Carlos Silva. *Data mining as a New Business Intelligence Paradigm in the Development of Database Marketing projects*. In International Conference on Future Computers in Education . ICFCE 2012, Lecture Notes in Information Technology, Vols.23-24, . pp. 260-373. 2012. IERI, 2012

Teresa Guarda, Maria Fernanda Augusto, Filipe Pinto and Carlos Silva. *Marketing Intelligence: a framework proposal*. In International Conference on Information Engineering. ICIE 2012, Lecture Notes in Information Technology. Singapore: IERI PRESS. 2012, 2012

Teresa Guarda, Manuel Filipe Santos, Filipe Pinto, Carlos Silva and João Lourenço. *A Conceptual Framework for Marketing Intelligence*. In Journal of e-Education, e-Business, e-Management and e-Learning . IJEEEE, Vol. 2, No. 6, December 2012, 2012

Teresa Guarda, Maria Augusto and Carlos Silva. *Competitive advantage in e-Commerce: The case of Database Marketing*. In International Conference on Business, Economics, and Financial Sciences, Management. BEFM 2011, Advances in Intelligent and Soft Computing Volume 143, 2012, pp 123-130 , Springer Berlin Heidelberg, 2011

Filipe Pinto and **Teresa Guarda**. *An Heuristic Process Proposal for Database Marketing Activities*. In Global Business and Technology Association - Conference. GBATA 2011, 2011

Filipe Pinto and **Teresa Guarda**. *Knowledge Extraction Guided by Ontologies - Database Marketing Application*. In 13th International Conference on Enterprise Information Systems. ICEIS 2011, Proceedings of the 13th International Conference on Enterprise Information Systems, Vol. 1, pp. 320-325. Beijing, China, 2011

Teresa Guarda and Filipe Pinto. *Database Marketing Supported by a Data Mining Process*. In 3rd International Conference on Computational Intelligence and Industrial Application. PACIIA 2010, Wuhan, China, 2010

Teresa Guarda and Filipe Pinto. *Data Mining como Novo Paradigma de Business Intelligence nos Projectos de Database Marketing*. In I International Gaia Congress, Julho 2009. IGC'09, 2009

Filipe Pinto and **Teresa Guarda**. *Data Pre-processing issues: a Case Study for Database Marketing*. In 4ª Conferência Ibérica de Sistemas e Tecnologias de Informação. CISTI 2009, Póvoa do Varzim, 17-20 de Junho de 2009, 2009

Part V – Final Conclusions

In this chapter we present the final conclusions of the developed work, and at the end, some further work considerations.

5.1 Discussion and Related Work

The complexity of today's business environment requires companies to be agile and proactive in relation to decision-making processes (Bocij, Greasley, & Hickie, 2009), it is necessary to understand the information to track the history of sustainable future events, is this factor that leads many organizations to adopt and BI systems in its business processes (Marjanovic, 2007). Then, one of the keys of business strategy for creating competitive advantages is understands the data that companies generate in its own business, the information processing has gradually become the basis for achieving competitive advantage, and organization has to believe that have the right information at the right time and available to the right people (Palmer A. a., 2000). 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 (Aaker, Kumar, Day, & Leone, 2009). BI tools have a number of advantages for businesses, emphasizing the reduction of the dispersion of information; improved access to information; real time information availability; versatility and flexibility in adapting to the reality of the company and usability useful in the decision making process (Lönnqvist & Pirttimäki, 2006).

It can be said that companies intend to obtain and maximize profit through the sale of goods and services. With BI organizations can understand in a systematic sales information and guide trade policies to the specific needs of customers, while still allowing attract new customers and retain old customers with value-added products (Green A. , 2007). The volume of data that companies are creating and storing is increasing, having several data sources: customers, suppliers, business partners, market research, and others. 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 (Eckerson, 2010), and that is essential for a good

business management, guiding managers in strategic direction for quality information, with the establishment of standards and procedures to ensure compliance with the objectives (Ranjan, 2008). It is not guaranteed that a BI system will generate a return on investment because not every business has been successful with BI solutions. But an adequate and integrated BI, can create the competitive advantage necessary for organizations. Once identified business processes must be identified stakeholders key and their roles should be defined the functional requirements and define the information needed for reporting, analysis, and presentation delivery. Companies that have adopted BI systems can compete more effectively in the marketplace, with additional information about their customers, as well as a more efficient financial management. Then, companies should adopt a strategic and active behavior, adjusting supply to its customers, exploring a more competitive pricing model, eventually replacing the current market for new markets, and becoming more competitive compared to competitors (Reeves & Deimler, 2009).

Pervasive Business Intelligence 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 of an organization, through the design and implementation of it as a whole, including technologies, business processes, and organizational culture (Vesset & McDonough, 2009). PBI aims to integrate and align all processes to enable the delivery of relevant information to users who need to support decision making.

The concept of general MKTI in particular has evolved, being seen as a driver for strategy and market success. A MKTI system is a set of procedures and sources used by marketers to get their daily information on relevant developments in the environment in which they operate (Mochtar & Arditi, 2001). The fundamental purpose of MKTI is to help marketing managers to take the decisions, Huster (Huster, 2005) define MKTI as the ability to understand, analyze and evaluate data from internal and external environment, related to the organization, customers, competitors, markets and companies to improve decision-making tactical and strategic, and the integration of competitive intelligence, marketing research, market analysis and analysis of business and financial information. In the future, efforts should be aimed at measuring the demands of not satisfied consumer,

through their behavior, measuring consumer response to marketing activities, and analysis customer's feedback. MKTI systems seeks to transform data into information, and information into intelligence, making it easier for marketers a pro-active and reactive posture.

5.2 Conclusions and Future Work

The research was achieved through exploring some prospective information systems areas, strategic factors, and measuring related judgments from expert panels. This study develops a conceptual framework that can assist decision makers in emerging economies, and in particular marketers. This theoretical framework should be followed for implementing PMKTI as an enabler for their competitiveness.

The framework was evaluated by an expert panel, for that, it was applied the Delphi methodology to assess the framework. The participants in this Delphi process achieved consensus on a generic quality criteria list. The adoption of this core set by the expert panel may be the first step toward a minimum reference standard of quality measures, for the framework quality criteria.

We hope that this research will be considered as a contribution to a better understanding of the application of MKTI em PBI in systems, which will enable organizations can achieve and maintain a sustainable competitive advantage. We intend to take that first step in filling a gap in the MKTI, in the context of PBI systems.

Future research directions include the framework improvement. We intended to deepen in machine learning context, exploring the models and studying the algorithms, with the objective of improving the prediction-making process.

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Apendix A - Delphi Method

1. Invitation eMail

Dear [name],

You are invited to participate in a research study conducted by Teresa Guarda, PhD student from Minho University, Information Systems Department. The researcher hopes to identify the innovation resources that contribute for the first step in filling a gap in the MKTI, by proposing a conceptual framework for Marketing Intelligence systems in the context of PBI systems. You are being asked to take part because you are considered as an expert in the area.

Participation in this research is totally voluntary. If you decide to participate, you will not receive any direct benefit from taking part in this study, but through your participation as an expert, researcher, and decision-maker, the study may help to increase knowledge which may help others in the future.

All process will be confidential and will not be shared with any third party. Any data linked to your identification will be kept confidential, only accessible by the researcher. The data will be stored in the researcher's computer, and will be destroyed within after the completion of research.

Best Regards,

Teresa Guarda

Minho University, Campus de Azurém
Guimarães, Portugal

2. Round 1

Framework description

There is no a generic model for PBI implementation success, and one of the reasons is the fact that different implementations processes are unique in their own way. In spite of its complexity, we can see the PBI as a framework for organizing the data, information management and tools and technologies that are used to build BI across all organizational departments, for reporting and data analytics (Pirttimäki, 2007; Borking, 2011), and when it's well implemented produces positive results for the end users (Watson & Wixom, 2007). The process for satisfying user's information needs is complex and composed by different activities to be exploited. The propose framework has been designed primarily to assess the outputs of qualitative inquiry, and comprises three dimensions: data in, data storage and data out. The 1st dimension defines the information needs of the end user. Then in the 2nd, based on the information requirements defined in the previous dimension, data is acquired from multiple sources (internal and external), extracted, cleaned and transformed into information. Finally, in the 3rd dimension, are used analyticals tools that transform information into knowledge that will be delivered to the end user for evaluation and possible further feedback if necessary, representing a three-dimensional iterative cycle. The cycle begins again or continues, as the information needs until the decision makers meet their needs appropriately. The first dimension is leveraged by the process mining (PM) for evaluation and suitability of process models to the requirements defined in the planning of necessary decision making information. Then the collection process, oriented by the appropriate process model, extract, transforms and load (ETL) organization internal and external data sources, and that include CRM, prospects data, market data and competition. The ETL is a process for extracting data from a database system, where the data are processed, modified, and then inserted into another database (Weijters & Van der Aalst, 2001; van der Aalst, 2009). In the second dimension, data from the first dimension are loaded, organized and coded information on the data warehouse data marts, specifically in marketing data mart, and is made available for direct querying. The metadata provides transparency as data moves from sources to

the warehouse, and from DW to end users (Watson & Wixom, 2007), and helps to create a common way of describing information assets across the organization, integrating the several metadata models in use in organization. In the third dimension, the data access and analysis process, access marketing data mart applying the marketing metadata models to process organization reporting, querying, and other analytical and predictive applications for representing information from marketing perspective, and the results, or valuable intelligence produced (Pirttimäki, 2007), will be distributed to end-users (marketers) for review and posterior feedback if needed, and the results must be clear and understandable enough for the required decision-makers (Thomas, 2001).

Framework
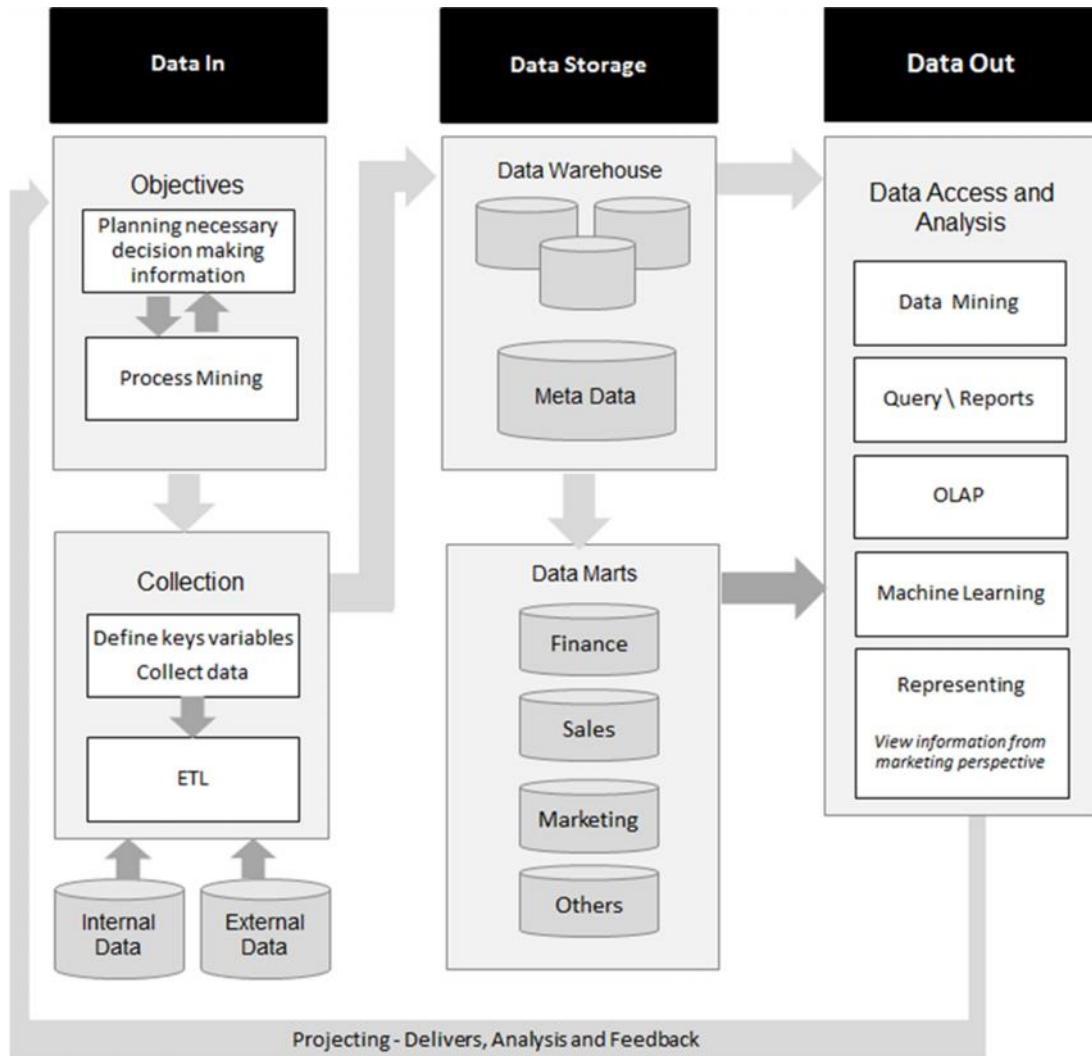
Round 1

Rate the framework. Will be used the Likert scale (1. Strongly disagree, 2. Disagree, 3. Neither agree nor disagree, 4. Agree, 5)

*Mandatory

1. How do you classify the framework in terms of Comprehensiveness. Is the scope adequa

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

2. How do you classify the framework in terms of Conciseness. Is understandable? *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

3. How do you classify the framework in terms of Completeness. It has all the necessary components? *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

4. How do you classify the framework in terms of Correctness. There are any errors? *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

5. How do you classify the framework in terms of Applicability. Can be applied? *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

6. How do you classify the framework in terms of Usability. It Is useful? *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

7. You agree with the three dimension structure? *

☐ Yes

☐ No

8. Comments and suggestions?

3. Round 2

Rate the each dimension framework. Will be used the Likert scale (1. Strongly disagree, 2. Disagree, 3. Neither agree nor disagree, 4. Agree, 5)

Dimension 1 – Data In

1. How do you classify the dimension in terms of Completeness. It has all the necessary steps?

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

2. How do you classify the dimension in terms of Correctness. There are any errors?

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

3. How do you classify the dimension in terms of Maintainnability. Can information be organized and updated as required?

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

4. How do you classify the dimension in terms of Interactivity. Can the information process be adapted to users needs?

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

5. How do you classify the framework in terms of Accuracy. Is the information precise enough?

1 2 3 4 5

Strongly disagree ○ ○ ○ ○ ○ Strongly agree

6. Comments and suggestions?

Rate the each dimension framework. Will be used the Likert scale (1. Strongly disagree, 2. Disagree, 3. Neither agree nor disagree, 4. Agree, 5)

Dimension 2 – Data Storage

1. How do you classify the dimension in terms of Completeness. It has all the necessary steps?

1   2   3   4   5

Strongly disagree   ○   ○   ○   ○   ○   Strongly agree

2. How do you classify the dimension in terms of Correctness. There are any errors?

1   2   3   4   5

Strongly disagree   ○   ○   ○   ○   ○   Strongly agree

3. How do you classify the dimension in terms of Maintainnability. Can information be organized and updated as required?

1   2   3   4   5

Strongly disagree   ○   ○   ○   ○   ○   Strongly agree

4. How do you classify the dimension in terms of Interactivity. Can the information process be adapted to users needs?

1   2   3   4   5

Strongly disagree   ○   ○   ○   ○   ○   Strongly agree

5. How do you classify the framework in terms of Accuracy. Is the information precise enough?

1   2   3   4   5

Strongly disagree   ○   ○   ○   ○   ○   Strongly agree

6. Comments and suggestions?

Rate the each dimension framework. Will be used the Likert scale (1. Strongly disagree, 2. Disagree, 3. Neither agree nor disagree, 4. Agree, 5)

Dimension 3 – Data Out

1. How do you classify the dimension in terms of Completeness. It has all the necessary steps?

1　2　3　4　5

Strongly disagree　○　○　○　○　○　Strongly agree

2. How do you classify the dimension in terms of Correctness. There are any errors?

1　2　3　4　5

Strongly disagree　○　○　○　○　○　Strongly agree

3. How do you classify the dimension in terms of Maintainnability. Can information be organized and updated as required?

1　2　3　4　5

Strongly disagree　○　○　○　○　○　Strongly agree

4. How do you classify the dimension in terms of Interactivity. Can the information process be adapted to users needs?

1　2　3　4　5

Strongly disagree　○　○　○　○　○　Strongly agree

5. How do you classify the framework in terms of Accuracy. Is the information precise enough?

1　2　3　4　5

Strongly disagree　○　○　○　○　○　Strongly agree

6. Comments and suggestions?

Apendix B – Publish Papers

Teresa Guarda, Manuel Filipe Santos, Filipe Pinto. *Pervasive Business Intelligence: a framework proposal.* In nternational Conference on Computer Science and Information Engineering (CSIE2015)). Will be Published in WIT Transactions on Information and Communication Technologies, ISSN: 1743- 3517. 2015

Teresa Guarda, Manuel Filipe Santos, Filipe Pinto. *Pervasive Marketing Intelligence.* In International nference on Computer Information Systems and Industrial Applications (CISIA2015). Will be Published in WDEStech Publication, ISBN: 978-1-60595-255-0. 2015

Teresa Guarda, Maria Augusto and Carlos Silva. *Database Marketing Tools for SMEs The case of RFM Model* . In International Conference on Logistics Engineering, Management and Computer Science . LEMCS 2014, 2014

Teresa Guarda, Manuel Filipe Santos, Maria Augusto, Filipe Pinto and Carlos Silva. *Process Mining: a framework proposal for Pervasive Business Intelligence*. In 8ª Conferência Ibérica de Sistemas e Tecnologias de Informação. CISTI 2013, 2013

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Teresa Guarda, Maria Augusto and Carlos Silva. *Competitive advantage in e-Commerce: The case of Database Marketing*. In International Conference on Business, Economics, and Financial Sciences, Management. BEFM 2011, Advances in Intelligent and Soft Computing Volume 143, 2012, pp 123-130 , Springer Berlin Heidelberg, 2011

Filipe Pinto and **Teresa Guarda**. *An Heuristic Process Proposal for Database Marketing Activities*. In Global Business and Technology Association - Conference. GBATA 2011, 2011

Filipe Pinto and **Teresa Guarda**. *Knowledge Extraction Guided by Ontologies - Database Marketing Application*. In 13th International Conference on Enterprise Information Systems. ICEIS 2011, Proceedings of the 13th International Conference on Enterprise Information Systems, Vol. 1, pp. 320-325. Beijing, China, 2011

Filipe Pinto and **Teresa Guarda**. *Database Marketing Process Supported by Ontologies:A Data Mining System Architecture Proposal*. In New Fundamental Technologies in Data Mining, Edited by Kimito Funatsu and Kiyoshi Hasegawa, ISBN 978-953-307-547-1, 2011

Filipe Mota Pinto, **Teresa Guarda**, Carla Fernandes, and Micaela Esteves. Achieving Advantage In The Education Of Young Children With Special Needs. In International Conference. IADIS e-Society 2011, Proceedings of the IADIS International Conference on e-Society. Avila, Spain, 10-13 March 2011. Edited by Piet Kommers and Pedro Isaías, ISBN (Book): 978-972-8939-46-5 , 2011

Filipe Pinto, **Teresa Guarda** and Pedro Gago. *A Framework Proposal for Ontologies Usage in Marketing Databases*. In International Conference on Model & Data Engineering. MEDI 2011, In Lecture Notes in Computer Science: Model and Data Engineering (Vol. 6918, pp. 31-41). Springer Berlin / Heidelberg, 2011

Teresa Guarda and Filipe Pinto. *Database Marketing Supported by a Data Mining Process*. In 3rd International Conference on Computational Intelligence and Industrial Application. PACIIA 2010, Wuhan, China, 2010

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