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# **BUSINESS INTELLIGENCE SYSTEMS IN THE FINANCIAL INDUSTRY**

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**SOMMARIO.** La Business Intelligence è un concetto manageriale in grado di supportare le persone nella gestione dell'informazione e nel prendere importanti decisioni. Molti hanno introdotto la BI come un processo di trasformazione dei dati in informazioni e delle informazioni in conoscenza. Questo concetto è diventato un trend molto popolare soprattutto in quei settori del business particolarmente interessati ad apportare valore aggiunto al proprio processo decisionale. La base del mio lavoro è rappresentata dalle ricerche svolte a livello generale al fine di analizzare la situazione attuale della BI nel settore finanziario. Per approfondire il livello di analisi ho poi sottoposto diversi campioni rappresentativi ad un sondaggio fine ad analizzare il livello di implementazione di applicativi BI all'interno dei maggiori gruppo bancari italiani. Questo studio va quindi ad analizzare l'attuale stato dell'arte per approdare poi alle maggiori tendenze future ed aspettative. La ricerca considererà parimenti le aree chiave di miglioramento nella Business Intelligence operativa, i benefici ottenuti e tutti i punti di forza che devono essere considerati a fronte dell'adozione di un sistema di BI nello scenario italiano.

Procederò quindi ad una disamina delle tecniche di Data Mining adottate dalle banche con attenzione particolare agli impatti dei flussi di informazione con la crisi finanziaria globale. Mi concentrerò specialmente nella ricerca del ruolo che gestioni non proficenti dei dati hanno giocato nei vari aspetti di tale crisi, con particolare attenzione all'identificazione delle frodi. Per dimostrare tale correlazione utilizzerò il famoso caso Madoff come oggetto di studio al quale applicare le diverse procedure di analisi, illustrando contemporaneamente le tecniche che avrebbero potuto portare ad una corretta identificazione della situazione ed enucleando quali di queste avrebbero comportato indicazioni di una frode.

Considerando tali premesse metodologiche, ulteriore e conseguente passo è stato quello di analizzare come la Business Intelligence possa influire positivamente sulla gestione dei rischi operativi connessi con l'attività bancaria e come a una corretta analisi dei dati conseguano concreti successi finanziari. L'emblematico caso Unicredit, descritto in questo lavoro, mostrerà il drastico cambiamento degli indicatori finanziari sia nell'indotto che nel bilancio da un anno all'altro.

Tesi centrale del mio studio è la dimostrazione, attraverso studi teorici e casi pratici, dell'importanza di una corretta analisi dei dati nel settore finanziario. L'utilizzo di applicativi adatti e la disponibilità di dati qualitativamente elevati può essere una strategia vincente nell'affrontare situazioni critiche cruciali, specialmente per le società del settore bancario che operano attraverso strategie di rischio che necessitano di un monitoraggio costante.

Nonostante non sia stato oggetto di sufficiente attenzione, o forse proprio per questo, l'utilizzo di flussi informativi di scarsa qualità ha giocato un ruolo chiave nella crisi finanziaria globale iniziata nel 2007. Questo è il motivo per il quale il cardine di questa ricerca ruota attorno alla domanda: "AVREBBE POTUTO LA BUSINESS INTELLIGENCE SCONGIURARE LA CRISI FINANZIARIA?"

**ABSTRACT.** Nowadays the Business Intelligence is one of the best new and innovative 'weapons' for banks and organizations to gain competitive advantage. In this work the main concentration is on Data Warehousing and Data Mining which are among the most often used Business Intelligence tools in banking industry. In a first part, after general researches and studies, a survey has been conducted with the aim to examine the present implementation of Business Intelligence tools in the Italian banking system. I have then moved to analyze the impact of data regarding the recent financial crisis. I have indeed carried out a little research investigating the role of data issues in various aspects of this financial criticality. In this special part I have illustrated how data that was available to underwriters, credit agencies, the Securities and Exchange Commission (SEC), and fund managers could have been used to detect the problems that led to the financial crisis. As a consequence to this last point I have finally analyzed how business intelligence is able to help in managing all different kinds of risk usually banks have to deal with and how a correct evaluation of data can result in a concrete financial success.

[Exegi monumentum aere  
perennius  
regalique situ pyramidum altius  
quod non imber edax, non Aquilo impotens  
possit diruere aut innumerabilis  
annorum series et fuga temporum ]

Orazio - Odi III, 30

The final work that I am going to present comes to the very epilogue of a whole academic career for which I have dedicated all my time, my energies and my concentration. In this moment it's really unavoidable, and almost compulsory, to think about all those places, episodes and people that have been scenario and company during my university years, distinctively featuring them and let them becoming special in their own way.

The first thanks that I have to make is bounded for professor Carlo Vercellis in order to have offered me the wonderful opportunity to deepen his subject of researches and to have therefore allowed me to be active part of his project. What I have appreciated the most has been the possibility to work on a creative and innovative idea.

I want then to thank all my friends, in particular those who have been close to me in these last months by showing enthusiasm and interest in my work and by enriching my spare time with encouragements, laughs, jokes and beautiful free moments.

Last but not least, I want to thank my family to have supported me during all my academic career and because it's thanks to their education if now I am able to show this strong behavior and determination typical on me. Considering the affection they have towards me I just hope to always be a source of satisfaction for them.

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## .EXECUTIVE SUMMARY.

Business Intelligence is a managerial concept that is able to help people to manage information and to make important factual decisions. Some have introduced Business Intelligence as a process of turning data into information and information into knowledge. This concept has become a popular trend for businesses interested in adding value to their decision making processes.

In a first part of this work I will run general researches and studies in order to analyze the current situation of BI in the financial sector and, to be more specific, a survey will be conducted with the central aim to examine the present implementation of Business Intelligence tools in the Italian banking system. This study, indeed, examines the maturity level of BI activities as well as all the future outlooks and trends related to them. The research will also examine key areas of improvement in Business Intelligence operations, benefits gained as well as the strength point of Italian banking industry in using Business Intelligence.

I will then move to examine all data mining techniques adopted by banks, in particular I will analyze the impact of data regarding the recent financial crisis. I will therefore carry out a little research investigating the role of data issues in various aspects of this financial criticality, my main focus will be on fraud detection. In order to demonstrate that, I will use the famous case of Madoff fraud as data quality case study by applying simple exploratory procedures to illustrate simple techniques that could have been used to detect problems. I will also illustrate some modeling methods that could have been used to help in finding indications of fraud.

As a consequence to this last point I will finally analyze how Business Intelligence is able to help in managing all different kinds of risk usually banks have to deal with and how a correct evaluation of data can result in a concrete financial success. I will examine the case of Unicredit Group where I will show the distinct change in all its financial indicators in both the income statement and balance sheet from a year to the other.



As a conclusion, the central aim of my work is then to demonstrate through either theoretical studies or practical cases the importance of data analysis in the financial sector. Having proper tools and data of high quality can be a winner strategy in order to face crucial and critical situations, especially for banks who have always to deal with dangerous activities that require 24 hours monitoring and controls. Though it has not received a lot of publicity, poor data quality played a significant role in the global financial crisis that began to unfold in 2007. That's why one of the central point of this research turns around the following question: "COULD BUSINESS INTELLIGENCE HAVE HELPED AVOID THE FINANCIAL CRISIS?".

[With all of these (cyclical) findings,  
why is it so hard for man to believe that perhaps  
his buying and selling of stocks and bonds  
may not be rational after all? ]

# .CHAPTER ONE: INTRODUCTION.

## 1.1 Introduction to cycles

Since the beginnings of recorded history, mankind has debated the ageless philosophical question of destiny and fatalism, and man's supposed free will to create his own individual life cycle. Natural catastrophes and large scale warfare have often been the philosophical catalysts in forming this debate of whether man actually has free will in determining his destiny.

In the natural realm, animal life was long known to exhibit life cycles of consistent regularity, and fisherman and fur trappers often recounted the years of abundance or scarcity in their harvest. Cycles of draughts and famines are well known to all farmers and workers of the land and weather prediction has become a modern day scientific marvel. Prior to the founding of the Federal Reserve System and centralized banking in this country, financial booms and busts were regular recurring phenomenon for months to buy and sell, and were held in awe by the less cyclically educated because of their seemingly uncanny ability to pick the highs and lows of the economic cycle.

In the ancient world, fascination with the heavenly bodies at least made the masses aware of possible cyclical influences in their lives, although fatalism and superstition prevented any real serious study except on a limited scale. Religious bias and persecution often hindered the study of cyclical determinants of human behavior especially when recurring crop failures and draughts could be of better use to politicians within the religious

governing bodies. Almost all rulers both secular and religious had appointed soothsayers and astrologers to provide official explanations for cyclical events that might rouse up the masses. Even in the more modern age, perhaps the greater mental giant that ever walked the earth, Sir Isaac Newton was the official court astrologer and personally defended the practice with great zeal.

In the modern age rigid political and academic ideologies constantly persecute cyclists and fatalists in order to maintain their power structures even in the face of modern scientific evidence of an overwhelming magnitude. Tacit acknowledgement of the cyclical nature of the economy is the underlying principle of Keynesian economic planning, whereby the politicians decide to spend more money in bad times to stimulate the economy when the natural consumer cycle is sluggish. It is a shame that politicians seem to think that everyday things are bad enough to need their omniscient stimulation.

Wall Street, although one of the last bastions of real freedom and economic choice, has had a hard time dealing with the rise of “ *cyclical investing methodologies* ” since these do not intellectually lend themselves to generating ever more sales commissions on a delay basis. Who wants, or needs a Wall Street stock analyst if the cycle say stocks will decline for the next year or even more?

In the final analysis, the human being is primarily a rational being. At least he thinks he is. Objective observation of human behavior would seem to indicate, however, that he is largely emotional by nature, and the more emotional he is the less it has to do with rationality.

Modern science has discovered biological clocks, circadian rhythms, estrogen and endocrine rhythms, sleep cycles, sunspot cycles, cosmic rhythms and a multitude of others too numerous to even mention. Most of these are what we would term external determinants, even though they are found often internally, as opposed to rational thinking determinants. With all of these findings, why is it so hard for man to believe that perhaps his buying and selling of stocks and bonds may not be rational behavior after all?

Over the years people have come to the conclusion that there are only four major motivating influences in the world. These are money, sex, power, and religion. The perfect

example of all of these in the U.S. Congress. Often all four will be excessively exhibited by individual members of Congress.

The stock market of course has to do with money and I would hypothesize that the smartest minds in the world that are motivated by money either are found on Wall Street or in Las Vegas why is it, that many of these great minds are not so successful in cracking the secret of stock price movements? It's firmly believed it has to do with rational minds trying to battle emotional problems. What people buy and sell has very little to do with what they say they are doing (rationalizing) but more with what they feel.

The intellectuals have been attacking the problem with a rational understanding which is bound to fail. The problem is akin to the millions of people who go on diets to lose weight. Billions of dollars have been made by selling books on diet fads, vitamins, and exercise, and knowledge about losing weight is readily obtainable by everyone. But who actually loses weight and keeps it off? The answer lies in emotional behavior not rational knowledge.

## 1.2 Why Business Intelligence matters now more than ever

I have decided to start with this history of cycles since I firmly believe that nowadays the power of taking decisions is strongly obstructed by the kind of information and the amount of time we have.

Following this concept, Herbert Alexander Simon, an American political scientist, economist, psychologist and professor, coined the term "*Bounded Rationality*". Bounded Rationality is a concept which relates to the fact that the decision making capability of individuals is limited by the information that they have and the finite amount of time they have to make decisions. This aspect definitely carries a lot of relevance to all those subjects like the Business Intelligence, where managers and decision makers have to grapple with a plethora of choices, both known and unknown, before zeroing in on the optimal choice of BI solutions for their respective organizations.

This aspect already described must be taken into deep consideration, since Business Intelligence and Information Technology in general is gaining more and more importance in the company strategic scenario, especially in the financial sector, where the importance of analysis and comprehension of data, forecasting of future trends and ability to run faultless decisions is absolutely critical. Researches and studies carried on show that nowadays Business Intelligence has reached a central and crucial role in the bank decision-making process. The importance of correct information and data quality is growing faster day by day, therefore it's time for financial companies to take steps to make BI tools available to all employees who need access to timely information and analysis of it. What pushes more and more toward the adoption and implementation of BI tools is the fact that those products on the market today run faster, are easier to use and cost less than once was the case. Nowadays BI applications can be delivered using open source software and on demand over the Internet in the form of software as a service (SaaS). Also customers' expectations have evolved: users want BI to do more than in the past, such as processing business events and adding geographic context to information, all capabilities that the conventional wisdom overlooks. Really useful BI involves collaboration and provides guidance on actions driven by goals, objectives and plans. These and other activities bring

BI into the real of performance management. To move towards this direction of more strategic BI, banks must manage data effectively to ensure that the information they disseminate is of high quality and subject to careful governance. This also means having fast and inexpensive data warehouses to support Business Intelligence where needed throughout the enterprise, never forgetting the management side. The latter point, even if underestimated, is critical. An effective BI, indeed, requires both capable executive leaderships and responsible boards of managers, who must be in charge in making BI available in both developing and embracing best practices to avoid unnecessary costs and inefficiencies. In these last years, all these features and goals have become achievable in financial companies, mainly thanks to the development of powerful software and tools able to meet all the requirements of either the company or the customer. Business Intelligence softwares, in fact, are no longer the exclusive province of technologically astute business analysts. Generally speaking, BI tools nowadays are being used by new types of users in new ways, for instance, by operational workers to respond to events as they occur in the sales organization or the supply chain, or by mobile users in sales and field service to access information related to geographical locations to maximize travel efficiency and provide service faster. Fields of application are thousands, what is really important and totally not easy is to turn the company culture into a different way of thinking and working.

If we consider in the past years, in fact, broadening the BI user base has presented not few challenges. These new users needed to access different and often more diverse sources of data than do business analysts, and this data often were stored in forms less highly structured than the relational databases where business data typically has been stored by IT. Moreover, it proved to be the case that users who draw on transactional systems for data often require more frequent and precise updates. Yet despite these challenges, the potential to be able to tap the right information and use it to make smart decisions quickly served as a strong motivator driving the wider adoption of BI across the enterprise. Businesses, nowadays, continuously collect information. This information can make banks more intelligent and competitive, so they naturally want to make it available to as many of their people and train them to use it productively. But employees must be able to sift through masses of data to find the information that helps them quickly make better decisions that benefit the business. Technically business analysts for years have used Business Intelligence software to access, analyze and report on data. But as the software became easier to use over this past year, its use spread to larger numbers of less

technically sophisticated users. Based on the year's developments, BI now seems about to break out of its propeller-head ghetto; all that's required is for the applications to be able to handle more types of data, including, for example, events reported by transactional systems and location contexts derived from operations.

As BI spread across the organization, recently new forms have begun to evolve to make it more broadly useful for business and IT. One key development, and also a crucial aspect especially for a bank reality, is *complex event processing*.

Line of business employees increasingly need to have real-time information that flows from events. This new technology, associated with operational intelligence, has enabled them to take action in response to these events to complete key processes, such as loans and credits. Increasingly in 2009, the usage of BI to infuse deeper real-time intelligence into operational decision-making provided a competitive advantage for banks in the form of better service to customers and distributors. Similarly, the location context of information continued to grow in importance to all those financial organizations that use physical proximity to help guide decisions. This approach is now called *location intelligence*. As expected, the ability to process data in a location context or present information graphically in maps or diagrams delivered an edge to organizations by improving their abilities to optimize customer relationships. The rising popularity of devices such as smart phones and geographic positioning systems, indeed, meant businesses had to learn to use information more dynamically. They faced, and in some cases satisfied, the demand to be able to provide it to employees across a range of roles to assist them in decision-making and make it available to today's increasingly impatient customers. The emerging combination of easier-to-use BI tools, the integration of various data types from multiple sources and frequent updates of data that change over time enabled progressive financial organizations to keep up with the hectic pace of business. But achieving this aim and meeting the technological challenges to support it proved challenging and requiring commitment from both the bank and its technology suppliers and this trend is still evolving as we transition to 2011.

# .CHAPTER TWO: BANKING BUSINESS INTELLIGENCE.

In this first chapter I will introduce the main concept of Banking Business Intelligence, an important branch of a broader field known as Business Intelligence. The chapter will cover the main themes in the following order:

- Banking scenario overview
- The evolution of banking Business IntelligenceBusiness Intelligence
- 2010 BI trends

Starting from a general introduction explaining the current banking scenario, I will then go through all different steps that signed both the evolution and development of Business Intelligence during centuries. After this “journey” I will finally describe the ten main trends occurring in the current year (2010), a very crucial point since it’s starting form here that, in collaboration with the “Osservatorio della Business Intelligence”, we started to run different researches and analysis based on real case studies.



## 2.1 A banking scenario overview

The banking sector today is fast paced and is constantly in the throes of change, with new regulations, new processes and new policies in place. Technology has played a critical role in the past in shaping the way things are today, and it will continue to do more than ever before. From being just a support function, technology is now regarded largely as a strategic function aiding banking organizations.

In the Banking sector today, indeed, there is a constant challenge of addressing the various industry pressures in terms of global competition, regulation and compliance, customer expectations and efficiency of operations. Competition makes it difficult for banks to show differentiation and even harder to show profits. In such a situation, competitive advantage is derived by those banks that effectively leverage their processes and systems around customers and channels in order to deliver innovative products and services, retain the customer and enhance lifetime value.

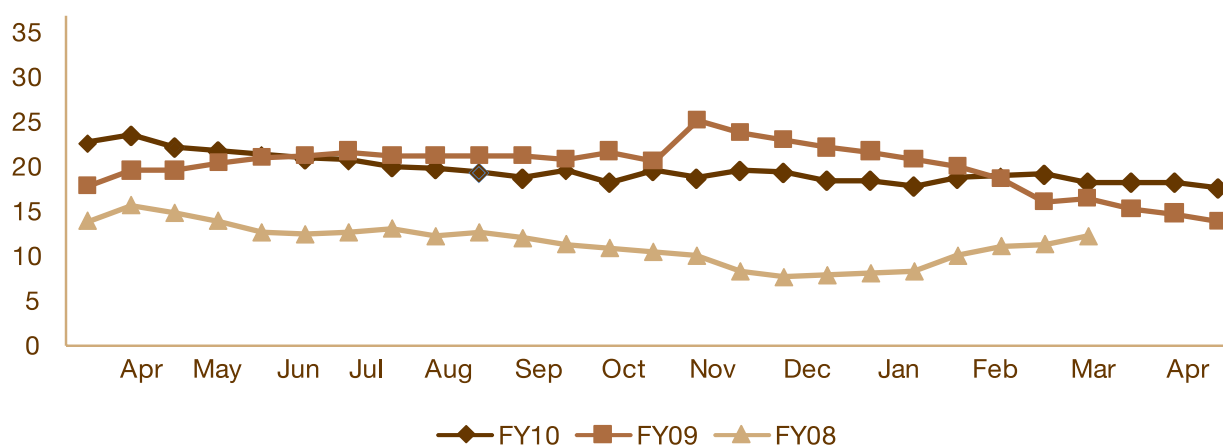
For banking and financial services institutions, indeed, drivers that precipitate a review and a change of systems can generally be categorized into a combination of three main business challenges:

- New or enhanced revenue streams
- Greater operational efficiency, visibility, risk and control
- Lower total cost of ownership

Figures 1 and 2 shown below draw perfectly the banking scenario in these last years, explaining all in terms of:

- Loans growth
- Low cost funds

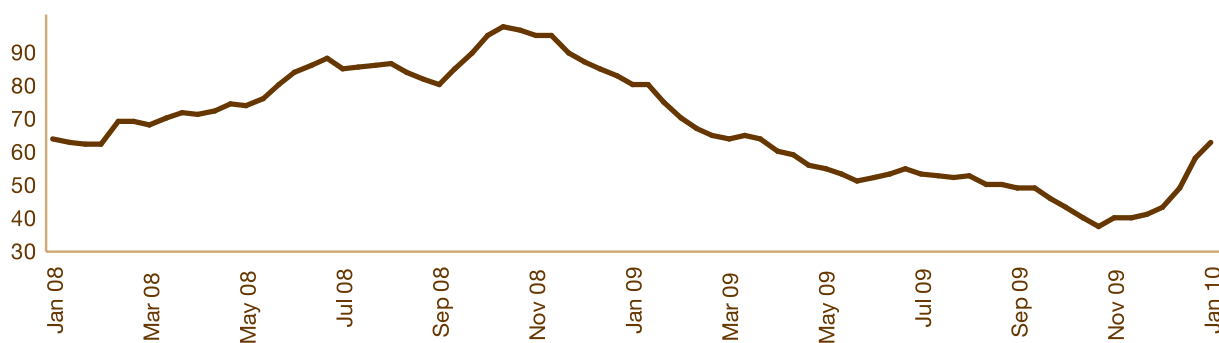
## Loans Growth: Out of recession



Source: RBI, PwC Research

Banking system loan growth at 14.9% YoY in end January 2010, was well above the multi-year low of 9.7% in October 2008. YTD loan growth now stands at 9.4%.

Figure 1: focus on low cost funds



Source: RBI, PwC Research

Deposits increased by Rs528bn during the fortnight, and are now growing at 17.1% YoY. Incremental loan to deposit ratio (LDR) improved to 62.7%, substantially above the low of 37% witnessed in October 2009. This should help banks to grow their NII further.

Figure 2: focus on low cost funds

## 2.2 The evolution of Banking Business Intelligence

Institutions in the banking sector have made big and substantial investments in Business Intelligence over the past decade. The always increasing awareness in all the potentialities of BI tools made possible all the fast and immediate changes in the internal organization of those financial institutions over time. They have progressively begun to understand the high capability of Business Intelligence in helping them to manage risks, to detect fraud, to leverage customer insights and to gain visibility into their profitability. However, the enormous upheaval in the industry over the last eighteen months unquestionably exposed glaring inadequacies in levels of *'intelligence'*, with many institutions either operating in blissful ignorance of the devastating time-bombs ticking away inside critical business units or choosing to willfully ignore ringing alarm bells when a more prudent approach was clearly required.

As it can be clearly seen, Business Intelligence has always played a strategic role in the financial world, as it has always empowered business managers to make faster, better and more informed decisions in a difficult business environment.

By going back to the past a little, and more precisely, by going to consider Banking Business Intelligence evolution, even when there were no computers, banks had put in place an efficient system of recording various transactions. Most business transactions took place at branches, which were supplying both management and regulatory reports. These reports were manually consolidated at intermediate controlling offices for eventual aggregation at the corporate level, but these manual systems worked well till the scale of operations were relatively small.

As banks grew in size and expanded geographically, the volume of transactions became quite large and manual aggregation became both time consuming and error prone. Banks with a large number of branches, indeed, spread across geographies, began using computers to automate the aggregation process.

Despite these efforts, Management Information System (MIS) in banks had the following drawbacks:

- Different views of data (departmental silos)
- Time lag (aggregation held up till each branch has reported)

- Data quality (each stage of consolidation and aggregation was a source of errors).
- Unavailability of customer specific data (customer identity shrouded by product centric record keeping and branch data encapsulation in batch processing)
- Data granularity required for developing analytics (what if scenario, drill down) was not available to decision makers.
- Reporting activity competed with business activity for resources at the branch.
- Data classification rules were not applied uniformly across the organization, and also varied with time.

Nowadays, majority of banks have begun to use information technology for MIS. The inflexibility of Cobol programs and batch processing was soon overcome by powerful desktop systems with rudimentary database systems, which allowed banks to analyze data, once it has been received in manual form from branches, transcribed into machine readable formats and validated. Quite a few of regulatory (which banks termed as statutory in those times) reports were also produced in this way. These earlier initiatives laid the foundations of BI in banking.

## 2.3 2010 Trends

After this 'journey' in the history of the Banking Business Intelligence I have decided to introduce the current scenario by listing and then analyzing the major 2010 Business Intelligence trends. Starting from a Gartner source, I have applied what are considered the main evolution factors of the current Business Intelligence to the banking world.

Those ten trends are the following:

- Business Intelligence program governance.
- Enterprise-wide data integration
- Semantic technologies
- Advanced Analytics
- Operational systems and data warehouse
- New priorities in BI
- Complex Event Processing (CEP)
- Unstructured/semi structured data
- Social Computing
- Cloud Computing

### 2.3.1 INCREASING DATA AND BUSINESS INTELLIGENCE PROGRAM GOVERNANCE

In order to make the most of BI and analytics, a bank needs to get the right data. That means:

- *Establishing a data governance discipline:* the discipline embodies a convergence of data quality, data management, data policies, business process management, and risk management surrounding the handling of data in an organization. Through data governance, banks try to exercise positive control over the processes and methods used by their data steward and data custodians to handle data.
- *Achieving and maintaining a level of data quality that is appropriate for the applications:* many organizations seem to prefer to wait until it is too late before taking any action, which is for obvious reasons critical for banks.. Ensuring data quality within operational and Business IntelligenceBusiness Intelligence applications is a discipline that is frequently overlooked by many organizations. It is often not until someone discovers a major problem that could have been avoided through quality control of data that the importance of data quality is recognized. Once this occurs, most executives quickly realize that almost all of the bank's operational and analytical business processes rely on a solid, high-quality, data foundation.
- *Developing a corporate standard for data terms and usage:* data standardization is the process of making all data of the same type or class conform to an established convention or procedure to ensure consistency and comparability across different databases. This is especially important and necessary in a data warehouse environment that contains information from many sources. Without data standardization, no relationship can be established between the various data sources to produce reports that include information from multiple data sets within the data warehouse.

### 2.3.2 ENTERPRISE-WIDE DATA INTEGRATION IS A GOOD INVESTMENT

Leading banks and financial organizations have begun to employ a coordinated, enterprise-wide approach to data integration, enabling either cross-functional analysis or enterprise-wide performance management, and improving applications such as customer (CRM) and risk management. The Enterprise-wide method is quite simply to set a way for companies to capture business-critical information and make it visible across the entire organization. In many businesses today the internal operations of banks run in a manner where the internal departments are treated as individual businesses somewhat like that of a silo or tower standing on its own and operating under its own controls and processes. Enterprise analytics is a way for the bank to link the separate business towers and make the critical business information available to all. In many cases the information being tracked is related to the transactions taking place. In addition, enterprise analytics must allow for the information to be easily viewed and readable to the persons that must make the critical business decisions that can lead to the success or failure of a bank. Enterprise analytics gives executives a way to see what is happening across the bank at any time. Their efforts demonstrate the cost savings of a comprehensive data integration approach replacing multiple isolated redundant projects.

### 2.3.3 THE INCREASING DIFFUSION OF SEMANTIC TECHNOLOGIES

Semantic technologies, including ontology, taxonomies, classification, content monitoring, filtering and analytics, applied to information management, help banks reconcile and normalize meaning across different sources of data and content. Recent innovation allowing structured queries over unstructured data is providing greater precision, speed of delivery and reduction of information overload when analyzing content, versus using enterprise search. The theme of semantic technologies is one of the '*hottest*' one of these last years, but in order to better understand it, it can be useful to start with another crucial principle of nowadays: *Content Intelligence*.

The adage "*content is king*" has never been truer than it is today. Banks across the board are rapidly evolving their services to provide their customers with even more value in the face of the economic meltdown. With its near unlimited capacity and zero-cost of publishing, the Internet has grown astronomically. In 2006, it was estimated that the Internet encompassed 70 million blogs and 150 million Web sites (three million times the information size of all books ever written), and is currently growing by ten thousand pages per hour. What's particularly interesting is that it's not just traditional publishing companies that have to find ways to compete with the explosion of information, companies ranging from pharmaceutical developers to mortgage companies are exploring ways to create new information services by tapping the immense amount of information available on the Internet today. However, creating these new information services can be extraordinarily time consuming and expensive without the help of semantic technologies. The incredible amount of information now available to billions of people and accessible from a simple search box has more or less delivered on the promise of the information age, access to relevant information for all people. The need today, in fact, is no longer availability of information (we can easily get tens of millions of hits from a typical keyword search), but rather for new and easier ways to find answers and quickly discover related information. Information consumers are starting to demand better ways to get quick summarized answers to questions without having to manually read, find and analyze the voluminous amounts of documents returned from a typical keyword search.



Then, after finding an interesting piece of information, users further seek to explore it, asking:

*But...Who makes it? What are the pros and cons of it? What causes it? What are the effects of it? What are the sources?*

Semantic technologies can read and extract interesting answers not just from the Web but also from legacy databases, premium subscription content, enterprise content and other sources of proprietary information. Its main objective, indeed, is to enable the description of Web contents in such a way that it will be possible for programs to locate and reason over Web resources. Banks today are recognizing that they are surrounded by volumes and volumes of content that, if made accessible or if applied to a specific application, could deliver extreme value to the organization and, more importantly, to its customers. The new world of semantics is about creating an intelligent platform that analyzes and delivers insights and intelligence to the business and its customers, just as Business Intelligence has served companies in analyzing and delivering meaning about such important things as supply chains and manufacturing efficiency. By applying semantic web technologies to analytical tools banks expect to tackle some of the main issues:

- Lack of flexibility for extension of the explanatory capabilities.
- No support for definition of business rules in order to get pro-active information and advises in the decision making.
- Lack of support to present information according to the different kind of users that can be found in an organization.

The concept of content intelligence, therefore, is about creating new content and information services derived from a bank's own premium content, and then optionally combining and enriching it with insights from the Internet, resulting in new sets of content that can power new and differentiated information services.

*But...how is this achieved?*

Here lies the relation between content intelligence and semantic technologies. The latter are so used to mine the breadth and depth of relevant, targeted information from the Web, or proprietary or enterprise sources. The content is already there, in overwhelming volumes, but semantics are essential for analyzing, organizing and structuring that content, giving it highly relevant meaning, and most importantly, making it actually valuable and tangible to users. At its most fundamental level, content supremacy enables organizations to convert semantic technology, once relegated to the realm of the science project, into a thriving, mainstream business engine.

As more businesses move towards creating integrated solutions that bring both content and expertise to their customers, content supremacy emerges as a key source of new revenue and thus stands as an important competitive differentiator. Today's businesses have to face a myriad of issues in order to retain and increase their user base and customer loyalty. To stay competitive, it is becoming crucial to continually enrich existing content and surface high-quality, meaningful, contextually aware insights from this data at the moment they are needed and within the context they are required. Through semantic technologies, banks can at last do just this and become content kings, increasing user interaction and time, as well as loyalty and brand perception. This in turn drives higher advertisement's revenues, creates up-sell opportunities, automatically increases Web site page inventory and improves contextual advertising on those pages. All without information overload.

To take it a step further, banks can also use semantics to create lightweight, Web-based applications that enable users to find answers through content supremacy. For example, to stay competitive, a bank may want to increase their credit loyalty, attract new customers and boost their online presence. In addition to leveraging semantics to combine a breadth and depth of relevant financial content from across the Internet and from their own proprietary content, they create a lightweight semantic application for their Web site. This application would serve one purpose: to help customers get answers to health questions. A customer could type "heartburn," and would instantly receive a summarized and organized view of medicines, natural remedies, treatments, diets, etc. all related to curing heartburn.

As banks are forced to innovate to stay competitive, content supremacy and semantics offer new opportunities for businesses to create new revenue streams and unlock the value of existing proprietary content by tapping deep slivers of insights and relationships within pools of unstructured content.

When companies infuse their content with the Web or vice versa, they can add much more value to their offering and their brand. In order to differentiate from the competition, banks must evolve to offer a wide range of content, but at the same time, they must ensure that it answers their customers' key questions and it is easy and quick to consume. Semantics are opening up entirely new possibilities for content supremacy, and today's businesses can't afford not to take note.

#### 2.3.4 EXPANDING USE OF ADVANCED ANALYTICS

Advanced analytics is the critical enabler in turning data into insight. The trend to make more use of the data warehouse for advanced analytics will accelerate as organizations strive to move from running BI point solutions to being a comprehensive analytics competitor. Predictive analytics, for instance, involves the extensive use of data mining, statistical analysis, forecasting, predictive modeling, and optimization techniques to drive all strategic and operational decisions and actions. Organizations rely on advanced analytics for insight that goes far deeper than what traditional Business Intelligence systems typically enable. While traditional Business Intelligence systems deal with data access and reporting and help answer questions such as what happened, what exactly is the problem, and what actions are needed, predictive analytics goes further and helps the company to understand why events are happening, predict what will happen next, and identify the most optimal course of action. The value of advanced analytics is then substantial. It can give to the business a competitive advantage, significant cost savings and greater revenues. To direct, optimize, and automate decisions to improve business processes, banks start to employ predictive analytics.

Predictive analytics include:

- Analysis of past, present, and projected future outcomes using advanced analytics.
- Decision optimization for determining which actions will drive the optimal outcomes, and then delivering those recommended actions to the systems or people that can effectively implement them.



Advanced analytics are used to examine the way in which specific business issues relate to data on past, present, and projected future actions. Advanced analytics include statistical, mathematical, and other algorithmic techniques such as those in the diagram above, and are more complex than the basic analytics used to compute frequencies, cross-tabs, query and reporting cubes.

From this advanced analysis results insight that is used to determine which actions will drive the optimal outcomes. Recommended actions, along with supporting information, are delivered to the systems or people that can effectively implement them.

Through measuring uncertainty surrounding these issues, predictive analytics enables proactive risk management, serving as a guide for refining key decision making processes through controlled, iterative testing of potential actions and their likely intended, and unintended, consequences. By deploying predictive analytics within front-line operational systems, specific organization goals relating to revenue increases, cost reductions, process improvements, and competitive advantages can be achieved.

### 2.3.5 NARROWING THE GAP BETWEEN OPERATIONAL SYSTEMS AND THE DATA WAREHOUSE

Increasingly, analytic results are being used directly in the workflow context to drive operational execution and dynamic process change. In the future, the data warehouse will be able to expand from traditional BI query and report generation to intelligent decision management and ultimately, the convergence of operational and analytic applications, including support for automated decisions. Despite unprecedented information availability, the past decade suffered from several imperfect decisions made in both the public and private sectors. It is not enough to provide voluminous access to information and expect good decisions to be made as a result. Numerous social, cultural and educational factors influence how well individuals and organizations are able to improve their decision-making ability, but clearly information systems have a significant impact. One of the most innovative decision support style is the "*Automating Decisions With Intelligent Decision Automation*" which describes Intelligent Decision Automation (IDA), an emerging tool that embeds BI and analytics into applications to automate and optimize high-volume, highly predictable and operational decisions. The trend toward more optimized decisions has begun with the emergence and early adoption of IDA, where BI embedded in applications along with business rules for operational (process-oriented, run type), highly predictable, highly structured, repeatable and automated decisions. Loan approvals, fraud detection, Web-based real-time offers and dynamic pricing are examples of decisions that are well supported by IDA.

### 2.3.6 A NEW GENERATION DRIVES NEW PRIORITIES IN DATA WAREHOUSING AND BUSINESS INTELLIGENCE

The EDW cannot be an isolated repository supporting standalone BI applications. BI systems have to make use of multiple event data, be able to find data that is needed, extract what is relevant, assimilate data from multiple sources, analyze it, and incorporate resulting information into applications as appropriate. It is important for analytic systems to be much more integrated into the organization's operations and information infrastructure.

### 2.3.7 GROWING IMPACT AND OPPORTUNITY OF COMPLEX EVENT PROCESSING

Whereas traditional BI analyzes data stored in the data warehouse, CEP engines (Complex Event Processing) analyze streams, continuously computing findings as new data arrives, updating the situational awareness, and allowing consideration of many more variables and context dynamics in making a decision. This tool consists in processing many events happening across all the layers of an organization, identifying the most meaningful events within the event cloud, analyzing their impact, and taking subsequent action in real time. Complex event processing refers to process states. It requires the respective event monitoring, event reporting, event recording and event filtering. An event may be observed as a change of state with any physical or logical or otherwise discriminated condition and in a technical or economical system, each state information with an attached time stamp defining the order of occurrence and a topology mark defining the location of occurrence. CEP will have a growing impact on BI systems as they evolve to provide more operational analysis and more automated decision support. Of course, rarely does the application of a new technology exist in isolation. A natural fit for CEP has been with Business Performance Management. BPM very much focuses on end-to-end business processes, in order to continuously optimize and align for its operational environment. However, the optimization of a business does not rely solely upon its individual, end-to-end processes. Seemingly disparate processes can affect each other significantly. The integration of CEP and BPM must exist at two levels, both at the business awareness level (users must understand the potential holistic benefits of their individual processes) and also at the technological level (there needs to be a method by which CEP can interact with BPM implementation).

### 2.3.8 GROWING IMPORTANCE OF INTEGRATING AND ANALYZING UNSTRUCTURED/SEMI-STRUCTURED DATA

Most organizations have content management systems to manage and search unstructured content, but have limited capabilities to use the information for decision-making. Business Intelligence systems have traditionally been built with "structured" data that has a known format (integer, character, scientific and the like) and a known position within a source (electronic) record. While building a Business Intelligence system is still a daunting exercise, finding the data within a source record has never been the primary challenge. The management of structured information has evolved throughout a relatively long history. Part of this evolutionary process included the development of increasingly sophisticated review, roll-up and analysis capabilities that are generally categorized as Business Intelligence. Business Intelligence capabilities run the gamut from simple reporting to sophisticated multidimensional analysis and its packages often contain services for next-best-action selection as well as presentation services for roll-up dashboards and at-a-glance reviews. Historically, though, Business Intelligence has primarily been used in structured and semi-structured data sets. That is changing as the wealth of information in unstructured data sources, such as documents, web pages and emails is simply too great to ignore. Those kind of data contains a great deal of information that can be usefully employed in a Business Intelligence system. Uncovering that data for BI analysis has been challenging, but emerging solutions can enable BI engines to utilize semi-structured and unstructured information. Nowadays, unstructured data can be analyzed to provide vital, enriching context for traditional BI results. Many organizations already have the available ingredients for a robust enterprise information management system, one that combines Business Intelligence with structured data stores and unstructured enterprise content management repositories. Most modern enterprise application systems are built on a service-oriented architecture (SOA). This means that BI capabilities can be invoked and consumed in a manner that is delinked from the housing application. Additionally, ECM systems are increasingly common infrastructure assets within an organization. But capability does not necessitate desirability, tactical utility and strategic vision both need to be taken into account and the decision calculus for tactical utility is very different from strategic vision considerations.



### 2.3.9 SOCIAL COMPUTING AND BUSINESS INTELLIGENCE

Business Intelligence can expand the insight it provides organizations if it encompasses the information from interactions that occur in social computing environments. Technologies such as social mining and social intelligence, indeed, use sophisticated data mining and text analytics to understand the implicit meaning of this unstructured data, which is completely reliant on the context in which it occurs. Social computing represents a general term for an area of computer science that is concerned with the intersection of social behavior and computational system and recently it has become a very important concept for use in business. Its usage can be done in two ways, as detailed below.

- In the *weaker sense of the term*, social computing has to do with supporting any sort of social behavior in or through computational systems. It is based on creating or recreating social conventions and social contexts through the use of software and technology. Thus, blogs, emails, instant messaging, social network services, wikis, social bookmarking, and other instances of what is often called social software illustrate ideas from social computing, but also other kinds of software applications where people interact socially.
- In the *stronger sense of the term*, social computing has to do with supporting “computations” that are carried out by groups of people, an idea that has been popularized in James Surovieck's book, “*The wisdom of crowds*”. Examples of social computing in this sense include collaborative filtering, online auctions, prediction markets, reputation system, computational social choice, tagging, and verification games. For many a corporate, social computing is perhaps the ultimate in unstructured data. While the use of social computing in corporate intranets and in other medium and large scale business environments is still in its infancy, it certainly could have benefits for BI, provided that relevant information can be distilled from these sources. It also depends on a company's adoption of social computing as an integral part of doing business.

Du Toit says about social computing:

*“Social computing in some form or other is already being integrated into enterprise resource planning (ERP) systems, among others. It could add value by leading to better communication, effectively mimicking the informal social networks of employees. If a social network gets extended to customers, suppliers, and shareholders then this network could begin to house vital information. The challenge, yet again though, would be to tag and extract relevant and useful information from this network”*

*“Perhaps vendors of social computing systems could adopt a services-oriented approach, which might make it easier to identify users, topics, and relevant elements, and extract these into the more formal BI environment ”*

### 2.3.10 GROWING INTEREST IN CLOUD COMPUTING FOR BUSINESS INTELLIGENCE

As the sophistication of Business Intelligence environments has increased, the same happened for their complexity and cost of management and organizations have already begun to adopt alternative delivery models to reduce the cost and complexity of other IT solutions. These range from open source tools and embedded functionality to bundled tools to development and starter licenses. The promise of cloud computing is shared resources, standard technology and automated provisioning. Cloud computing, indeed, is able to change the economics of BI by making available the hardware, networking, security and software needed to create data marts and data warehouses on demand with a “*pay-as-you-go*” approach to usage and licensing.

More and more businesses are turning to analytic applications to provide critical business insights. Whether focused on achieving higher ROI, better understanding of the competitive landscape, improving product and service quality, Business Intelligence is one of the few technologies that can equip organizations to more effectively prepare for tomorrow today. It's no wonder the BI platform is expected to grow by 7.9% through 2012 (according to Gartner).

Du Toit, again, explains his opinion about that:

*“ Speaking of software as a service (SaaS), there is no reason why most – if not all – BI functions can't be done 'in the cloud'.”*

*“ Certain BI applications are well suited to the cloud. Take for example applications for small companies that do not have a large amount of data, or those applications for which the source data already exists in the cloud. ”*

*“ There is also the obvious benefit of moving BI to the cloud in that there is no need to invest in expensive hardware architectures, as well as possibly much quicker deployment times by utilizing predefined application logic and infrastructure without having to define and implement it yourself. ”*

*However, there are some constraints to the cloud, which could make BI functions near impossible. For example, moving large volumes of data into the cloud might be problematic due to latency and data storage fees.*

*“Data security issues might also prevent certain companies from moving BI to the cloud. However, as speed becomes less of an issue, storage capacity becomes almost infinite, and cloud providers become more mature regarding security, we might see more and more BI solutions being made available in the cloud, especially for the SME market.”*

## .CHAPTER THREE: BUSINESS INTELLIGENCE AND ITALIAN BANKS.

In this chapter I will show all the results of the empirical research I carried out this current year (for this part, only considering the Italian scenario) in collaboration with the “Osservatorio della Business Intelligence” at the Politecnico di Milano. In particular, in this session I will examine and analyze the results of a questionnaire (see *Appendix A*) that, starting from the ten points I have well described in the previous chapter, we have submitted to a samples of banks. Results will be analyzed following this partition:

- The degree of diffusion of BI systems in Italian banks
- The Maturity Model
- The adoption process (Gartner Magic Quadrant)
- The advantages gained
- The critical factors found
- The organizational impact
- The investments for the future

Starting from the analysis of the level of usage of BI tools in Italian banks, we have positioned them into a maturity model (framework taken from attended sources). Once having positioned the samples, we have evaluated the choosing process criteria, advantages gained, difficulties found, level of organizational impact and how they are willing to invest in Business Intelligence in the future.

## 3.1 Business Intelligence systems diffusion

### 3.1.1 LEVEL OF DIFFUSION PER BANK'S FUNCTIONS

Empirical researches recently carried out mainly highlight that, nowadays, most used and developed BI functionalities are strongly related to the simple need to access data. If we go to consider the specific sector of banks and financial institutions, it's easily seen that this need is represented only by the mere generation of both queries and ad hoc reports, despite there are much more developed and powerful tools available, i.e. OLAP, multi-dimension cubes, dashboard and analytics that could be really helpful in carrying out deeper analysis. Nowadays, those tools are able to cover all the different areas of the internal organization of a bank and they encompass different managerial levels, by including some C-levels, staff's analysts and knowledge worker at the operational level. Financial marketing functions seem to represent almost the central point of usage and for this very reason there is a high need to monitor and analyze constantly the current situation.

Starting with this background and considering the current situation, one important thing that must be kept in mind is that, despite the principal need explained before, even OLAP analysis and multi-dimensions cubes are starting to be used in a very significant way inside banks. In particular, by analyzing data gained from reliable sources, we have found that *Query and Reporting* have the highest concentration in financial marketing, with a percentage of about the 60%, closely followed by the administration and control sector with almost the 50%. *OLAP and Cubes* are still mostly used in the financial marketing field, which keeps again the first position with a percentage of 40%. *Dashboards, scorecards are alerting* are mainly used by both the general and the top management, with a score of about 45%, but they are deep considered even in the administration and control functions (30%) as well as, again, in the financial marketing ones (25%). *Analytics*, unfortunately, are not well diffused yet, with the exception of forecasting and statistical techniques that play an important role always in the financial marketing sector by reaching the 35%. *Predictive analytics and data mining* are crucially considered in the development of relational financial marketing strategies (about 25%).

Results show that the pure financial sector is not really confident in adopting those kind of techniques yet, even if companies are slowly starting to be aware of the real importance of these methods to analyze and better understand financial situations (later I will show a case study related to this concept). *Optimization models*, finally, are definitely underestimated and under-utilized, they are diffused with a reasonable percentage (15%) only in the operations department.

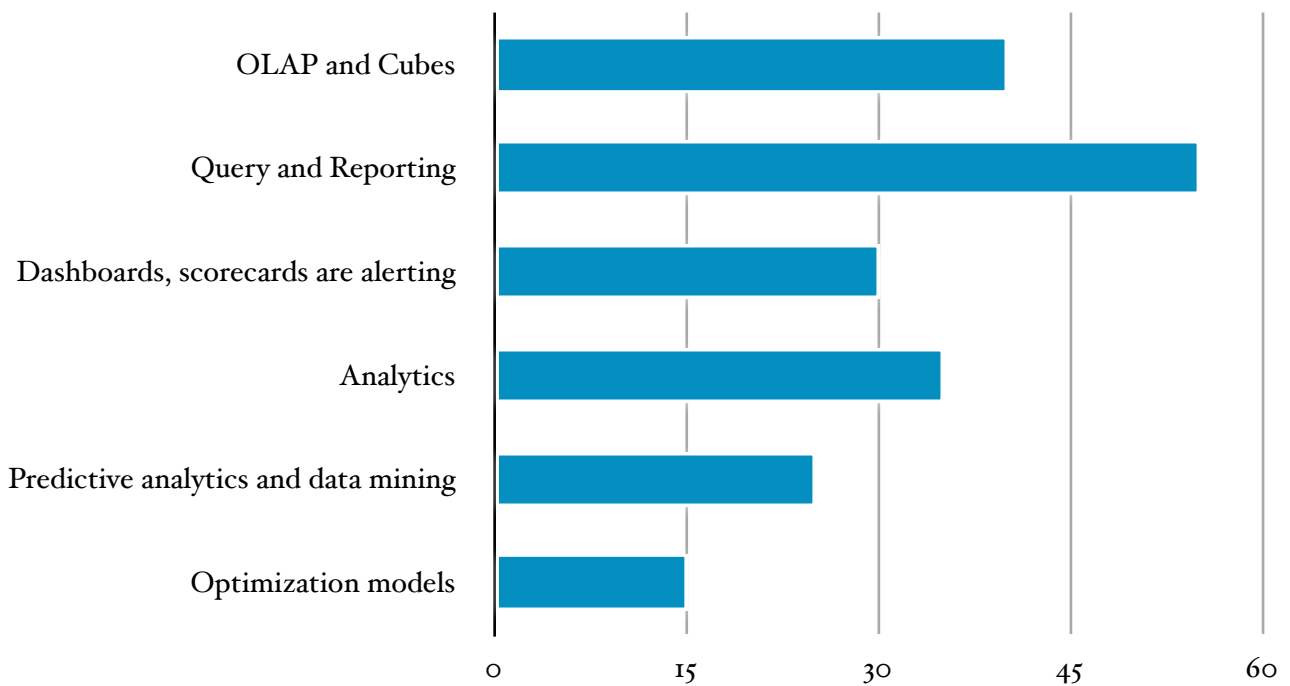


Figure 3: level of diffusion per Banks functions

### 3.1.1.2 LEVEL OF DIFFUSION PER BI TOOL

The other interesting research done is shown in Figure 4. It has been carried out by developing an analysis of the diffusion of BI functionalities inside the banking and insurance sector. What can be highlighted from here is that Business Intelligence systems are strongly present in most of Italian banks, at least with the mere functionality to access data through query and reporting. Banking and insurance sector differentiate itself from other companies since it uses forecasting methods and data mining techniques too in order to manage data and strategic decisions. Institutions in the financial sector, indeed, have made substantial investments in Business Intelligence over the past decade since they discovered that BI technologies can be really crucial in helping them to manage risk, detect fraud, leverage customer insights and gain visibility into their profitability.

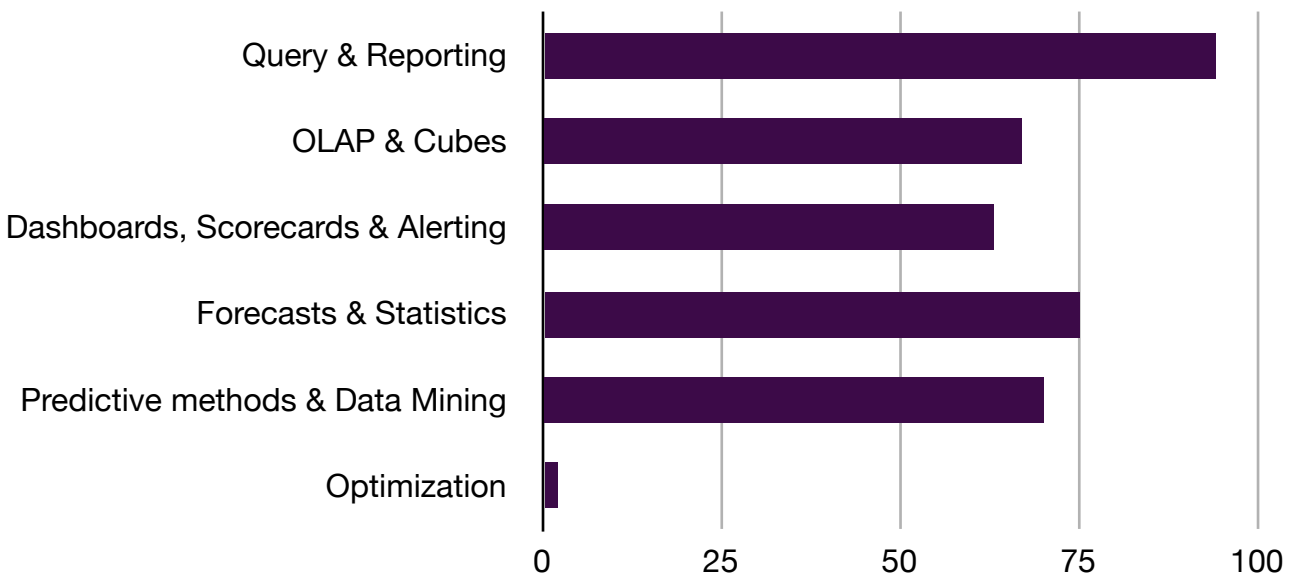


Figure 4: level of diffusion of BI in banks



## 3.2 Maturity Model

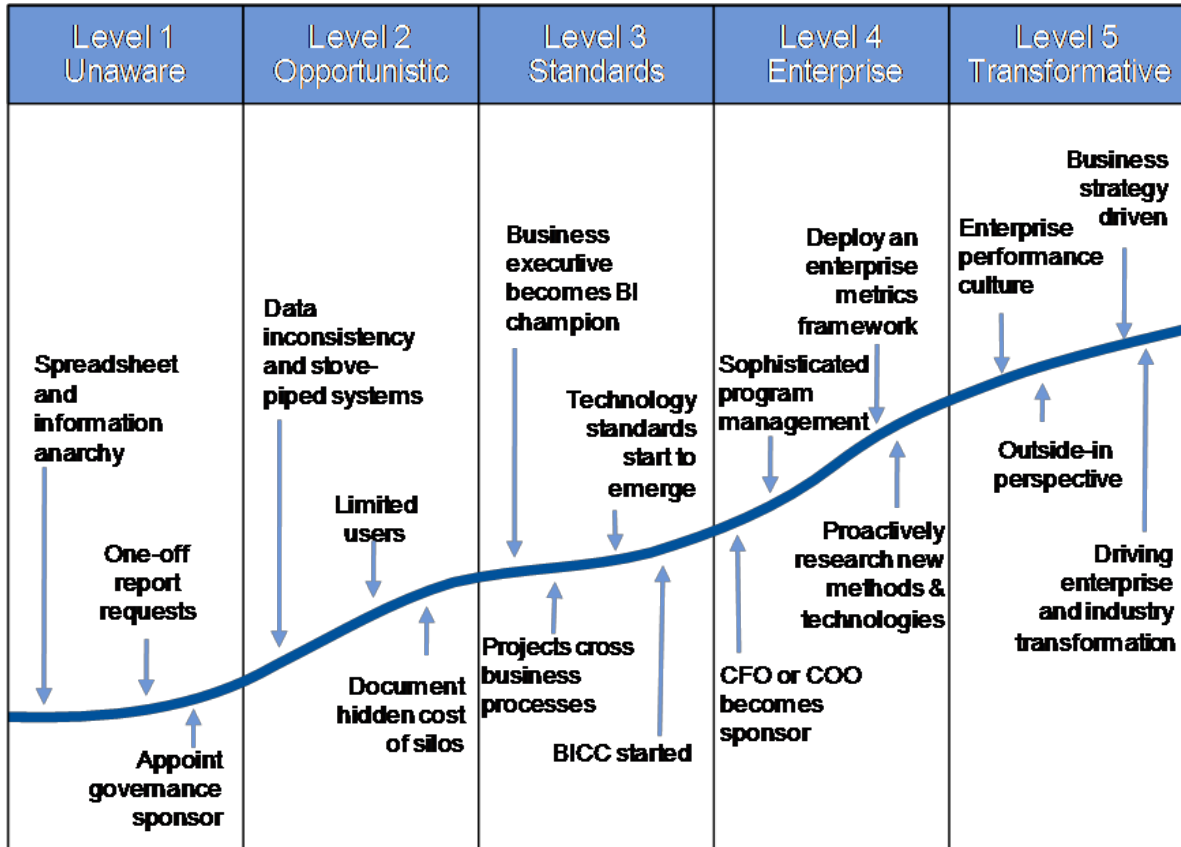
### 3.2.1 GENERAL OVERVIEW

During these last years, many banks have started to take a strategic approach to Business Intelligence and Performance Management since individual projects that prevailed in the past have created silos of information without always giving managers the insight they need to make good decisions. However, despite the emergency and the continuous willingness to quickly shift towards BI technologies, banks cannot enact a strategic approach in one simple step, it takes time to build all the skills needed for the right BI and PM program.

The model framework that I have decided to use as metrics of classification is the Maturity Model developed by Gartner. This model aims at identifying the enterprise's level of maturity, both current and required.

In the Figure 5 it's clearly shown the rising levels of maturity for a Business Intelligence program that includes people, skills, processes, technologies and other components listed on Gartner's enlarged BI framework (see "*Gartner's Business Intelligence, Analytics and Performance Management Framework*" and "*Maturity Model Overview for Business Intelligence and Performance Management*").

The Maturity Model assumes a complete portfolio that includes traditional BI applications (such as ad hoc query, reporting, dashboards, online analytical processing (OLAP), data integration and data warehouse), analytic applications (for example, customer service analytics) and PM applications (such as for sales).



BI = business intelligence

BICC = BI competency center

Source: Gartner (August 2010)

Figure 5: BI and PM Maturity Model

## LEVEL 1: UNAWARE

At this level, BI and analytics occur in an ad hoc manner. Typically, executives and managers ask for information, and users scramble to provide it with any operational application that is available. These users range from skilled analysts to self-appointed "*spreadsheet jockeys*". They deliver results in spreadsheets designed for one use and merely stored on someone's PC. Any analytics are embedded in the spreadsheets and the enterprise doesn't have any information infrastructure at all, except for Open Database Connectivity (ODBC) connections. There are neither defined processes to carry out analytics and decision making nor performance metrics. Many banks prefer to use this approach since it costs little to get started. Unfortunately, these efforts are:

- Labor - intensive and duplicative, and therefore expensive overall.
- Do not provide consistent and accurate information.
- Are not audited and, especially for financial companies, carry a high risk of fraud.

## LEVEL 2: OPPORTUNISTIC

At this level, business units undertake every BI, PM or analytics project individually to both optimize processes and help make tactical decisions. The evolution point here is that each project or domain has its own information infrastructure, tools, applications and performance measures and, therefore, different applications proliferate across the organization, each one guided by its own team of IT workers, business application users and operational managers. These people have the possibility to use data integration tools, analytic capabilities, databases and BI platform capabilities, maybe acquired in one packaged application. They are also able to deliver results via reports, ad hoc query and dashboards. This approach delivers value to users quickly, by providing them with relevant information and analysis. However, these skills become "*siloes*" along with the applications and information so that the wider organization cannot completely benefit from any expertise.

### LEVEL 3: STANDARDS

At this level, people, processes and technologies start to become coordinated across the enterprise. A senior executive, usually from the business side, becomes the enterprise champion for BI, PM and analytics. Process managers and IT leaders oversee projects across multiple business processes that need to share analysis and decisions (for example, financial or marketing processes). Users make decisions based on multiple streams of data and many enterprises implement a BI competency center consisting of business users, IT professionals and analysts to share expertise and improve consistency for specific applications or uses of information. Technology standards start to emerge, including for information infrastructure, data warehouses, and BI or corporate PM platforms, but they are not mandated. Here, an "*inside out*" perspective dominates and for the very first time, the enterprise starts to lower the overall cost of its BI, PM and analytics efforts through improved coordination and the standardization of technologies. However, the adaptability of BI, PM and analytic systems remains low, so the enterprise has not yet reached strong economies of scale.

### LEVEL 4: ENTERPRISE

At this level, top executives such as the CFO or COO become the program's sponsors. The enterprise has defined a framework of performance metrics that links multiple processes to enterprise goals and guide the overall enterprise strategy. Corporate and operational executives can see cause/effect relationships with key activities and people from analysts to business managers and senior executives use the same BI, PM and analytic systems, sometimes even partners, suppliers and customers use them. An enterprise information architecture guides the design of new systems. The enterprise exhibits a high degree of discipline around BI, PM and analytic projects, with release-oriented program management. Although BI, PM and analytic efforts have become more efficient, usage grows and therefore costs remain high. The enterprise must maintain people with a high level of skill in many different areas, such as program and change management.

## LEVEL 5: TRANSFORMATIVE

At this level, BI, PM and analytics have become a strategic initiative, jointly run by the business and IT organization, and supported and governed at the highest levels of the organization. The enterprise has completed its performance metrics framework and even extended it to include partners and customers (for example, to measure the performance of the supply chain). An "*outside in*" perspective now permeates the measurement system. All of these stakeholders use the information from BI, PM and analytics systems to coordinate a response to changing business conditions across the whole value chain and to make transformational decisions. Users come from multiple levels within the organization, multiple business units and multiple geographies as well as from customers and partners. The enterprise has turned legacy applications into services to promote fast, easy integration and reuse and it has optimized costs by sharing systems, processes and skills across the organization. Users therefore can see the enterprise's performance and the factors that contribute to it. However, mergers or acquisitions can reintroduce many of the problems that the enterprise has overcome.

A very important point of the questionnaire I have submitted was both to evaluate and to position banks where they were working on the Maturity Model line according to the level of Business Intelligence evolution they have reached. I have also asked to classify themselves into one of the five main steps that characterized the Business Intelligence maturity path:

- Pre - BI
- Initial/Basics BI
- Targeted BI
- Integrated BI
- Strategic BI

#### P R E - B I

Zero level corresponds to all those banks that are positioned outside the graph, since they don't have neither developed nor implemented any BI application. This phase includes both banks that still don't have started any BI project or initiatives and those one that, in the past, begun to implement some BI applications but finally they failed and therefore they abandoned the whole project. In order to carry out analysis aiming at supporting the decision making process, data access must be necessarily present in this reality too, it has to be based on traditional tools and it requires for sure a deep and ad hoc selection of all data needed (considering any analysis developed) with consequently high costs and response time. Banks positioned in this phase will find themselves to start with a big process of BI systems' adoption in order to keep the competitive advantage among others and do not lose their efficiency.

## INITIAL BI – BASIC BI

The very first level is represented by a pool of banks that use BI tools only focusing on query and reporting in order to have flexible and on time accesses firstly to all data placed into the DWH and then to data mart, with the main final goal to be able to answer in an autonomous and confident way to all ad hoc questions that analysts are usually willing to do during the decision making process. The other important element that characterized this group deals with the level of pervasiveness related with BI instruments. This aspect is usually limited to one or maybe two bank's functions and, most likely, those functions are exactly the same as those those that have solicited the diffusion of the BI inside the company. Therefore, this BI initiative results limited mainly to a single function, and then episodically spread into others too.

During this phase dashboards and other instruments can be used in addition, with the goal to evaluate and monitor performances, even if they are still bordered mainly into the promoting function of the BI. All the results gained from targeted analysis are sometimes shared already at this point, through Internet publications for instance, but only inside the leader function of the BI. Here, the typology of users mainly concerns both the intermediate management and the staff of the function targeted, therefore the number of users of BI tools is really poor and meagre. It's very hard to find C-levels among those users and functional data marts can be sporadically present, with the main objective to substitute the enterprise data warehouse, which is often not yet developed. The latency period in updating data is relatively high, it normally takes a week to be correctly refreshed and updated. This segment includes either those banks that have just begun to run their first steps toward BI systems and that have the will to evolve toward a higher maturity level phase in a quite short run, or those one that have already started a BI initiative but they haven't considered a possible following evolution in the direction of other phases.

## TARGETED BI

The second level corresponds to those banks that, even if they are characterized by a limited level of pervasiveness (in other words, with only a single leader function that uses BI tools), they push themselves into using BI application in a very sophisticated way. Near the common and systematic use of both instruments to access data and systems to

measure performances, those companies are able to use also applications based on analytics, usually in a vertical way. To provide an example: a banks can decide to use data mining instruments in order to develop propensity models aiming at identifying the optimal target for financial marketing campaigns. Usually the number of banks that reside in this group is not high and they are all characterized by a common feature: they all have incremented the qualitative level in the use of BI instruments, by pushing themselves to gain a competitive advantage form specific niche vertical solutions based on analytics. Nevertheless, the use of BI in this phase stays burdened to a single function and globally the bank doesn't gain any suitable advantage related to those potentialities. It's evident that a bank that resides in this phase must concentrate all its efforts in order to expand the usability of BI instruments inside the organization, either by promoting BI outside the leader function or, finally, by looking at reaching the level of pervasiveness hoped and planned.

#### INTEGRATED BI

The third maturity level identifies all those banks that are able to spread BI instruments to almost all the functions of the firm, with a high degree of pervasiveness too. It must be kept in mind that, even here, the usage of BI instruments is always limited to the only timely access to data and use of systems of performance measurement. The latter evolves inside those banks from simple dashboards to scorecard systems (addressed to C-levels) able to give a punctual and dynamic monitoring of performances in order to better verify and check the alignment between different business components and the strategy of the company. This degree of evolution comes necessarily with a suitable governance of BI systems and, most of the time, it foresees those roles and figures dedicated either in IT function or with user functions. In those situations, it's not hard to find a Business Intelligence Competence Center (BICC) responsible for developers and BI garrisons. Banks placed here owns a homogeneous distributed intelligence that facilitates both communication and sharing of knowledge, through the whole firm structure. Results of the analysis can be either published or used among users through all different functions. The number of users during this phase grows in a very significant way and it virtually spreads information among all its knowledge workers who operate in a company, without doing any hierarchical distinction. The bank becomes information-driven, since there is a proliferation



of data culture that subdues all the choices done by making use of documented and objective events. BI processes are deeply modified and redesigned, and the impact over both the organization and the human resources is very strong.

## STRATEGIC BI

The fourth maturity level corresponds to all those banks whose use of Business Intelligence has reached the absolute excellence. Therefore, they find themselves able to transform it into a powerful strategic opportunity to create a competitive advantage. The bank uses instruments in a pervasive way and it involves all the functionalities available, analytics in particular, that are able both to forecast all future phenomena with a high level of accuracy and to drive critical decisions in an optimal way. Under a technological point of view, it becomes necessary a global alignment along with the most advanced state of the art. Data must be updated at a lower period latency, generally it must be no more than 24 hours, but then it must decrease to very few minutes in order to be able to support typical decisional processes of the BI real-time.

After the detailed description of each phase of the model, it's easily understandable that, nowadays, BI applications are starting to be presented as Service Oriented Architecture (SOA) and they can easily be recalled as integrated functions of the management system. By doing like that, each user can easily access to information while doing his usual activities, while managing mails and while writing documents. The use of widgets, indeed, becomes important as well as customized bars in order to access data and dashboard. Alerting mechanisms are gaining more and more popularity since they announce to customers whether a situation can be anomalous and it needs to be managed. BI portfolio of applications is going to be enriched with new functionalities and expanded to all the other different banks activities. BI analysis, especially data mining predictive methods, have integrated access to structured and unstructured information, represented by text, hypertext, email, web pages, documents, forum, blogs and website accesses, as I have properly described in the previous chapters. By following this methodology, indeed, it becomes possible to provide support to decisional processes related to big current problems. A bank positioned in this area is completely *BI-driven*, covering all intents and purposes, and it can gain competitive advantage towards competitors by using different strength points. Typical examples are: its ability to plan the production of new products and new services basing it on the identification of effective segments and market's niches, the capability to optimize the operative processes by maximizing its revenues and minimizing costs, the ability to identify with the highest efficacy the target in order to develop financial marketing campaigns, by trying to increase both the customer's loyalty and products and services' portfolios used by each customer. Last but not least, it's above all thanks to its capability to react in a short space of time to all those changes linked to both market's conditions and competitor's bid. By merging all the concept described before we have positioned graphically the results gained. What was really interesting to discover was that the biggest concentration of banks is seen in the last step of the Maturity Model, where the red circle is bigger, represented by the Strategic BI. This surprisingly means that, nowadays, most of banks that make usage of Business Intelligence has reached the complete excellence and this fact gives totally good hopes for the imminent future. A lower number, then, is positioned in the Integrated BI phase, the level represented by the pool of samples able to spread BI instruments to almost all the functions of the firm, with a high degree of pervasiveness too. Finally, even a lower number identifies its position in the Initial BI, where they have still to evolve their internal BI applications deeper. Very few cases are positioned in the Targeted BI and Pre BI. Here below results are shown.

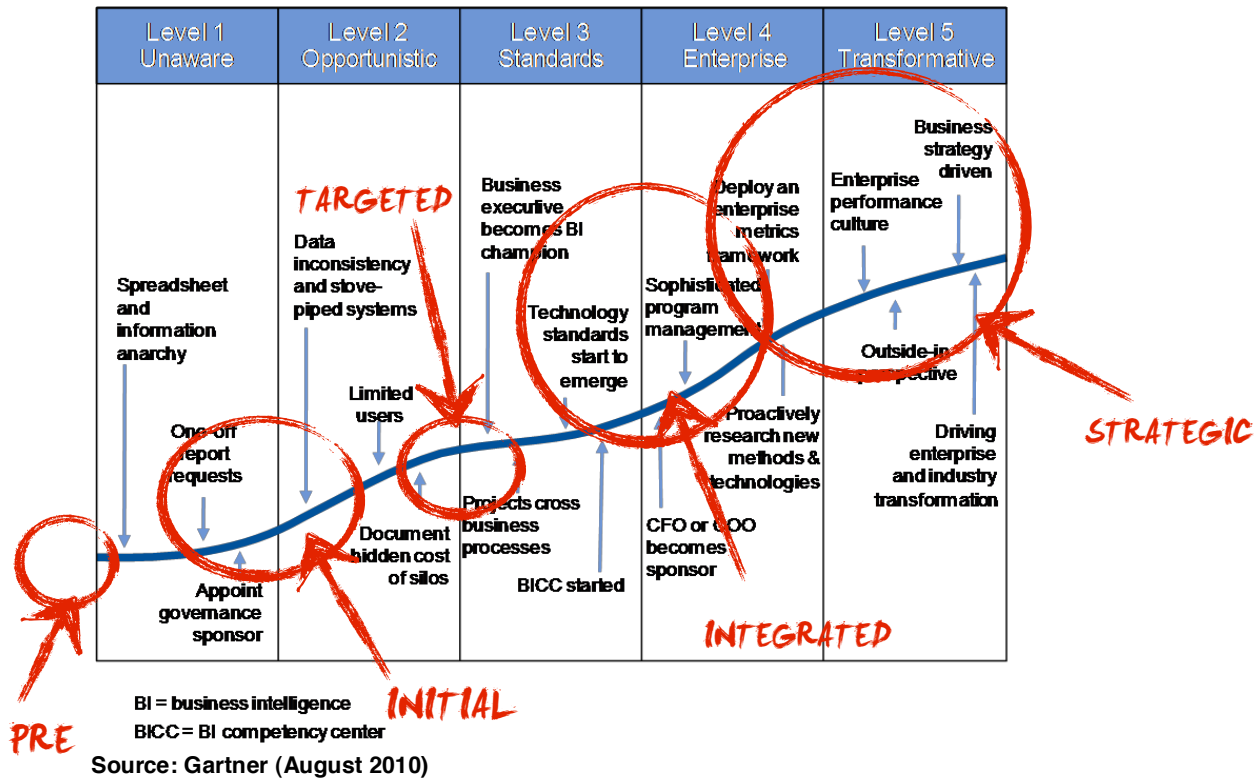


Figure 6: Banks' position in the Maturity Model

After having first explained all the phases of the Gartner Maturity Model and then positioned the cluster of Italian banks into this model, we have finally built a matrix in order to classify in a significant way all financial institutions in relation to their relative degree of control and mastery in using Business Intelligence tools. I have then decided to link three different types of information came out from the research concerning the diffusion of BI systems previously described.

In particular, we considered either the extension's degree of the Business Intelligence's functionalities or the pervasiveness level of those BI instruments that are used in all different banks' functions (Y axes), by introducing a partial correction based on the percentage of knowledge workers that use BI applications (X axes).

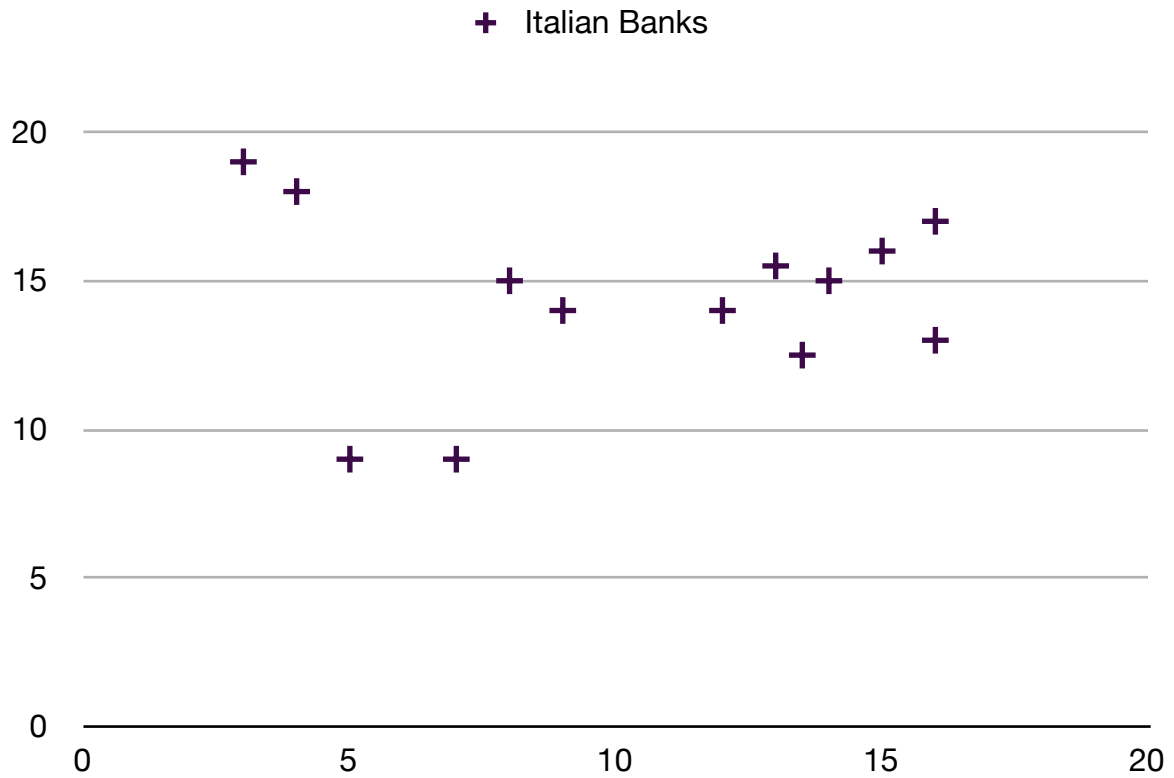


Figure 7: % of knowledge workers and extension's degree of BI functionalities

Figure 7 above shows the cross between the two most important dimensions of this classification. The main goal of this representation is to determine in a high measure the maturity degree in using BI, represented by the extension of functionalities and by the level of pervasiveness of the company. What is particularly remarkable here is that the highest number of banks are positioned in the high - right area of the graph, which means that they are completely able to combine a high percentage of skilled workers and a company with a high level of BI usage.

## 3.3 Business Intelligence systems adoption process

### 3.3.1 BI USAGE IN BANKING

In the previous pages I have well described at what level of BI evolution banks have been positioned and I have surprisingly found that the highest number of them considers themselves highly skilled for what concerns all BI tools and usages. Starting from this background I have gone deeper into the real and practical usage of their Business Intelligence, analyzing one by one all tools that are mainly exploited in order to gain and then maintain their competitive advantage. It's now clear that Business Intelligence tools are used by banks for a lot of activities, like historical analysis, performance budgeting, business performance analytics, employee performance measurement, executive dashboards, marketing and sales automation, product innovation, customer profitability, regulatory compliance and risk management. All those activities are designated to grow more and more with the passing of time, but for the moment I will limit my analysis on these current tools.

## HISTORICAL ANALYSIS (TIME-SERIES)

Banks always monitor and analyze their historical performance over time to be able to plan for the future. In order to carry on this type of analysis in the best way, they must be capable to choose the correct value and parameters needed to run their complete historical analysis. Researches and studies show that the most important and crucial key performance indicators include deposits, credit, profit, income, expenses, number of accounts, branches, employees etc. So absolute figures and growth rates (both in absolute and percentage terms) are required for this analysis. In addition to time dimension, which requires a granularity of years (half year, quarter, month and week), other critical dimensions are those of control structure (zones, regions, branches), geography (countries, states, districts, towns), area (rural, semi-urban, urban, metro), and products (time, savings, current, loan, overdrafts, cash credit). Income could be broken down in interest, treasury, and other income; while various break-ups for expenses are also possible. Other possible dimensions are customer types or segments. Derived indicators such as profitability, business per employee, product profitability, etc are also evaluated over time. The existence of a number of business critical dimensions over which the same transaction data could be analyzed, makes this a fit case for multi dimensional databases (hyper cube or 'the cube').

Though it is a major requirement, it hardly receives the attention of BI vendors. For sometime, these requirements were bundled as Executive Information Systems (EIS). But the safe, quantifiable world of computers runs up against a wall of unquantifiable abstractions, value judgments and opinions when designing an EIS system and how information is analyzed, interpreted and acted upon is a very subjective exercise. There must be no surprise, therefore, that BI vendor shifted their focus to customer relationship management (CRM), which still continues to be the center of their sales pitch to banks today, even risk management comes a close second.

## PERFORMANCE BUDGETING

Banks used to adopt performance budgeting as a management tool in the sixties. The success of the tool depended on historical data on which the current performance levels could be realistically based, and periodic reviews to take corrective actions if there were large variances between budgeted and actual figures. Historical analysis and performance budgeting used roughly the same indicators and the same dimensions, except for resource allocation to achieve the budgeted targets.

## CUSTOMER RELATIONSHIP MANAGEMENT (CRM)

As I stated earlier, this application is at the center stage of BI in banking. It is difficult to assess whether it is driven by technology or business. Surveys and researches that I have carried on show that traditional or conservative banking business models of Italian banking industry relied heavily on personal relationships that the bankers of yesteryears had with their customers. If we have a little more closely look into the application of CRM in banking, CRM is an industry term for the set of methodologies and tools that help an enterprise manage customer relationships in an organized way. It includes all business processes in sales, marketing, and service that touch the customer. With CRM software tools, a bank might build a database about its customers that describes relationships in sufficient detail so that management, salespeople, people providing service, and even the customer can access information, match customer needs with product plans and offerings, remind customers of service requirements, check payment histories, and so on.

A CRM implementation consists of the following steps:

- Find customers
- Get to know them
- Communicate with them
- Ensure they get what they want (not what the bank offers)
- Retain them regardless of profitability
- Make them profitable through cross-sell and up-sell
- Covert them into influencers
- Strive continuously to increase their lifetime value for the bank.

The most crucial and also the most daunting task for banks is to create an enterprise wide repository with 'clean' data of the existing customers. It is well established that the cost of acquiring a new customer is far greater than that involved in retaining an existing one. Shifting the focus of the information from accounts tied to a branch to unique customer identities requires a massive onetime effort. The task described involves creating a unique customer identification number and removing the duplicates across products and branches. Technology can help here but only in a limited way and the transition from a product-oriented business model to a customer-oriented one is not an easy task for the banking industry. It is true of all the banks, Italians or otherwise.

Related to the latter concept, I report here few instances from an interview done to a head of retail business of a technology savvy new generation private sector bank

*“On conditions of anonymity, there is no 360 degree view of a single customer available in my bank. We treats credit card applications from our existing customers in the same way as we do for new customers. The retail loan application does not take into account the existing relationship of the customer with the bank, his credit history in respect of earlier loans or deposit account relationship. And my bank is one of the pioneers in setting up a data warehouse, and a world class CRM solution”.*

Nevertheless, most CRM solutions in Italian banks are, actually, sales automation solutions. New customer acquisition takes priority over retention and this fact leads to the hypothesis that it is BI vendors that are driving CRM models in banks rather than banks themselves. Product silos have moved from manual ledgers to digital records and there is not a single implemented model of 'relationship' in Italian banking industry as of today.



## RISK MANAGEMENT

Normally, banks transform, distribute and trade financial risks in their role of a financial intermediary. However, the risk management discipline as it is known today has its roots in statistical techniques, which require historical data, both internal and external. Statistical models for measurement of various risks such as credit, market, and interest rate depend on the availability, accuracy and amount of historical data for their predictive power. Though most of this data gets generated out of banking transactions, it needs to be extracted, cleansed and transformed before it can be used in risk measurement models. Most of the risk management in Italian banking industry is regulator driven (For a deep analysis see *Chapter 8*).

## REGULATORY COMPLIANCE

Regulatory compliance requirements in the banking industry worldwide are on the increase. Basel II, anti-money laundering, Sarbanes-Oxley, and Sebi clause 49 are a few examples. All these regulatory requirements share one common feature, they are data-intensive and some of these requirements are now quite stringent about the quality of reporting, making the chief executive officer (CEO) and the chief information officer (CIO) personally liable for the correctness of reports. Regulatory reporting, therefore, requires a properly-audited data collection and collation process. However, all these BI applications cater to the needs of the top management in banks, but line managers have a different set of BI requirements, which differ from those of the top management and these requirements constitute the so called '*Operational BI*'.

### 3.3.2 SELECTION AND ADOPTION PROCESS

In a scenario as the one already described, it is evident that banks and financial institutions in general need to adopt BI applications, at least to cover some critical area. I have found that banks, on order to chose which is the best tool to adopt and in order to select the most suitable solution, follow a specific selection and adoption process. The most important evaluation criteria they always take into consideration in choosing their software vendor are the following:

#### ABILITY TO EXECUTE

Vendors are judged on their ability and success in making their vision a market reality. In addition to the opinions of Gartner's analysts, the scores and commentary in my work are based on another important parameter, which is the customer perceptions of each vendor's strengths and challenges. Here below all the main points I have submitted to samples:

- *Product/Service*: how competitive and successful are the goods and services offered by the vendor in this market?
- *Overall Viability*: what is the likelihood of the vendor continuing to invest in products and services for its customers? Viability includes an assessment of the overall organization's financial health, the financial and practical success of the business unit, and the likelihood of the individual business unit to continue to invest in the product, continue to offer the product and advance the state of the art within the organization's portfolio of products.
- *Sales Execution/Pricing*: does the vendor provide cost-effective licensing and maintenance options? This covers the technology provider's capabilities in all pre-sales activities and the structure that supports them. This includes deal management, pricing and negotiation, pre-sales support and the overall effectiveness of the sales channel.

- *Market Responsiveness and Track Record:* can the vendor respond to changes in market direction as customer requirements evolve? This covers the ability to respond, change direction, be flexible and achieve competitive success as opportunities develop, competitors act, customer needs evolve and market dynamics change. This criterion also considers the provider's history of responsiveness.
- *Market Execution:* are customers aware of the vendor's offerings in the market? This assesses the clarity, quality, creativity and efficacy of programs designed to deliver the organization's message in order to influence the market, promote the brand and business, increase awareness of the products and establish a positive identification with the product/brand and organization in the minds of buyers. This mind share can be driven by a combination of publicity, promotional, thought leadership, word-of-mouth and sales activities.
- *Customer Experience:* how well does the vendor support its customers?
- *Operations:* what is the ability of the organization to meet its goals and commitments?

After having submitted all those points, Figure 8 shows the results gained.

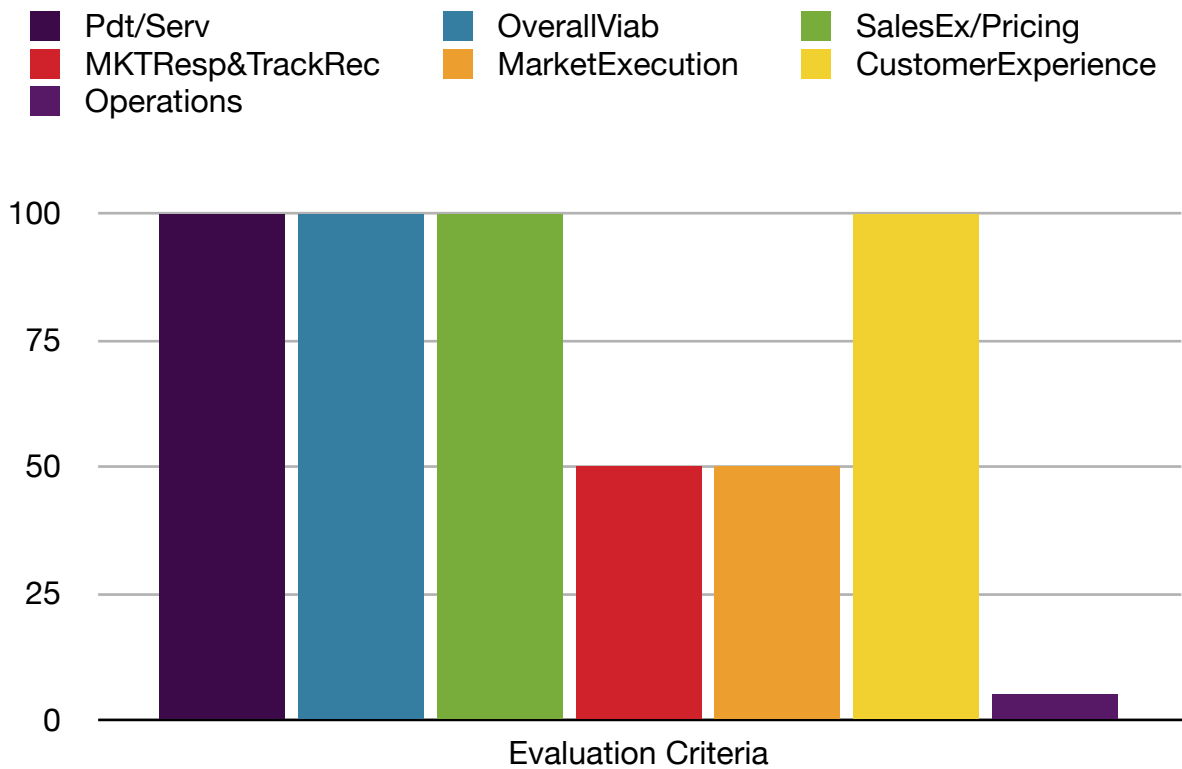


Figure 8: Evaluation Criteria of Software Vendors

On a scale from 0 to 100 of importance, it can be clearly seen that banks want the best almost in all different points. Excluding Operations and whatever deals with the market, they ask for excellence in everything, since they can recognize the real importance of having all the other activities at the top. Therefore a software provider, in order to be the best one and then be chosen by the company, must be able to provide exactly what banks ask for and in an optimum way.

## COMPLETENESS OF VISION

Once banks have in front a list of potential vendors, they are rated on their understanding of how market forces can be exploited to create value for customers and opportunity for themselves. (As before, data are taken both from a Gartner source and from a survey I have done). Here below all the main points I have submitted to samples:

- *Market Understanding*: does the vendor have the ability to understand buyers' needs, and to translate those needs into products and services?
- *Marketing Strategy*: does the vendor have a clear set of messages that communicate its value and differentiation in the market?
- *Sales Strategy*: does the vendor have the right combination of direct and indirect resources to extend its market reach?
- *Offering (Product) Strategy*: does the vendor's approach to product development and delivery emphasize differentiation and functionality that maps to current and future requirements?
- *Business Model*: how sound and logical is the vendor's underlying business proposition? Note that this criterion has been given no rating because all vendors in the market have a viable business model.
- *Vertical/Industry Strategy*: how well can the vendor meet the needs of various industries, such as financial services or the retail industry?
- *Innovation*: how well does the vendor direct related, complementary and synergistic layouts of resources, expertise or capital for investment, consolidation, defensive or pre-emptive purposes? How well does the vendor exploit current or new technologies and combine them in a novel way to address a market need?
- *Geographic Strategy*: how well can the vendor meet the needs of locations outside its native country, either directly or through partners?

In Figure 9 are showed all results gained.

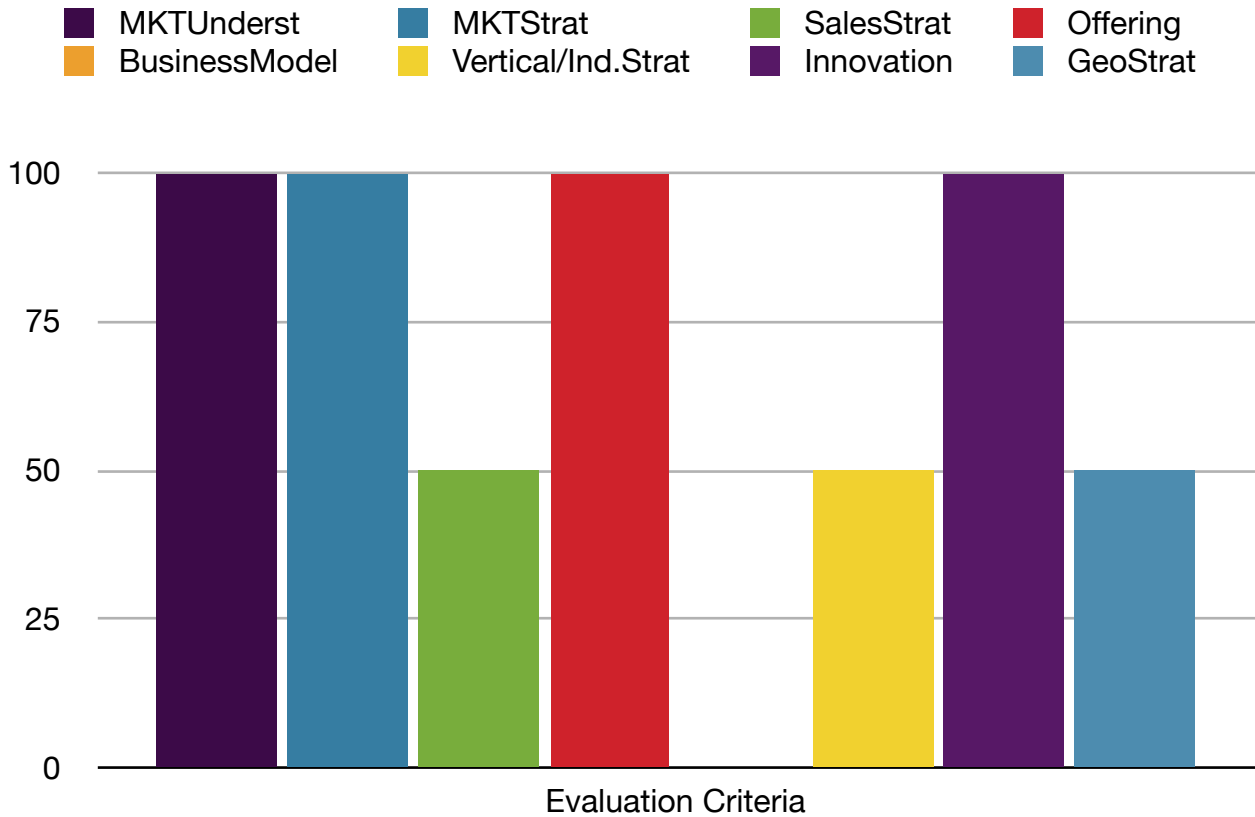


Figure 9: Evaluation Criteria of Software Vendors

Here, as before, a software vendor must reach the excellence in order to be chosen by the bank as its software provider, especially in activities like Market Understanding and Strategy, level of Offering and Innovation. Of less importance they evaluate the aspect of Sales, Vertical/Industry and Geographic Strategy.

## 3.4 The Magic Quadrant: an overview of current vendors

Related to the adoption process, I have decided to introduce an analysis of which are the main competitors in the business arena of the BI software vendors since I think it's really important to understand what is on the other side of the BI market in current years too. During years, indeed, they have gained a lot of popularity, especially in 2009, where mega vendors held almost two-thirds of Business Intelligence Business Intelligence platform market share, even if impatient business users increasingly turned to pure-play BI platforms, particularly those of small innovative vendors, to fill usability and time-to-value needs unmet by the larger vendors. In order to classify all those players, I have decided to use the *Gartner Magic Quadrant*.

### 3.4.1 MARKET OVERVIEW

The market in 2009 was defined by the result of the David and Goliathian war that occurred between resilient BI pure-play vendors and ostensibly omnipotent mega vendors. The frenzy caused by major BI platform market consolidation in 2007 and 2008 gave way to a post acquisition hangover in 2009 in which mega vendors' customers reported greater overall dissatisfaction due, in large part, to the often messy post acquisition "digestion" process. Yet, despite mega vendor acquisition "growing pains," stack-centric buying led by applications and information infrastructure dominated BI platform investment decisions in 2009 with the top five vendors controlling 75% of the market. At the same time, however, based on researches conducted for this work and interactions with Gartner surveys and customers, there is a significant, even if not euphoric, global satisfaction and an accelerated interest in pure-play BI platforms. This is particularly true for smaller, innovative vendors filling needs left unmet by the larger vendors.

To understand this paradox, it is necessary to consider a number of factors that are driving the BI platform buying decision today:

- *Growing bifurcation of stack versus departmental BI buying.* Market bifurcation continues toward the same strategic arena based on dominant applications or information infrastructure stacks on the one hand, and business and department buying on the other hand. Pressured by new economic realities and the need to quickly demonstrate business value, business users, often with an enterprise BI standard in place, are increasingly turning to innovative, pure-play vendors offering highly interactive and graphical user interfaces built on alternative in-memory architectures to address their unmet ease-of-use and rapid deployment needs. The perceived benefit is so compelling that business users are making this choice, despite the risk of creating fragmented silos of applications and tools.
- *Last year's Visionaries become this year's Challengers.* Driven largely by business user buying, the data discovery tool architecture pioneered by last year's Visionaries (for example, QlikTech and Tibco Software) and new Magic Quadrant entrant Tableau is now becoming much more accepted in the industry. Organizations are rapidly embracing the idea of providing data to end users and empowering them with an ability to navigate and visualize the data in a "surf and save" mode as an alternative to a report-only architecture. Threatened by the success of these vendors (and adding to their credibility), traditional BI platform vendors are attempting to imitate them with easy-to-use interactive visualization alternatives (for example, Microsoft with PowerPivot, SAP with SAP BusinessObjects Explorer, IBM with IBM Cognos Express, and Information Builders with WebFocus Visual Discovery) often incorporating in-memory technology. This imitation, coupled with a growing recognition by user organizations that data discovery tools can be used as full-functioned BI platforms for a broader range of BI platform capabilities and use cases (beyond rapid prototyping), justifies the significant move of these vendors from the Visionaries to the Challengers quadrant. A Z-shaped movement



in the Magic Quadrant from the Visionaries to Leaders quadrants is typical, as a vendor that may have been visionary in a specific segment becomes subject to a broader visionary lens and expanded buying requirements. The response of the traditional BI vendors to these new market Challengers has accelerated in 2010 and has likely led to further industry consolidation, while at the same time putting pressure on Challengers that don't improve their enterprise capabilities and continue to innovate.

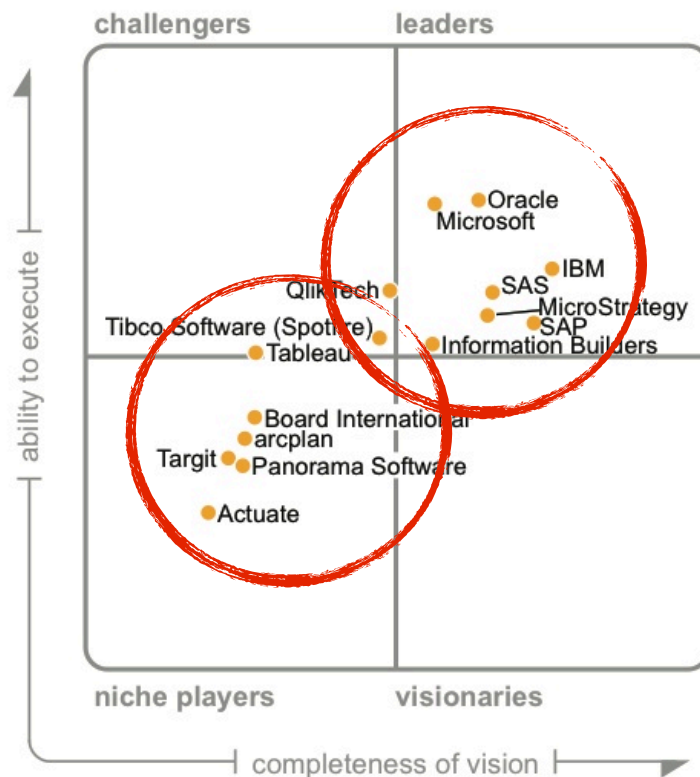
- *Acquisition transition takes its toll on customers.* Customer turmoil from acquisitions typically follows a life cycle. Initially, there is significant customer concern because of uncertainty about product road maps and commitment. This is followed by the actual execution of the acquisition transition in which support, contracting, pricing, sales territory alignments and products are often changed. This transition process takes time and is not easy on customers. Successful acquisitions at some point complete the transition and reach a new "normal" for customers. While Oracle, which acquired Siebel and Hyperion in 2005 and 2007 respectively, seems to be successfully exiting the back of this curve, as shown by significantly improved Magic Quadrant customer survey results this year over last, weak customer survey results for IBM and SAP suggest that they are still in the throes of this transition. This heightened level of customer dissatisfaction revealed in the customer survey is reflected in these vendors' Ability to Execute positions.
- *Shift from measurement to analysis, forecasting and optimization.* While reporting remained the dominant style of information delivery of BI in 2009, the increased proliferation of interactive visualization tools pushed the power of data analysis and discovery into the hands of a larger number of users than ever before. Moreover, driven in part by the economic downturn, the need for more accurate forecasts and optimized business processes, and to identify leading versus lagging indicators, was on the rise. In response, IBM acquired predictive analytics market leader SPSS in the only major acquisition by a BI platform vendor in 2009. At the same

time, many pure-play vendors (Information Builders, Tibco Software, MicroStrategy) and most of the mega vendors (SAP, IBM, Microsoft) either introduced or matured capabilities to make statistics, predictive analytic models and forecasting algorithms more consumable in reports, dashboards and analytic applications. These advances constitute important steps toward increasing the availability of predictive analytics to business users beyond the traditional statistician installed base. This shift in market center for predictive analytics has also resulted in a narrowing of Completeness of Vision leadership between SAS and many of the other BI market players.

- *Economic conditions driving interest in low-cost alternatives.* BI spending remained firm in 2009 as organizations turned to BI to survive the worst downturn in modern history. While projects to improve decision making, identify operating efficiencies and risk, and attract new customers more cost-effectively continued, the need to do more with less, more quickly, increased interest in lower-cost options. Beyond Microsoft, the traditional low-cost BI platform, organizations showed an increased willingness to consider open source for their enterprise BI platform deployments, and interest in BI embedded both in packaged analytic applications and in business process platforms, and, to a lesser extent, in alternative deployment models, such as software as a service (SaaS).

In the wake of the merger and acquisition turbulence of 2007, 2008 and 2009, 2010 continued to be a year of transition, particularly for SAP and IBM. Business users in particular showed a growing impatience with the time to deploy and complexity of traditional enterprise tools, which led to a rise in departmental buying of alternatives. Looking forward, 2011 is likely to be a critical year in which ease of use, time to value, scale and performance, and total cost of ownership will dominate the BI market narrative, while the ability to mesh the newly proliferated departmental silos with enterprise deployments will be a critical IT challenge. As the tough economic environment continues through 2011, new opportunities will emerge to build new sources of growth and business value. The ability of BI to identify and optimize these opportunities will be under greater pressure than ever to deliver results.

Figure 10 below shows the Magic Quadrant framework.



Source: Gartner (January 2010)

This quadrant is divided into four main areas, where inside have been positioned all software vendors considered before.

Those 4 areas are the following:

- Leaders
- Challengers
- Visionaries
- Niche players

#### LEADERS

Leaders are those vendors that are reasonably strong in the breadth and depth of their BI platform capabilities and can deliver on enterprise wide implementations that support a broad BI strategy. Leaders articulate a business proposition that resonates with buyers, supported by the viability and operational capability to deliver on a global basis.

#### CHALLENGERS

Challengers offer a good breadth of BI platform functionality and are well positioned to succeed in the market. However, they may be limited to specific use cases, technical environments or application domains. Their vision may be hampered by a lack of coordinated strategy across the various products in their BI platform portfolio, or they may lack the sales channel, geographic presence and industry-specific content offered by the vendors in the Leaders quadrant.

#### VISIONARIES

Visionaries are vendors that have a strong vision for delivering a BI platform. They are distinguished by the openness and flexibility of their application architectures, and they offer depth of functionality in the areas they address, but they may have gaps relating to broader functionality requirements. A Visionary is a market thought leader and innovator. However, it may have yet to achieve sufficient scale, or there may be concerns about its ability to grow and provide consistent execution.

## NICHE PLAYERS

Niche Players are those that do well in a specific segment of the BI platform market, such as reporting, or that have limited capability to innovate or outperform other vendors in the market. They may focus on a specific domain or aspect of BI, but are likely to lack depth of functionality elsewhere or they may have gaps relating to broader BI platform functionality. Alternatively, Niche Players may have a reasonably broad BI platform, but have limited implementation and support capabilities or relatively limited customer bases, or they may not yet have achieved the necessary scale to solidify their market positions.

### 3.5 Advantages in adopting Business Intelligence systems

At this point it's obvious that BI provides many benefits to banks that are able to use and exploit it. It can firstly eliminate a lot of guesswork within an organization, secondly it is able to enhance communication among departments while coordinating activities and finally it enable companies to respond quickly to changes in financial conditions, customer preferences, and supply chain operations. Information is often regarded as the second most important resource a banks has (a company's most valuable assets are its people). So when a bank can make decisions based on timely and accurate information, the bank can mathematically improve its performance. BI also expedites decision-making, as acting quickly and correctly on information before competing businesses do can often result in competitively superior performance. It can also improve customer experience, allowing for the timely and appropriate response to customer problems and priorities.

Some of the advantages gained and well explained by some interviews done are listed below. With Business Intelligence advanced tools, banks can:

- easily convert their employees' business knowledge into analytical intelligence in order to solve many business issues, like increase response rates from direct mail, telephone, e-mail, and Internet delivered financial marketing campaigns.
- identify their most profitable customers and the underlying reasons for those customers' loyalty, as well as identify future customers with comparable if not greater potential.
- analyze click-stream data to improve online banking strategies.
- quickly detect warranty-reported problems to minimize the impact of imminent complex situations.
- discover money-laundering criminal activities.
- analyze potential growth customer profitability and reduce risk exposure through more accurate financial credit scoring of their customers.

- determine what combinations of products and service lines customers are likely to purchase and when.
- set more profitable rates for insurance premiums.
- reduce equipment downtime by applying predictive maintenance.
- determine with attrition and churn analysis why customers leave for competitors and/ or become the customers.
- detect and deter fraudulent behavior, such as from usage spikes when credit or phone cards are stolen.

Customers are the most critical aspect to a bank's success. Without them a financial institutions cannot exist, so it is very important that banks have all the information needed in order to focus on their preferences. Banks must quickly adapt to their changing demands and Business Intelligence enables them to gather information on the trends in the marketplace and come up with innovative products or services in anticipation of customer's changing demands. Competitors can be a huge hurdle on bank's way to success. Their objectives are the same as other banks' that is to maximize profits and customer satisfaction and be ready to face risky situations. Therefore, in order to be successful banks must stay one step ahead of the competitors and Business Intelligence helps in telling what actions competitors are taking.

Figure 11 below shows the percentage of some advantages found during some researches and surveys done.

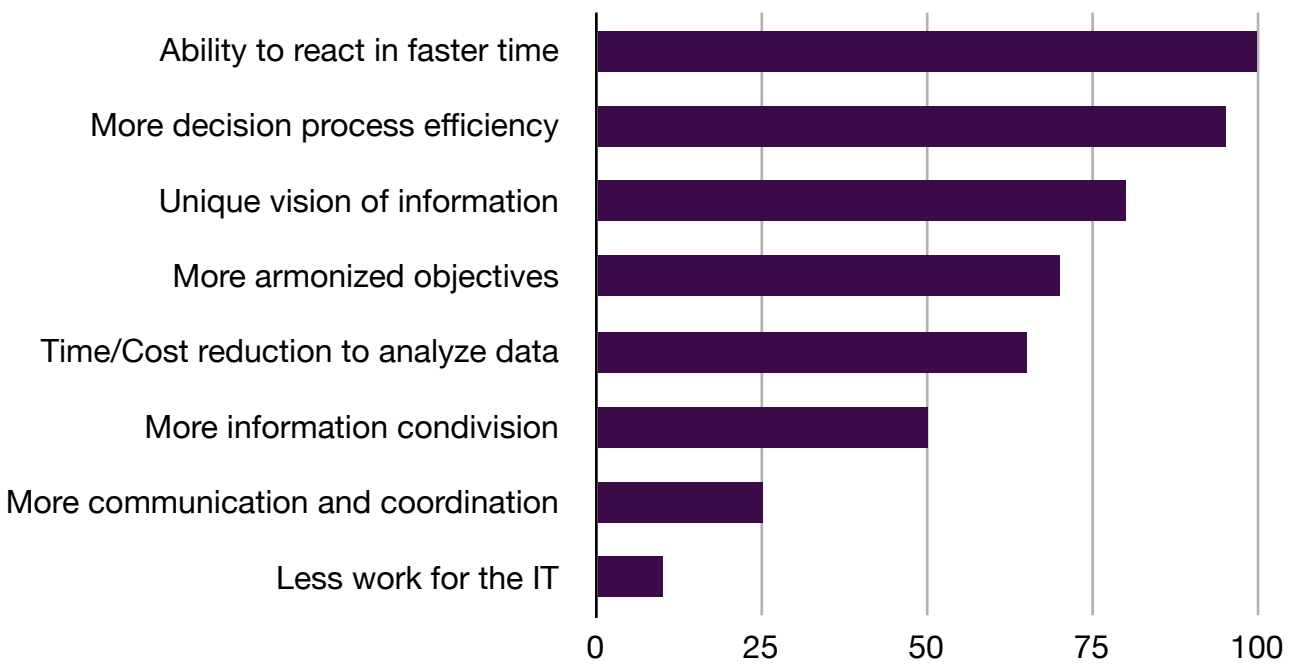


Figure 11: Percentage of advantages



### 3.6 Difficulties in adopting Business Intelligence systems

Figure 12 below shows all the difficulties and criticizes found in the adoption of BI systems, in terms of percentages of answers taken from interviews. What is really interesting is to see that the poverty of data quality is identified as the main critical factor that obstacles the adoption of a BI system (see *Appendix B*). At the second place there is the difficulty of integration, mainly for big banks, since the complexity of the IT systems and IT infrastructures is very high. Finally, at the third place, there are cultural and organizational difficulties in processes' changes, followed by a big lack of commitment of the management.

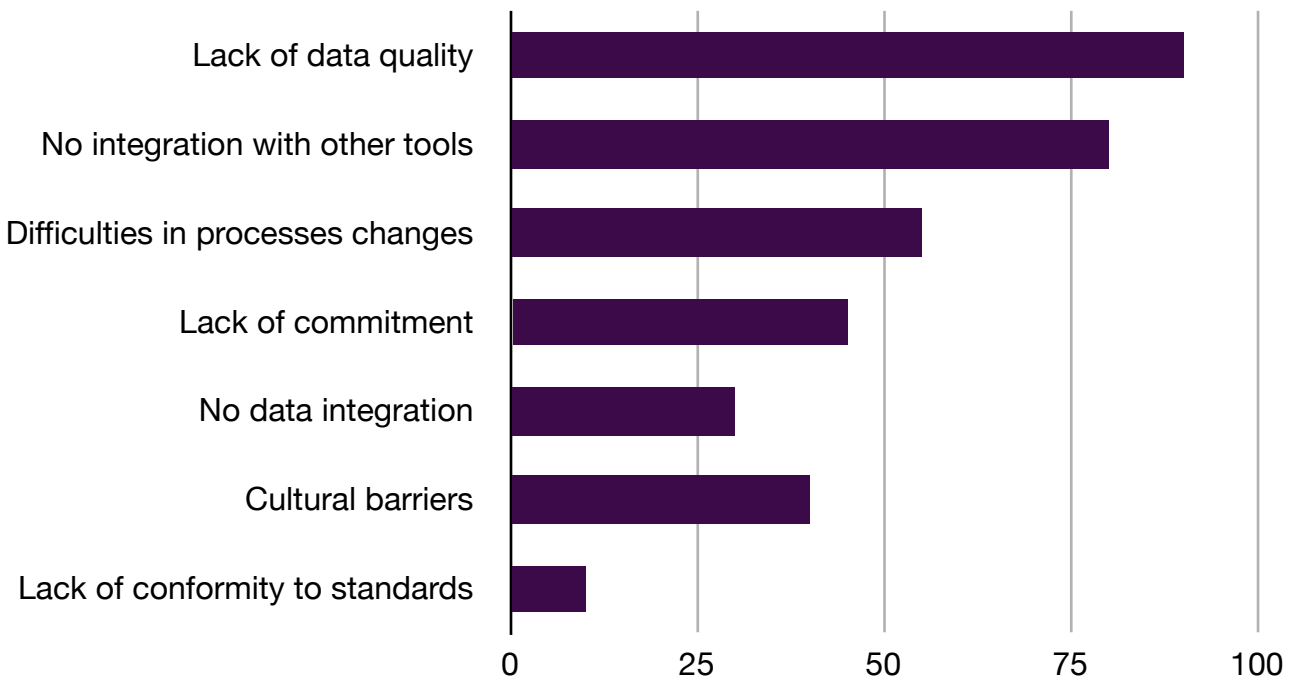


Figure 12: Percentage of difficulties

### 3.7 Effects and impacts in adopting Business Intelligence systems

Figure 13 below show that the perception of all the interviewees working in big banks is very different to the one working in small ones. The firsts believe that the main impact of BI is liked to the human resources, instead of on processes. There is about the 10% who didn't feel any significant effect and, for small banks, the impact on processes is higher than the impact on human resources. What I have done is an average of the two percentages, and what results is that the impact over resources is finally higher than the impact over processes.

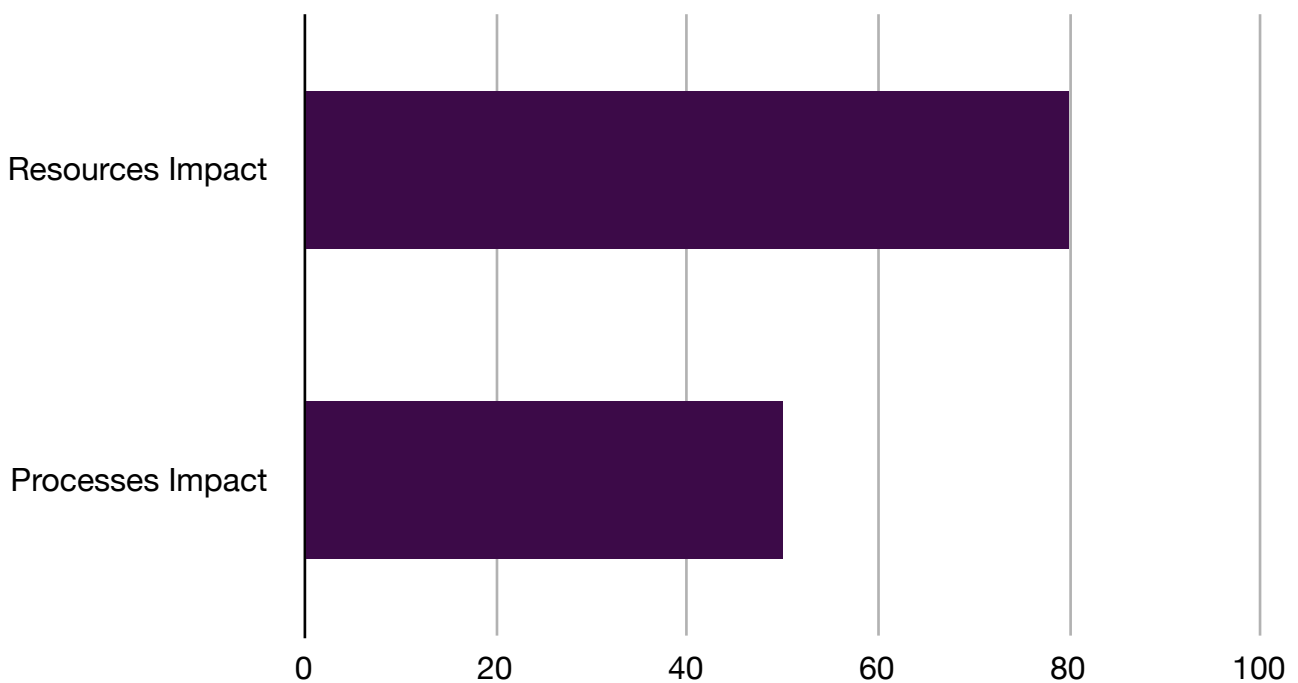


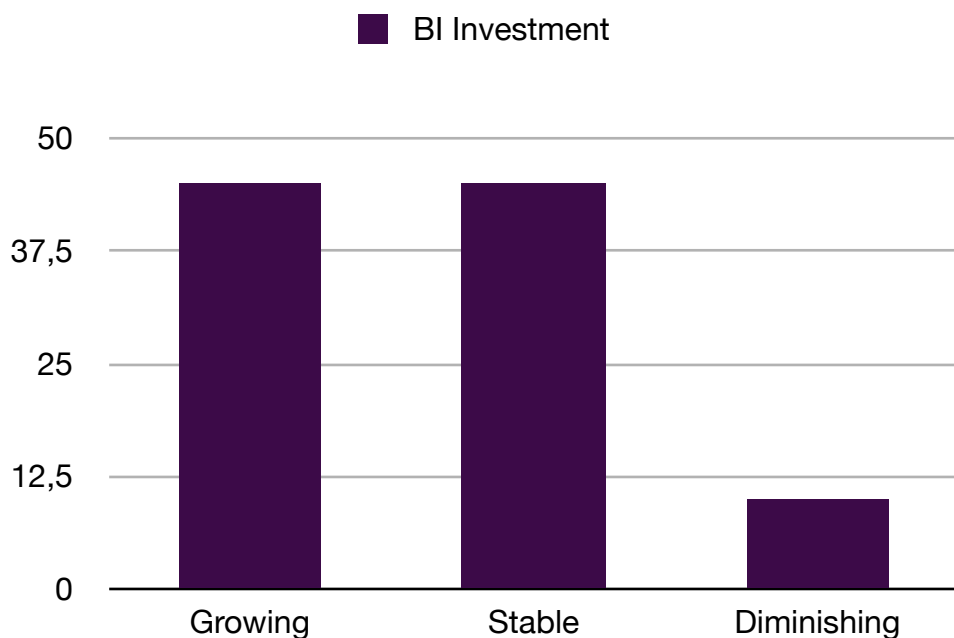
Figure 13: Percentage of impact

### 3.8 Investments in Business Intelligence for the future

After having concluded all the surveys and data analysis, we have carried out a general research about what could potentially be the level of investments in BI in the future. What we have found is that Business Intelligence technology is in constant flux, as BI vendors buy other companies and add new features to their software. In addition, emerging technologies such as operational BI, real time BI, in-memory and in-database analytics are creating new challenges for BI teams. In such a complex and confused scenario people often wonder:

*“Is the banks ready for the future of BI tools? Should this “next generation” of BI software be rolled out enterprise-wide or departmentally? How should be prioritized the bank’s BI investments and build a business case for implementations of new BI technologies? “*

Thinks that IT and business professionals involved in managing BI systems need to consider are a lot but, thanks to the survey done, what is clear is that the stability to keep BI tools ‘as is’ is quite the same as the envy to invest in the enrichment of the area covered by the BI, as shown in the Figure 14 below.



## .CHAPTER FOUR: CASE STUDY.

In this chapter I will show two depositions taken from two different Italian banks:

- Banco Popolare
- Monte dei Paschi di Siena

For each of the listed banks I will report an interview taken from reliable sources with relative comments and specifications for each single case. In particular, I have chosen those two banks since they have implemented BI tools in order to better manage data and information inside the organization and, because of the positive effect they have gained, they have reported very well their account.

## 4.1 Banco Popolare

Banco Popolare was born in 2007 as a consequence of a fusion between BPVN and BPI. What really characterizes this bank and differentiates it from all the others is its strong territorial settlement and its tenacious willingness to always be able to satisfy customers needs, especially in the context of SME, which represent, in these last years, the heart of the Italian productivity.

### 4.1.1 WHEN CONFORMITY BECOMES THE REAL MOTOR OF THE BUSINESS

Starting with such a background, the focus of this reality is of course represented by the risk analysis of counterparts done through rating systems. This methodology, indeed, enables the bank to capture with the highest precision possible the risk profile of its customers and collect it into a specific personal portfolio. This latter aspect results crucial as well as to guarantee data quality, usually used in the rating level calculation in order to always monitor and control models performances and then to evaluate both the correctness and the adequateness in the whole company's process.

Massimo Marastoni, Responsible of the Internal Validation Unit at Banco Popolare, describes very well his point of view.

*“ Because of these motivations, the structure that I manage responds to those important points. The main task of this structure is to monitor internal rating systems, to evaluate the conformity to the regulation 263 of Banca d'Italia, and to verify the correspondence of rating systems implemented internally. After the validation activity, the documentation that picks up the resulted evidences during the verification process is submitted to internal controlling members and then transferred to Banca d'Italia. “*

#### 4.1.2 TO OPTIMIZE THE WHOLE RATING PROCESS

In order to analyze and validate both the operational and credit risk, Banco Popolare has adopted SAS analytics techniques. In particular, thanks to its advanced technology, SAS techniques have become crucial for the implementation of internal rating models since, beyond giving the possibility to use routine certificates, they have ensured the traceability of all analysis carried on with the main consequence of facilitating following checking phases. Indeed, in the process of data quality control for the credit risk the adoption of SAS tools have given the possibility to be completely conformed to all the requirements like completeness, correctness and coherency imposed by the normative 263 of Banca d'Italia.

#### 4.1.3 A PERFORMANT AND SCALABLE DEVELOPMENT AND VALIDATING ENVIRONMENT

*“ As can be easily understood, it's extremely hard to guarantee top results starting from millions of positions that belong to different geographical areas and economic sectors. At the same time, without proper analysis tools, it becomes really difficult to develop models able to be commensurate to single profiles and then to verify the pursuing of attended results. In such a context, SAS gives us the possibility to run a huge number of elaborations in the short run and with the highest degree of precision, objectivity and homogeneity of results gained during all phases. In addition, we have been able to optimize elaborative resources in terms of calculation capability and availability to realize a scalable development and validation environment related to the always changing necessities that must be analyzed. “*

*(Marastoni)*

#### 4.1.4 AN EVOLUTION LEADED BY THE MACRO ECONOMIC BACKGROUND

A lot of guidelines have been already developed by the macro economic context, in particular in the financial sector. What Marastoni thinks is the following:

*“ The right risk management is a first importance leverage of optimization for our bank. We don't have to forget that the underestimation of risks has been one of the main causes of the world financial crisis. Our mid term goal is to consolidate the current architecture to give the possibility to both analysis and validation activities to be able to use in a continuous way tools like the model monitoring. Another important objective that we want to reach is to give the possibility to each resource belonging to the validation structure to work as an analyst of a specific typology of risk in order to improve the global control with a really high level of professionalism. “*

## 4.2 Monte dei Paschi di Siena

For a bank, the calculation of financial requisites with the help of the only advanced methods is really quite hard. It's not enough anymore to apply regular and mechanical ponderation rules of the assets as previous regulations asked. Nowadays it's necessary firstly to develop statistical models able to calculate the default probability, then to draw processes able to use those probabilities in managing the risk of counterparts and, above all, it's necessary to use calculations based on a high number of information. It's starting from this concept that the need (felt from the first drafting of Basel II) to identify an internal validation structure of the rating system rose. In recent years rating system is present in almost all bank's environments, with a high level of diffusion, and for this very reason the continuous verifying of its correct working requires specific skills and differentiated control processes: quantitative knowledge and statistics controls are needed in order to verify the correct development and implementation of all models, while, on the other side, there are the necessity of credit skills and qualitative controls in order to better understand the right implementation and usage of rating assignment processes. Finally what is needed are computer skills too, in order to verify the correct running of both garrison and data quality which feed the system and that the system produce itself.

Starting from here it's clear that the IT framework must be flexible and able to manage all these different needs.

*“ Nowadays, even a small business manager of a small firm, for instance, have to use the proper small business rating and he starts to understand that the supply of credits must be related to a specific creditor's classification following precise parameters. It's not enough just “ to draw on a little cloud “ a management model, it must be used too. Validation has to show the latter point too, and it does that through targeted controls and interviews whose results must be correctly integrated inside the training process related to the global judgment of validation. “ (Mauro Rizzitiello – Staff Models Validation and Credit Systems Responsible of MPS Group)*



#### 4.2.1 COMPLETE ANSWERS TO COMPLEX PROBLEMS

Banks and financial institutions are required to always be updated on all the procedures of functioning systems and criticalities that must be faced with fast corrective interventions. MPS Group asked to SAS an IT tools in order to support the internal validation process with the main goal to guarantee maximum transparency and traceability of the process itself and, above all, with the aim to minimize operational risks that come out from the high amount of information managed implicitly.

*“ In order to obtain a validation judgment training process that is transparent and traceable in all its components – says Rizzitiello – we have decomposed the process into different areas and into different passages where, for each, coherence of choices done with regulations requirements and time performances have been accurately verified. In order to realize this process we have to interact with a big number of interlocutors. We talk with Risk Management too in order either to understand if the model has been realized in an efficient way or during the monitoring phase in order to understand when the model is not aligned with the portfolio evolution anymore. We talk with credits areas that use ratings, with human resources areas that deal with counterparts, with the management control that have to run reports, with the area that manage the regulation part, with the operative consortium for the IT part and, of course, with all banks of the group” .*

The solution is obtained by ‘ *atomizing* ’ regulations of surveillance authorities, a procedure that is not just simple but also very transparent. In order to verify the coherence level with each regulation requirement the bank built some multiple choice questions. To each question there has been assigned a weight and to each answer a point that contribute to the final result proportionally to the weight assigned. This methodology allows to obtain both global judgments and specific aspects of the rating system. Based on the question they decide to aggregate it will also be possible, for instance, to have a judgement about the global level of coherency of the PMI rating assignment process. Questions of course can be both qualitative and quantitative.

#### 4.2.2 A WHOLE ONLINE PLATFORM

The high number of both existing tools and human interventions multiplied error's possibilities. As a direct consequence, there was an automatic increase of security needs and data certification. In addition to the previous points, there was also the necessity to systematically keep track of all historic events about processes outputs and transparency.

*“ With SAS, the need to face all these requirements in a coordinate and complete way has been solved by implementing a unique platform completely placed on the Internet enterprise network, where each employee has the possibility to access to all validation tools. Thanks to the opportunity of online sharing, for instance, questionnaires will have the possibility to be filled directly by those structures that develop those initiatives”.* Says Rizzitiello.

After the filling, each questionnaire is verified, compiled and blocked. A validation data warehouse is provided and processed by the specific SAS tool located on the IT department server and it's composed by reference tables used to certify the quality of all information available. All questionnaire are kept in an historical sequence, with all modifying dates, in order to allow all users to access and to have the complete visibility of reports and questionnaires directly from the system, solving the issue of communication problems and guarantying the highest transparency possible. Both questionnaires and reports structures, indeed, allow the access to third parties and different users when needed.

#### 4.2.3 ADVANTAGES FOR ALL USERS

In the questionnaire, the elaboration of closed questions reduces arbitrary margins usually associated to a qualitative answer. A description space is indeed available, even if what is important is the closed answers code. It's also possible to attach documents used to choose the proper answer by specifying the direct link to the document used to generate the specific qualitative judgement. Once the filling of the questionnaire is done, a selection of details is generated, containing questions and answers with all the related weights and calculations, qualitative comments and regulation links. From here, a synthesis pool is created, summarising the global validation judgement and all related sub-judgements. *"In conclusion, I can say that even before we had an internal instrument and, when we started to adopt SAS, we had a very clear idea about what we wanted to obtain from its evolution – says Rizzitiello – that fact allowed us to set up the whole project with SAS not only as a simple collaboration with a software vendor but as a real partnership focused on real needs of customers. It was easier for us to succeed in those activities since this was also SAS approach: one thing I have appreciated a lot, for instance, was the fact that all existing instruments were transferred into the new platform giving us the possibility to migrate also all the historical reports without losing past information."*

# .CHAPTER FIVE: DATA ANALYSIS AND COMPREHENSION USING BI TOOLS.

In this chapter I will show the possibility to both analyze and comprehend data by using BI tools. Many organizations, especially banks, haven't understood yet the real importance in using data in order to foresee future scenarios and therefore in order to be much more prepared in facing imminent and complex situations. The order I will follow in this chapter will be the following:

- Information needs of banking are unique
- Data analysis using BI

Starting from the description of what kind of situation banks and financial institutions need I will then go through the main BI tools available today in the banking sector used to analyze and comprehend data.

## 5.1 Information needs of banking are unique

The information requirements of banking business differ from other businesses on account of the following:

- *Banking converts money into information and vice-versa.* Modern banking offers a large variety of services. But the most fundamental activity of any bank is accepting deposits for purposes of lending. By accepting deposits it converts money into a piece of information that is commonly known as bank balance. It converts this information into cash at ATMs and its branches.
- *Banking manipulates this information to produce services.* The large pool of banking services is a result of various ways in which banks manipulate this information. For instance, banks offer payment services through cheques, drafts, electronic remittance, plastic cards, and mobile phones. What actually moves is the information, and what actually changes is also the information. It comes as no surprise, therefore, that banks worldwide are the major users of information technology.
- *Like any service industry, banks produce in real time.* All services are produced and consumed in real time. When a customer wants to deposit money, the bank produces the deposit accepting service at that point of time. If the customer wants to remit money to another person, the bank produces the remittance service to him by taking his instructions, money and effects the remittance. When a customer pays through a credit or debit card at a merchant establishment, card issuing and transaction capturing banks collaborate (with other service providers like Visa acting as facilitators) to produce the payment service at that point of time.

- *Banks are geographically dispersed.* Before the advent of technology-enabled alternate delivery channels, banks needed to have *points of presence* to produce services for their customers near their physical location. Each point of presence has its specific information requirements. This geographic dispersion, in turn, dictates the control structures in a banking organization. In Italy, these are commonly known as 'regional', 'zonal', 'circle', or 'local head' offices. These offices used to depend on the points of presence or branches under their control area for all the management information needs.
- *Banking services have rich variety .* The variety of banking services springs from the variety of requirements of their customers. Banks cater to individuals regardless of their financial status or profession, small businesses, industries, and large diversified corporate groups. Each of these customer segments has different needs for banking services. This variety has given rise to multiplicity of technology solutions in banking and no single software solution today can satisfy even the transaction processing requirements of a large bank. To produce this variety of banking services at dispersed geographical locations, and to gain the competitive advantage, banks have an equally complex Business IntelligenceBusiness Intelligence requirements.

## 5.2 Data analysis using Business Intelligence

Many large banks use Business Intelligence systems to monitor a wide range of *key business performance indicators* at corporate, divisional, departmental and business unit levels. These systems rely on pre-defined extracts and summaries of data, and are limited when in depth, dynamic analysis of very large quantities of detailed transaction data is required. Successful businesses continuously look for areas where they could improve performance by monitoring, reviewing and analyzing the information extracted from the data produced through their day to day operations. Most modern businesses have data warehouses and reporting systems which provide the basis for monitoring their regular activity answering questions about sales, customers, marketing, finance, personnel, etc. Conventional Business Intelligence systems, therefore, are generally predicated on a "*model based*" approach. The data for reporting and query is selected and organized to mirror a model of how the business should be operating. They focus on monitoring straightforward measures of business performance, such as sales volumes, stock value, customer numbers, number of visits, etc., and even when they highlight exceptions, they are only against these predefined measures. The every-day monitoring of these standard measures of business performance can be done against data which is summarized against a limited number of dimensions (e.g. sales by product, sales by store, sales by date, etc). In addition BI systems provide *drill-down* and *multi-dimensional* capabilities to investigate to some extent what lies beneath the highest level summaries.

However, for applications such as fraud detection, financial risk analysis, and financial marketing analytics the ability to combine extensive domain knowledge with the ability to dynamically analyze and "mine" very large quantities of raw data is a fundamental requirement. In order to deliver reasonable desktop performance, Business Intelligence systems generally access data that is either pre-summarized to meet those reporting and query needs which can be pre-determined, or pre-filtered to eliminate data which was not recognized as having high utility during data warehouse requirements analysis. To keep the data volumes within the capabilities of these systems, much of the detailed data will either be discarded or rolled up into summarized totals, especially where such detail appears to have little utility for day-to-day reporting. Indeed the challenge for the analyst designing Business IntelligenceBusiness Intelligence applications is to ensure that the data made available to users is the minimum necessary for their identifiable requirements. This reduces the difficulties in delivering reasonable query performance to end users, and

reduces the costs and complexities of managing the large, complex databases of most data warehouses. This is doubly important because any single user may require several views (stored in structures such as cubes and data marts) of the data for different reports or queries, thereby duplicating data and increasing complexity. So any data which cannot be specifically identified and justified for inclusion is usually discarded as unnecessary for purpose. The effect of this is that reports and queries, even when they are designed to report on the target problem, may not be alerting management to dysfunctional activity in their business, since the vital clues of unusual behavior may be masked. This is exacerbated when these tell-tale signatures of such activity (as is the case for retail fraud) are constantly changing. For example, a report of overall levels of refunds by store may not be sensitive to dishonest refund activity by a single cashier (in fact refunds data may not even be available in the data warehouse). If however there would be the possibility to analyze the fine details of the transactions to detect unusual behavior patterns, perhaps an unusual number of refunds to one credit card, then the problem would be quickly highlighted and provide the evidence to resolve the issue.

BI platforms, therefore, enable users to build applications that help organizations learn, understand and optimize their business. Gartner defines a BI platform as a software platform that delivers the 13 capabilities listed below. These capabilities are organized into three categories of functionality:

- Integration
- Information delivery
- Analysis.

In 2009, enhancing integration between BI platform components has been a major focus of mega vendors digesting their numerous acquisitions. Information delivery continues to be a core focus of most BI projects today, but what can be seen is also an increasing demand for tools that enable easier and more intuitive analysis to discover new insights.



### 5.2.1 INTEGRATION

- *BI infrastructure*: all tools in the platform should use the same security, metadata, administration, portal integration, object model and query engine, and should share the same look and feel.
- *Metadata management*: not only should all tools leverage the same metadata, but the offering should provide a robust way to search, capture, store, reuse and publish metadata objects such as dimensions, hierarchies, measures, performance metrics and report layout objects.
- *Development tools*: the BI platform should provide a set of programmatic development tools and a visual development environment, coupled with a software developer's kit for creating BI applications, for integrating them into a business process and/or embedding them in another application. The BI platform should also enable developers to build BI applications without coding by using wizard-like components for a graphical assembly process. The development environment should also support Web services in performing common tasks such as scheduling, delivering, administering and managing. In addition, the BI application should assign and track events or tasks allotted to specific users, based on predefined business rules. Often, this capability is delivered by integrating with a separate portal or workflow tool.
- *Collaboration*: this capability enables BI users to share and discuss information and/or manage hierarchies and metrics via discussion threads, chat and annotations either embedded in the application or through integration with collaboration, analytical Master Data Management (MDM) and social software.

### 5.2.2 INFORMATION DELIVERY

- *Reporting*: reporting provides the ability to create formatted and interactive reports (parameterized) with highly scalable distribution and scheduling capabilities. In addition, BI platform vendors should handle a wide array of reporting styles (for example, financial, operational and performance dashboards) and should enable users to access and fully interact with BI content delivered to mobile devices.
- *Dashboards*: this subset of reporting includes the ability to publish formal, Web-based reports with intuitive interactive displays of information, including dials, gauges, sliders, check boxes and traffic lights. These displays indicate the state of the performance metric compared with a goal or target value. Increasingly, dashboards are used to disseminate real-time data from operational applications.
- *Ad hoc query*: this capability enables users to ask their own questions of the data, without relying on IT to create a report. In particular, the tools must have a robust semantic layer to allow users to navigate available data sources. These tools should include a disconnected analysis capability that enables users to access BI content and analyze data remotely without being connected to a server-based BI application. In addition, these tools should offer query governance and auditing capabilities to ensure that queries perform well.
- *Search-based BI*: applies a search index to both structured and unstructured data sources and maps them into a classification structure of dimensions and measures (often leveraging the BI semantic layer) that users can easily navigate and explore using a search (Google-like) interface.

### 5.2.3 ANALYSIS

- *OLAP*: this enables end users to analyze data with extremely fast query and calculation performance, enabling a style of analysis known as “slicing and dicing.” This capability could span a variety of storage architectures, such as relational, multidimensional and in-memory.
- *Interactive visualization*: this gives the ability to display numerous aspects of the data more efficiently by using interactive pictures and charts, instead of rows and columns. Over time, advanced visualization will go beyond just slicing and dicing data to include more process-driven BI projects, allowing all stakeholders to better understand the workflow through a visual representation.
- *Predictive modeling and data mining*: this capability enables banks to classify categorical variables and to estimate continuous variables using advanced mathematical techniques. BI developers are able to integrate models easily into BI reports, dashboards and analysis.
- *Scorecards*: these take the metrics displayed in a dashboard a step further by applying them to a strategy map that aligns key performance indicators with a strategic objective. Scorecard metrics should be linked to related reports and information to perform further analysis. A scorecard implies the use of a performance management methodology such as Six Sigma or a balanced scorecard framework.

## .CHAPTER SIX: CASE STUDY.

In this chapter I will examine the case study of Unicredit, of how the board decided to completely revolutionize its internal IS architecture in order to implement BI applications. I will touch the following points :

- Prelude
- Introduction
- Challenge
- Approach
- Results
- Critical success factors

With this case study I will demonstrate how a huge bank as Unicredit was able to turn over the old IS infrastructure to give place to new BI applications able to analyze data with a deeper level of detail than before.

## 6.1 UNICREDIT - IS Architecture revolution

### 6.1.1 PRELUDE

In February 2006, Unicredit (formerly HypoVereinsbank AG), was the overall winner in Gartner's BI Excellence Award competition. Unicredit built a sophisticated Business Intelligence environment that drives a profitable new business for the bank by managing a portfolio of loans based on their risk profiles. This is achieved via risk modeling, an integrated data warehouse and reporting front end that delivers information from both the traditional credit loan business and the new credit derivatives business. Advanced analytical models continuously evaluate risk levels of the debt held within the portfolio. Business rules guide the portfolio managers to hedge specific exposures out of the portfolio when those loans reach dangerous levels of risk and then to reinvest in other diversified areas. Key elements of the project include tight integration between IT and business stakeholders and a strong focus on agility, functionality can be updated on a daily basis.

### 6.1.2 INTRODUCTION

In 2005, Unicredit's Markets & Investment Banking division (formerly HypoVereinsbank Corporates & Markets) started a new business to manage a portfolio of corporate loans using risk pricing models and credit derivatives to buy and sell loans as financial assets. A new business unit, known internally as *active credit portfolio management* (ACPM), was created to run the emerging business model. ACPM enables Unicredit to avoid bulk risks, diversify its risk, optimize the risk/return profile and generate additional income through investments in structured credit products. All corporate loans are transferred internally from origination to ACPM using market-based pricing. ACPM gets full asset ownership and profit and loss responsibility for the portfolio.

### 6.1.3 CHALLENGE

ACPM portfolio managers are required to have extensive reporting and analysis capabilities to develop a deep understanding of each loan's risk profile. They also needed to be able to aggregate the information with some flexibility, adding and subtracting positions from the portfolio to ensure it was properly diversified. Unicredit required both an online analytical processing (OLAP) architecture to aggregate the information and a more sophisticated simulation capability that could perform " *what if* " analysis, based on various external market factors. ACPM also required a rule-based warning system to identify deterioration in the risk profile of a position as soon as possible.

All of these Business Intelligence capabilities (reporting, analysis, monitoring, and simulation) required ACPM to integrate two separate subject areas with different business approaches and paradigms; the existing commercial loan business and the new capital markets derivative business. This required enormous amounts of data integration across 90 different internal and external systems. Therefore, Unicredit had to build a world-class BI environment as the backbone of its ACPM unit.

#### 6.1.4 APPROACH

The project had great freedom. A new governance model was created which re-defined the IT/business collaboration and supports the idea of continuous integration. All data management processes and the business logic are designed, implemented and tested within the business unit and can be staged automatically into the production system within a few minutes.

The project timeline was as follows:

- April 2004: Definition of the requirements and target architecture.
- June 2004: Evaluation of BI vendors was conducted.
- August 2004: Installation of development environment and training on new tools began.
- September 2004: Implementation.
- December 2004: First release (with 15 data sources) on development server.
- April 2005: Production environment set up with high performance cluster, load balancing and failover mechanisms.

Unicredit had a budget of 3 million euros to start up the project. The project costs incurred from April 2004 through October 2005 included the following:

- 500 full-time equivalent (FTE) days for internal IT department to perform tool evaluation, set up the infrastructure, develop the staging server and carry out all the necessary security and administration set-up.
- 900 FTE days for internal business resources to perform tool evaluation, create functional design, build basic models, develop extraction, transformation and loading (ETL) scripts and data management, create business logic and design reports.
- 800 FTE days for external staff from three different contractors to support these efforts. The ongoing costs of the project are budgeted at about 4 million euros annually with 90% of those costs for personnel.

There are 16 people working on the ongoing BI team:

- Two business analysts
- Four financial engineers
- One data modeler
- Three ETL designers
- Three report designers
- Two infrastructure managers
- One project manager

Unlike typical BI projects, with most of the costs incurred during the plan/build phase, Unicredit saw its costs increase in the operational phase. The company said it was necessary to add more staff, mostly financial analysts, to the project during the operational phase to extend the business logic and models used in the application layer. The team devotes about 30% of its resources to project maintenance and 70% of its time to functional enhancements, due to rapidly evolving markets with lots of product innovations.

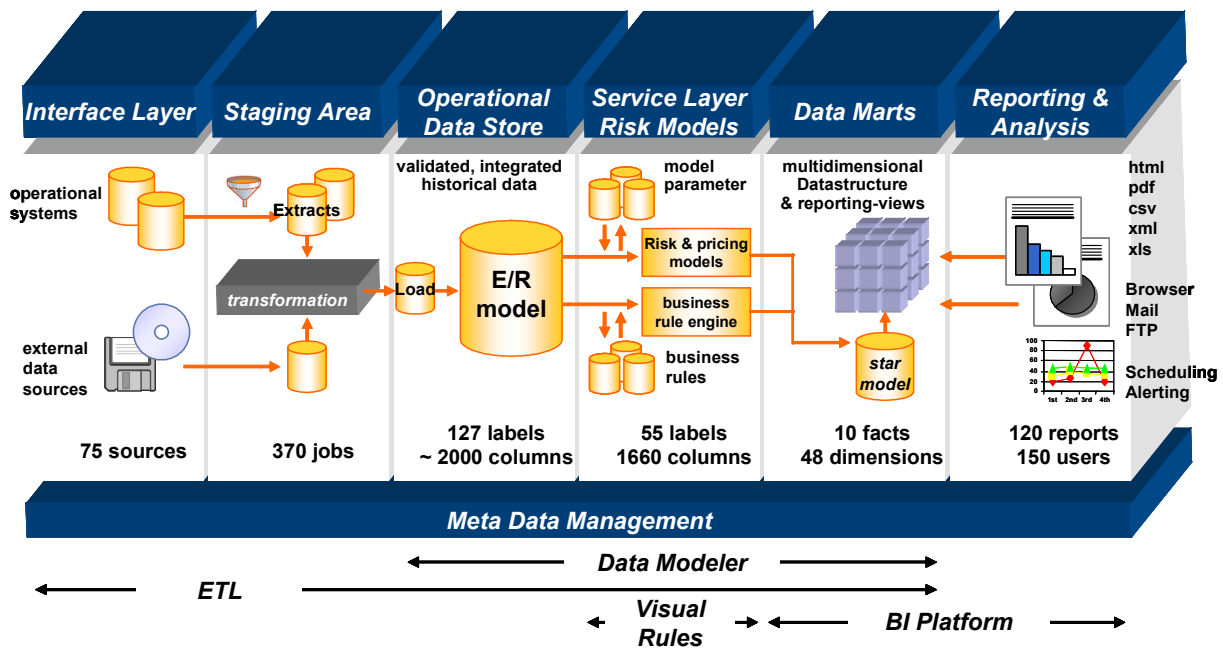
The project leveraged the following technologies:

- The data warehouse and associated data marts are run in Oracle RDBMS v.9.2 on six 4-way Sun servers, each with 16 GB of memory.
- SAS version 9 Data Integration Studio is used to run about 700 jobs a day, moving data from 89 source systems to populate the data warehouse and associated data marts.
- Ad hoc query, reporting, OLAP and other end-user tools are provided by Cognos 8 Report Studio, Query Studio and Analysis Studio.
- The business rules and logic are implemented in Visual Rules.
- ERWIN is used to define and modify the data model and to generate all database scripts.
- Risk modeling and simulation programs were custom-coded in C++ and encapsulated in a Rogue Wave Web services framework.



- The expected profit or loss is estimated for each trade via custom models that are made available by passing the required parameters to the model via Web services. Sensitivities and other risk measures are computed as well.
- To understand whether the portfolio has sufficient diversification, Unicredit relies on a highly scalable Monte Carlo simulation capability that was custom-coded in C++. Unicredit can simulate millions of permutations and then deliver a probability distribution of the possible outcomes.

Figure 15 shows layer architecture based on common metadata management.



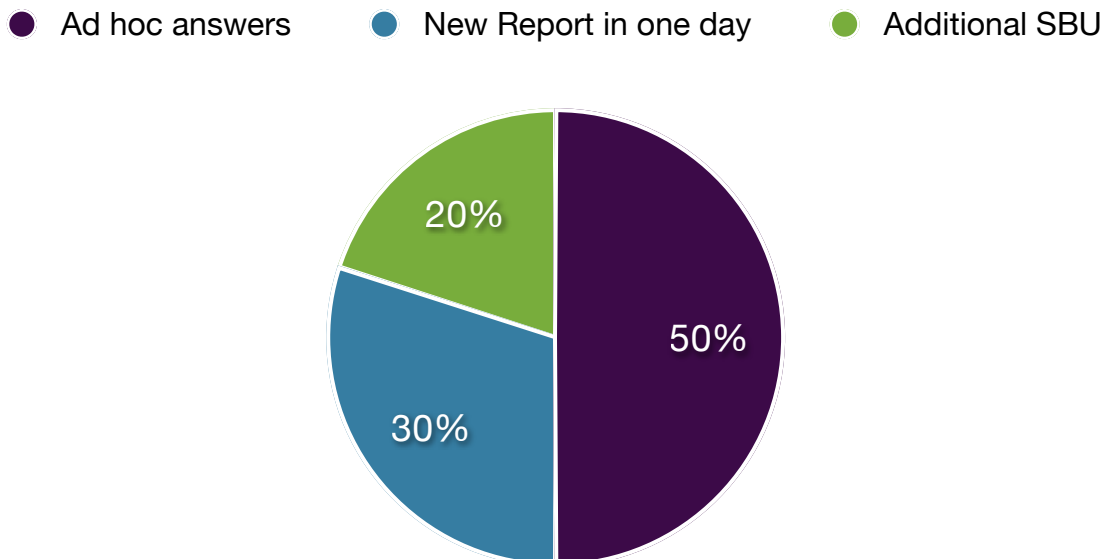
Source: Unicredit (Markets & Investment Banking Division)

The first layer of the Business Intelligence environment is the interface area where input files are delivered to "data ramps" and external source systems are connected. This layer represents the "E"-level within ETL. The second layer contains all data transformations (the "T"-level) and prepares all data ready for loading. The loading interface (the "L" level) is based on a generic framework for handling historic data and for versioning data which is changing slowly. Separating ETL into three distinct activities makes the architecture more flexible. With this architecture, extraction can now work

against any data service in a service-orientated architecture (SOA). Transaction can be embedded for use as a quality rule in an application. Loading is only about data delivery, achieved by separating the data management rules from the data delivery mechanism. The operational data store (ODS) level is a "normalized" Entity/Relationship (ER) model (not strictly to the third level) to keep all data and ensure its integrity. In the next level (called the application layer) the data is de-normalized and value added with some business logic. Data is provided for business objects (like customers, deals, products and so on). Based on this information, Unicredit built data marts for feeding the risk models and the rule-based early warning signal system. Additionally, the data is transformed into a star model with 10 fact and 36 dimension tables. The Cognos-reporting front end is based on this star schema. The ODS comprises about 250 tables with slightly more than 4200 columns. The application layer with the data marts consists of 72 tables with 3100 columns.

### 6.1.5 RESULTS

The world-class BI system Unicredit built has enabled it to become a global leader in a market that has grown to a multi-trillion euro market in less than seven years. The application of this sophisticated BI technology, when applied to a specific business case, meant that Unicredit was able to generate a return on investment in less than one year. Without combining the data of the commercial loan business with the derivative trading business, the new business model would not have succeeded. Thanks to the BI project, portfolio managers are able to understand and manage the actual composition of the credit portfolio. In particular, portfolio managers can now view credits by industry, region, rating class and maturity. Portfolio managers can use this information to understand the credit quality of the assets and to identify and explain market price movements.



About 50% of information requests can be answered ad hoc, about 30% by creating a new report within one day and about 20% require additional business logic within the application layer. In most cases this can be delivered in less than one week. The data warehouse also feeds all the risk models successfully with relevant data. The risk models calculate the *expected and unexpected losses and their volatilities*. Those measures are essential for ACPM to ensure its portfolio is optimally priced and diversified. Also, a rule-based early warning signal system detects possible credit deteriorations and highlights noticeable companies, giving exact explanations of which risk triggers were fired. Finally, the universal metadata supports the documentation and management of system changes for audit compliance. The documentation can be generated directly out of the system, which keeps it up to date and significantly reduces the effort to produce it. Beyond its information technology sophistication, Unicredit's ACPM project also won the best in class award from Risk Management Magazine.

# .CHAPTER SEVEN: DATA ANALYSIS AND COMPREHENSION USING DATA MINING TECHNIQUES.

In this chapter I will show the possibility to both analyze and comprehend data by using Data Mining techniques. As previously explained, nowadays many financial institutions are beginning to be aware of the real importance in using data in order to foresee future scenarios and therefore in order to be much more prepared in facing imminent and complex situations. The order I will follow in this chapter will be the following:

- What is Data Mining
- Data Mining Operations
- Data Mining in the banking industry

Starting from a general description of Data Mining world, I will go through a more detailed analysis concerning the application of Data Mining methods in the banking industry, by highlighting some central points that demonstrate the big importance to analyze data before something happens. With the realization that data mining and warehousing have become such integral and important issues for the development of banking organizations, there is a clear impetus to examine the impact of this technology in the industry. Using this as a basis for research, this investigation considers the application of data mining and warehousing technologies in the banking industry. Through a careful consideration of what has been written on this process, a more integral understanding of how this technology is impacting the banking industry will be elucidated.

## 7.1 What is Data Mining?

Data mining refers to computer-aided pattern discovery of previously unknown interrelationships and recurrences across seemingly unrelated attributes in order to predict actions, behaviors and outcomes. Data mining, in fact, helps to identify patterns and relationships in the data. Because data mining is a relatively new concept, it has been defined in various ways by various authors in the recent past. Box below provides a few definitions from literature on what data mining is, and how it can be beneficial to an organization.

### Data Mining Defined Throughout Literature

Data mining is defined as the process of extracting previously unknown, valid, and actionable information from large databases and then using the information to make crucial business decisions (Cabena et al)

Data mining is described as the automated analysis of large amounts of data to find patterns and trends that may have otherwise gone undiscovered (Fabris)

The objective of data mining is to identify valid, novel, potentially useful, and understandable correlations and patterns in existing data (Chung and Grey)

It may be noted at the outset that definitions of data mining given by these authors are somewhat different, but all have a common idea: to extract important information from existing data and enable better decision-making throughout an organization. Not only can data mining improve decision-making by searching for relationships and patterns from the extensive data collected by organizations, it can also reduce information overload. Data mining enables an organization to focus on the most important information in the database, which allows managers to make more knowledgeable decisions by predicting future trends and behaviors. Before data mining was utilized, managers were not as capable of making such informed decisions because searching through large amounts of data was too expensive and time-consuming.

Data mining, as is evident from its key elements, typically involves the use of predictive modeling, forecasting and descriptive modeling techniques. By using these techniques, an organization can proactively manage customer retention, identify cross-sell and up-sell opportunities, profile and segment customers, set optimal pricing policies and objectively measure and rank which suppliers are best suited for their needs. Solutions provided have a wide variety of applications across industries, starting from banking and finance, retail, insurance and telecommunications to arrive to database marketing, sales forecasting, call behavior analysis and churning management in telecommunications; and still forecasting of demand for utilities, such as energy and water; simulation of chemical and other process reactions; finding critical factors in discrete manufacturing (aerospace, automobile, electronics), CPU usage and forecasting. Data mining is often referred to as '*analytical intelligence*'. Several recent trends have increased the interest in data mining, including the declining cost of data storage and the increasing ease of collecting data, the development of robust and efficient machine-learning algorithms to process data, and the declining cost of computational power. With greater data storage capabilities and declining costs, data mining has offered organizations a new way of doing business since it is able to help organizations to better understand their business, to be able to better serve their customers and to increase the effectiveness of the organization in the long run. To stay competitive and keep abreast of industry dynamics, enterprises are using IT to generate, store and analyze mass-produced data not only for operational purposes but also to enable strategic decision making.

## 7.2 Data Mining Operations

Data mining operations are classified in different ways. A few categorizations of data mining operations are:

- clustering/segmentation
- visualization
- predictive modeling
- link analysis
- deviation detection
- dependency modeling
- summarization

With most analysis tools, users know what questions they want to ask before using the tool. With data mining, users do not necessarily need to know what questions to ask since the software uncovers patterns for the users. Data visualization tools allow users to 'see' patterns in data. These tools allow users to build quite complex, three-dimensional representations of the data.

Many of the methodologies that are commonly described as forming part of a standard data mining tool kit have been developed either by the machine-learning community or by statistical data analysts. In fact, it is really difficult to specify any particular technique as being unique to the data mining community. Therefore, any listing of data analysis methodologies as data mining techniques would appear 'subjective' and somewhat arbitrary. Some widely used techniques in data mining include artificial neural networks, genetic algorithms, K-nearest neighbor method, decision trees, and data reduction.



## 7.3 Data Mining in the Banking Industry

The banking industry across the world has undergone tremendous changes in the way the business is conducted. With the recent implementation, greater acceptance and usage of 'electronic' banking, the capturing of transactional data has become easier and, simultaneously, the volume of such data has grown considerably. It is beyond human capability to analyze this huge amount of raw data and to effectively transform the data into useful knowledge for the organization. The enormous amount of data that banks have been collecting over the years can greatly influence the success of data mining efforts. By using data mining to analyze patterns and trends, bank executives can predict, with increased accuracy, how customers will react to adjustments in interest rates, which customers will be likely to accept new product offers, which customers will be at a higher risk for defaulting on a loan, and how to make customer relationships more profitable. The banking industry is widely recognizing the importance of the information it has about its customers. Undoubtedly, it has among the richest and largest pool of customer information, covering customer demographics, transactional data, credit cards usage pattern, and so on. As banking is in the service industry, the task of maintaining a strong and effective CRM is a critical issue. To do this, banks need to invest their resources to better understand their existing and prospective customers. By using suitable data mining tools, banks can subsequently offer 'tailor-made' products and services to those customers. In particular, the banking industry around the world has undergone a tremendous change in the way business is conducted. Leading banks are using Data Mining tools for customer segmentation and profitability, credit scoring and approval, predicting payment default, marketing, detecting fraudulent transactions, etc. One of the most important concept that must be kept in mind is that data are, in fact, one of the most valuable assets of any corporation, but only if it knows how to reveal valuable knowledge hidden in raw data.

Data mining, indeed, has a lot of advantages:

- It allows to extract diamonds of knowledge from the historical data and predict outcomes of future situations.
- It helps optimize business decisions, increase the value of each customer and communication, and improve customer satisfaction.
- It is the process of extracting previously unknown information, typically in the form of patterns and associations, from large databases.
- It is a valuable tool, by identifying potentially useful information from the large amounts of data collected, an organization can gain a clear advantage over its competitors.
- It can help companies in better understanding of the vast volume of data collected by the CRM systems. In the past few years, many banks have recognized the vital importance of the information they have on their customers.
- It can identify products that are often purchased together, which can help build product bundles that are more likely to be successful.

With banking transactions moving to an online platform that captures transactional data at the point-of-transaction itself, banks are amassing a huge volume of data that has immense business values buried in it and can provide valuable insights into the banking habits of customers of varying profiles. A substantial part of budget allocation, out of the total expenditures at banks and insurance companies, is being done for IT implementation. There are numerous areas in which data mining can be used in the banking industry, which include customer segmentation and profitability, credit scoring and approval, predicting payment default, marketing, detecting fraudulent transactions, cash management and forecasting operations, optimizing stock portfolios, and ranking investments. In addition, banks may use data mining to identify their most profitable credit card customers or high-risk loan applicants. Following are some examples of how the banking industry has been effectively utilizing data mining in these areas.

### 7.3.1 MARKETING

One of the most widely used areas of data mining for the banking industry is marketing. The bank's marketing department can use data mining to analyze customer databases and develop statistically sound profiles of individual customer preferences for products and services. By offering only those products and services that customers really want, banks can save substantial money on promotions and offerings that would otherwise be unprofitable. Bank marketers, therefore, need to focus on their customers by learning more about them. *Bank of America*, for instance, uses database marketing to improve customer service and increase profits. By consolidating five years of customer history records, the bank was able to market and sell targeted services to customers. 'Cross-selling' is another marketing area where data mining can be extensively used. Here, a service provider makes it attractive for a customer to buy additional products or services with the same business. The more products and services a bank can provide for customers, the more likely the bank is to retain those customers. For example, several leading private and foreign banks in India (ICICI, HSBC, etc.) use data mining to find customers with demand deposit accounts who may be interested in a home equity loan. A model is built of the customers who already have home equity loans and this model is used to pinpoint other customers who may also be interested.

Another example is Bank of America, which has recently completed a project with IBM's data mining tools to search its database of corporate clients and try to figure out what products the clients may need next.

### 7.3.2 RISK MANAGEMENT

Data mining is widely used for risk management in the banking industry. Bank executives need to know whether the customers they are dealing with are reliable or not. Offering new customers credit cards, extending existing customers lines of credit, and approving loans can be risky decisions for banks if they do not know anything about their customers. Data mining, however, can be used to reduce the risk of banks that issue credit cards by determining those customers who are likely to default on their accounts.

An example was reported in the press of a bank discovering that cardholders who withdrew money at casinos had higher rates of delinquency and bankruptcy. It is a common practice on the part of banks to analyze customers' transaction behaviors in their deposit accounts to determine their probability of default in their loan accounts. Credit scoring, in fact, was one of the earliest financial risk management tools developed. It can be valuable to lenders in the banking industry when making lending decisions. Lenders would not have expanded the number of loans they give out without having an accurate, objective, and controllable risk assessment tool. The examples of both a 'good' and 'bad' loan applicant's histories can be used to develop a profile for a good and bad 'new' loan applicant. Data mining can also derive the credit behavior of individual borrowers with installment, mortgage and credit card loans, using characteristics such as credit history, length of employment and length of residency. A score is thus produced that allows a lender to evaluate the customer and decide whether the person is a good candidate for a loan, or if there is a high risk of default. Customers who have been with the bank for longer periods of time, remained in good standing, and have higher salaries/wages, are more likely to receive a loan than a new customer who has no history with the bank, or who earns low salaries/wages. By knowing what the chances of default are for a customer, the bank is in a better position to reduce the risks.

### 7.3.3 FRAUD DETECTION

Another popular area where data mining can be used in the banking industry is in fraud detection. Being able to detect fraudulent actions is an increasing concern for many businesses and with the help of data mining more fraudulent actions are being detected and reported. Two different approaches have been developed by financial institutions to detect fraud patterns.

1. In the first approach, a bank taps the data warehouse of a third party (potentially containing transaction information from many companies) and uses data mining programs to identify fraud patterns. The bank can then cross-reference those patterns with its own database for signs of internal trouble.
2. In the second approach, fraud pattern identification is based strictly on the bank's own internal information. Most of the banks are using a 'hybrid' approach.

One system that has been successful in detecting fraud is Falcon's '*Fraud assessment system*'. It is used by nine of the top ten credit card issuing banks, where it examines the transactions of 80 per cent of cards held in the US. Mellon Bank also uses data mining for fraud detection and is able to better protect itself and its customers' funds from potential credit card fraud.

#### 7.3.4 CUSTOMER ACQUISITION AND RETENTION

Not only can data mining help the banking industry to gain new customers, it can also help retain existing customers. Customer acquisition and retention are very important concerns for any industry, especially the banking industry. Today, customers have so many opinions with regard to where they can choose to do their business. Executives in the banking industry, therefore, must be aware that if they are not giving each customer their full attention, the customer can simply find another bank that will. Data mining can therefore help in targeting 'new' customers for products and services and in discovering a customer's previous purchasing patterns so that the bank will be able to retain existing customers by offering incentives that are individually tailored to each customer's needs. When *Chase Manhattan Bank in New York* began to lose customers to competitors, it began using data mining to analyze customer accounts and make changes in its account requirements, thereby allowing the bank to retain its profitable customers. Data mining is also being used by *Fleet Bank, Boston*, to identify the best candidates for mutual fund offerings. The bank mines customer demographics and account data along different product lines to determine which customers may be likely to invest in a mutual fund, and this information is used to target those customers.

*Bank of America's West Coast* customer service call centre has its representatives ready with customer profiles gathered from data mining to pitch new products and services that are the most relevant to each individual caller. Mortgage bankers are also concerned with retaining customers. The program uses leading-edge Internet technologies, predictive models, and customer-direct marketing to enable lenders to identify new customers and retain those that they already have.

## .CHAPTER EIGHT: CASE STUDY.

In this chapter I will examine the case study of Madoff Data, of how it was able to “play dirty” with money without anyone could see that. I will touch the following points:

- General overview on the history
- Test 1: Histogram of returns
- Test 2: Descriptive Statistics
- Test 3: Benford's Law
- Test 4: Scatter Plot of returns vs a related return series
- Test 5: the split-strike strategy

With this case study I will demonstrate how a huge fund owner was able to steal a huge amount of money during financial crisis years easily. I will then demonstrate how a deeper analysis of data would probably have avoided this big fraud case.

I evaluated the Madoff fund data using simple graphical and statistical procedures. I compared the histogram of the Madoff returns to that of a purportedly related return series (if the claim to the split-strike, S&P 100 investment is believed) and found stark differences. I produced a scatter plot of the Madoff returns and found no meaningful correlation, even though there should have been one. I also computed simple descriptive statistics for the Madoff returns and four other comparative return series. The Madoff returns first of all had a much higher mean and then they had a much lower standard deviation than all comparison categories, including a balanced and long term bond fund whose return volatility should be tempered compare to an equity fund. I also found that the Madoff data was positively skewed compared to the negative skewness of the other series. A more sophisticated test, Benford's Law, was applied to the Madoff returns and failed to provide evidence of fraud. While Benford's Law is a handy tool used by fraud experts to uncover “fake” accounting transactions, it would not likely be known to the typical fund manager screening potential investments for clients. It is possible that Madoff was familiar with the rule and prepared reports to investors that would not trigger an investigation by those applying the rule. Nonetheless, the dramatic departure of the Madoff returns from reasonably expected statistical patterns should have triggered a high level of concern on the part of fund managers and the SEC.

## 8.1 The Madoff Data

In December 2008, the nation was stunned when Bernard Madoff was arrested for perpetrating one of the world's largest Ponzi schemes. What was remarkable about this fraud was that more than eight years earlier the SEC (Security and Exchange Commission) had been alerted to the fraud by Harry Markopolos. Markopolos, a securities industry executive, testified:

*“As early as May 2000, I provided evidence to the SEC’s Boston Regional Office that should have caused an investigation of Madoff. I resubmitted this evidence with additional support several times between 2000 and 2008.”*

According to ASOP No. 23, *“A review of data may not always reveal existing defects. Nevertheless, whether the actuary prepared the data or received the data from others, the actuary should review the data for reasonableness and consistency.”*

The Markopolos testimony, along with the statements of others (Arvedlund 2008), suggest that due diligence was not performed by the “feeder funds” or fund managers, who provided many of the client funds “invested” in the Madoff Ponzi scheme. It also appears that the SEC was lax and did not follow through on what now appears to be obvious clues to the fraud. Much of the analysis of data will be motivated by the analyses described in the Markopolos testimony (Markopolos 2009). The analysis will be applied to published returns from one Madoff feeder fund. The fund was sold by the Fairfield Greenwich Group. The founders of the New York hedge fund at the center of the Bernard Madoff scandal, indeed, have begun selling assets as their firm faces massive losses and a slew of lawsuits. Walter Noel and Jeffrey Tucker, co-founders of Fairfield Greenwich Group, a New York hedge fund that lost a whopping \$7.5 billion to Madoff's alleged Ponzi scheme, have been forced to curb their lavish lifestyles amid mounting doubts that the firm can survive the firestorm. All the information for the analysis was downloaded from reliable sources. The data is the monthly return for the fund from January 1991 through October 2008. Figure 16 below clearly displays all data retrieved.



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Jan		3,01	0,42	-0,09	2,11	0,85	1,42	2,38	0,85	1,99	2,14	2,14	-0,04	-0,35	0,88	0,51	0,70	0,29	0,63
Feb		1,40	2,72	1,86	-0,44	0,69	0,66	0,67	1,23	0,11	0,13	0,08	0,53	-0,05	0,44	0,37	0,20	-0,11	0,06
Mar		0,52	0,94	1,79	1,45	0,78	1,16	0,80	1,68	2,22	1,77	1,07	0,39	1,85	-0,01	0,85	1,31	1,64	0,18
Apr		1,32	2,79	-0,01	1,75	1,62	0,57	1,10	0,36	0,29	0,27	1,26	1,09	0,03	0,37	0,14	0,94	0,98	0,93
May		1,82	-0,27	1,65	0,44	1,65	1,34	0,57	1,69	1,45	1,30	0,26	2,05	0,90	0,59	0,63	0,70	0,81	0,81
Jun		0,30	1,22	0,79	0,23	0,43	0,15	1,28	1,22	1,70	0,73	0,17	0,19	0,93	1,21	0,46	0,51	0,34	-0,06
Jul		1,98	-0,09	0,02	1,71	1,02	1,86	0,68	0,76	0,36	0,58	0,38	3,29	1,37	0,02	0,13	1,06	0,17	0,72
Aug		1,00	0,86	1,71	0,35	-0,24	0,20	0,28	0,21	0,87	1,26	0,94	-0,14	0,16	1,26	0,16	0,77	0,31	0,71
Sep		0,73	0,33	0,28	0,75	1,63	1,16	2,32	0,98	0,66	0,18	0,66	0,06	0,86	0,46	0,89	0,68	0,97	0,50
Oct		2,75	1,33	1,71	1,81	1,53	1,03	0,49	1,86	1,05	0,86	1,22	0,66	1,26	0,03	1,61	0,42	0,46	-0,06
Nov		0,01	1,36	0,19	-0,64	0,44	1,51	1,49	0,78	1,54	0,62	1,14	0,10	-0,14	0,79	0,75	0,86	1,04	4,50
Dec	2,77	1,56	1,36	0,39	0,60	1,03	0,41	0,36	0,26	0,32	0,36	0,12	0,00	0,25	0,24	0,54	0,86	0,23	5,40
	2,77	17,64	13,72	10,75	10,57	12,04	12,08	13,10	12,52	13,29	10,67	9,82	8,43	7,27	6,44	7,26	9,38	7,34	
	6,79	38,52	30,39	21,96	18,05	19,67	21,09	23,83	22,32	25,27	14,28	17,79	17,74	15,48	12,20	10,50	13,59	7,58	

Figure 16: matrix of monthly returns of the Fairfield Greenwich Group from 1990 to 2008

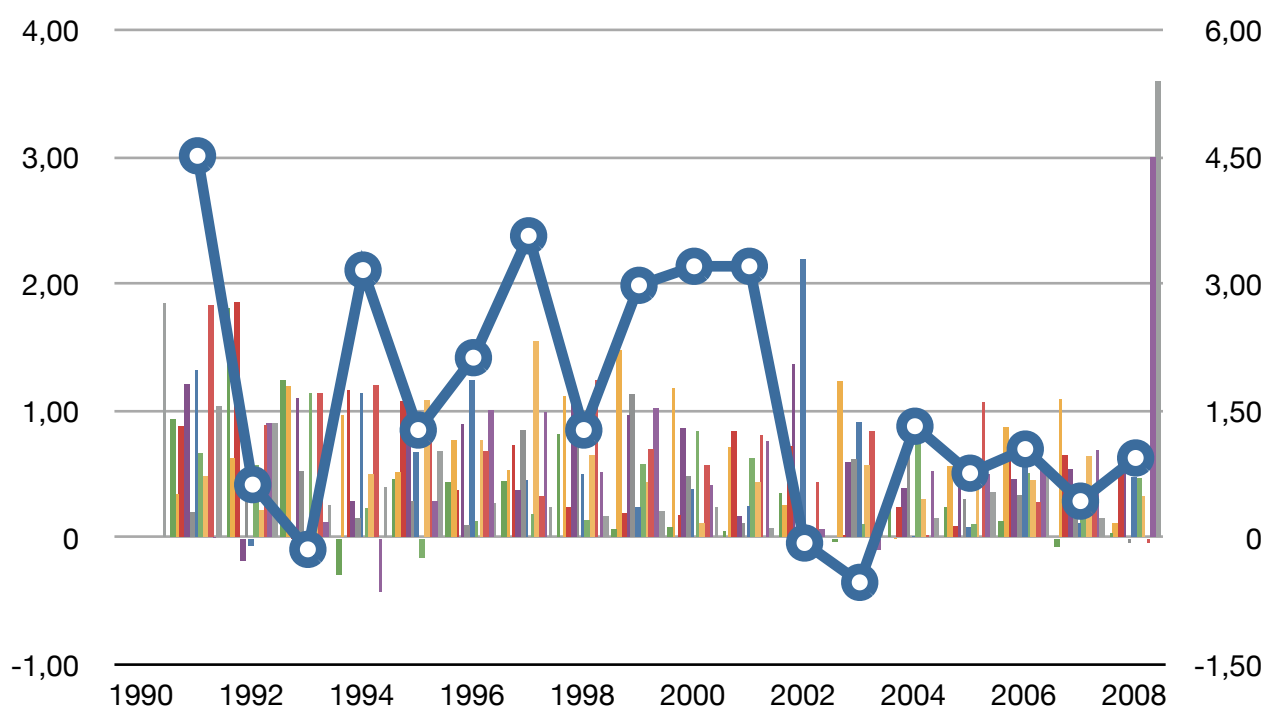


Figure 17: graph monthly returns of the Fairfield Greenwich Group from 1990 to 2008

In the testimony, Markopolos described a number of approaches he used to determine that Madoff return data was fraudulent. According to Markopolos, the returns on Madoff's investments were too good to be true. He believed that the "split-strike conversion" strategy that Madoff claimed to use would probably not beat T-Bill returns, especially after expenses are factored in. In the analyses it will be shown that a number of simple graphical and descriptive statistics should have provided red flags or warnings that the Madoff data was fraudulent. These tests include histograms, descriptive statistics and a scatter plot. I will also introduce a statistical test, Benford's Law, which is frequently used to detect fraudulent transactions by forensic accountants.

Madoff claimed to have purchased a basket of 30-35 stocks whose returns closely followed the returns of the S&P 100 index. Because it had fewer stocks, this portfolio could be expected to have higher volatility than the index it is tracking. Absent other aspects of the investing strategy to dampen volatility such as the split-strike strategy, which I will address later, Madoff's returns would be expected to share many characteristics with the S&P 100 index.

## TEST 1: HISTOGRAM OF RETURNS

Starting with the consideration that the histograms of the returns for the S&P 500 and its subset of 100 stocks ("S&P 100") are very similar and with an almost bell-shaped distribution, I went to compare the histogram of the returns for the S&P 100 and the Madoff Feeder Fund, which was composed of the largest 30-35 of S&P 100 companies (see Figure 18). The Madoff and S&P 100 histograms are dramatically different. The Madoff data is much less dispersed, i.e., it has a much higher peak and much shorter tail than the S&P 100 returns, and has virtually no left tail, suggesting the two are from very different distributions.

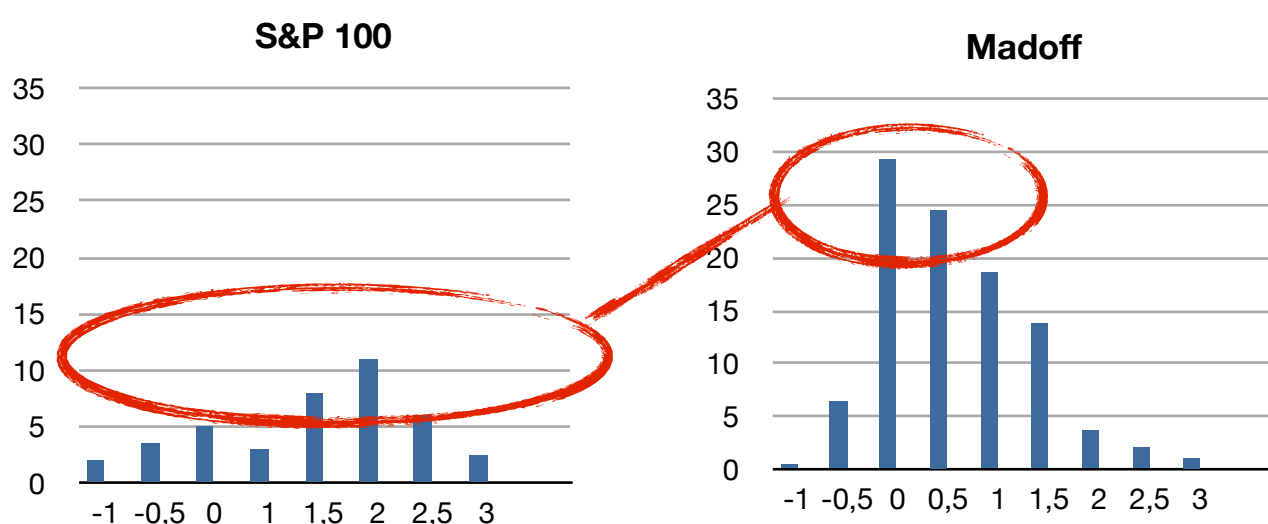


Figure 18:monthly returns of S&P and Madoff Fund

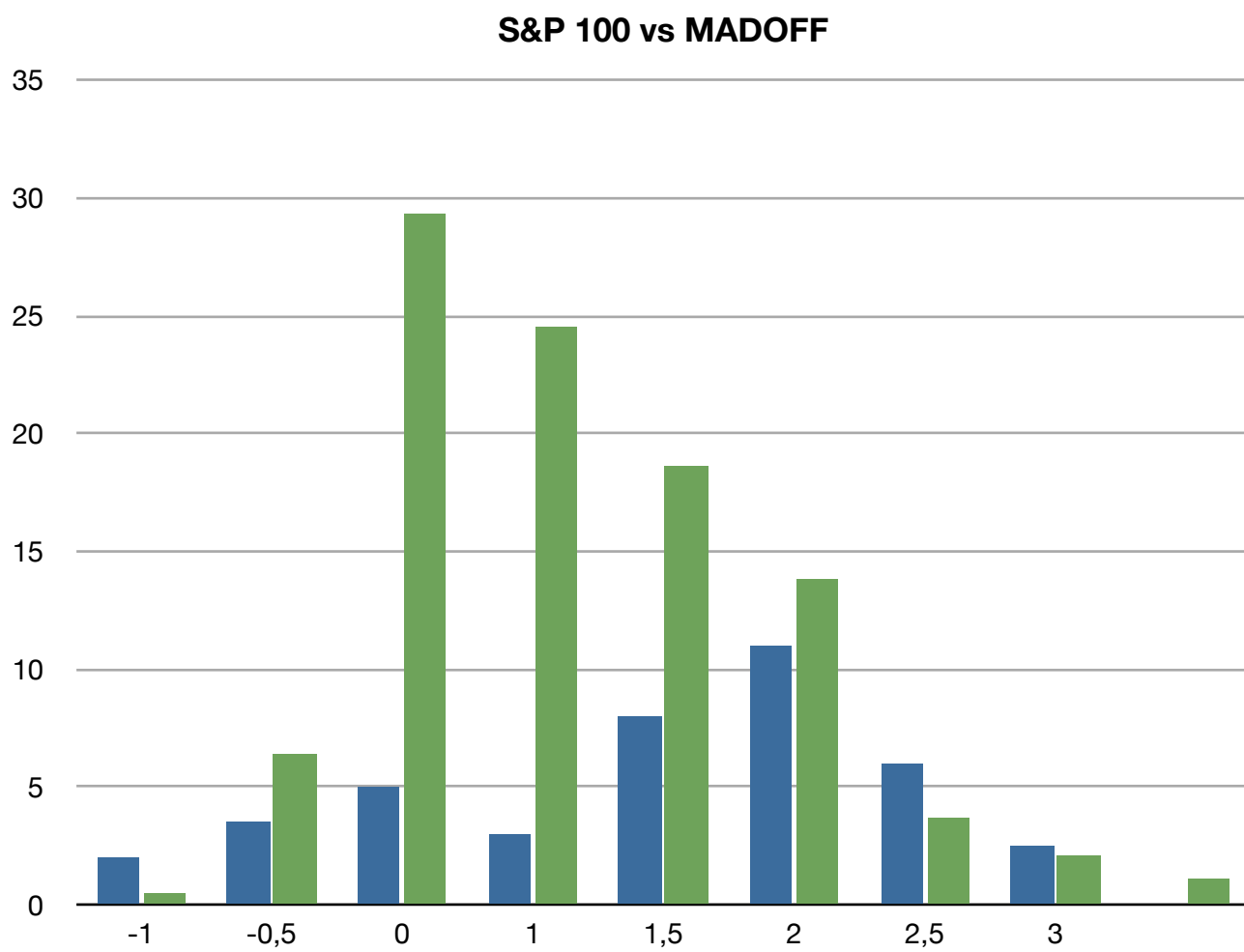


Figure 19: S&amp;P vs Madoff

## TEST 2: DESCRIPTIVE STATISTICS

Another test performed starting from Markopolos deposition was an examination of simple statistics for a Markopolos fund. I perform a similar analysis below. For comparative purposes, I have provided returns of several stock indices and large mutual funds including:

- The S&P 500. Because it contains 500 stocks instead of the 30-35 in Madoff's fund, it should have lower volatility (standard deviation) than the Madoff data.
- The S&P 100. This is the index Madoff claimed to track. Because it contains 100 stocks instead of the 30-35 in Madoff's fund, it should have lower volatility (standard deviation) than the Madoff data.
- A Balanced Fund that contains a mixture of equities and income producing investments and could be expected to have lower volatility than an equity index (S&P 100). A motivation for investing in a balanced fund is to reduce exposure to risk. A balanced fund is expected to be significantly less volatile and to have somewhat fewer extreme values than a stock-based fund.
- A long-term bond fund that should have the lowest volatility of all the assets as it is composed entirely of bonds.

In producing the following tables, data were limited to returns subsequent to June 1996 because the return series from the comparative mutual funds begins in mid-1996. A surprising result is that the Madoff Feeder Fund has a lower standard deviation than even the bond fund (see Figure 20). Indeed, its standard deviation is about 25% of that of the next most volatile asset category. It can also be noted that the Madoff data has a relatively large positive skewness while all the other assets have negative skewness.

ASSET	MEAN	STD. DEVIATION	SKEWNESS	KURTOSIS	N
BALANCED	0,46%	2,84%	-0,89	1,69	149
LONG BOND	0,60%	2,40%	-0,36	2,24	149
S&P 100	0,31%	4,77%	-0,47	0,47	149
S&P 500	0,30%	4,61%	-0,70	1,02	149
MADOFF	0,75%	0,62%	1,01	1,25	149

Figure 20: statistical data

Another statistic that Markopolos commented on was the small number of negative return months for Madoff investments. Figure 21 displays the negative return statistics for each of the assets. The Madoff fund has a far lower percentage of negative returns than any of the other assets, including a bond fund. According to Markopolos, the probability of such a low percentage of negative return months with a real invested asset is virtually nil.

ASSET	PERCENT OF MONTHS
BALANCED	39%
LONG BOND	37%
S&P 100	44%
S&P 500	42%
MADOFF	6%
TOTAL	33%

Figure 21: negative return statistics for each of the assets

Another point that Markopolos made was that, given a portfolio of 30 to 35 stocks, at least one stock would experience a significant loss during at least one month that would result in a negative return of at least 3% for the portfolio. We see in Figure 22 that the minimum return for the Madoff fund was a negative 0.6%, well above that of any of the other assets. For the entire 18 years (as opposed to the 12 years) of the Madoff data, the Madoff minimum return was -0.64% versus -14.6% for the S&P 100 for the same period.

ASSET	MEDIAN	MINIMUM	MAXIMUM
BALANCED	0,8%	-11,6%	5,7%
LONG BOND	0,9%	-8,7%	11,4%
S&P 100	1,0%	-14,6%	10,8%
MADOFF	0,7%	-0,6%	3,3%

Figure 22: minimum return for all assets

## TEST 3: BENFORD'S LAW

Benford's Law is a little known statistical procedure that is used to detect accounting fraud. It is particularly useful in detecting "fake" data. The test is based on the distribution of the first digits of numbers. For instance, Triola (2002) notes that the first digits of amounts on checks tend to follow Benford's law. Figure 23 below displays the theoretical distribution.

FIRST DIGIT	PROPORTION
1	30,1%
2	17,6%
3	12,5%
4	9,7%
5	7,9%
6	6,7%
7	5,8%
8	5,1%
9	4,6%

Figure 23: display of the theoretical distribution

A common mistake of people committing fraud is to assume that digits are uniformly distributed. Thus, the perpetrators of fake data tend to fabricate returns whose first digits fluctuate randomly around a discrete uniform distribution. Figure 24 displays the distribution of the first digit of the Madoff Feeder Fund's returns compared to the theoretical Benford's Law distribution. For comparison purposes, the distribution of S&P 100 returns are displayed, as we assume these represent the distribution of digits of a "true" random return series.



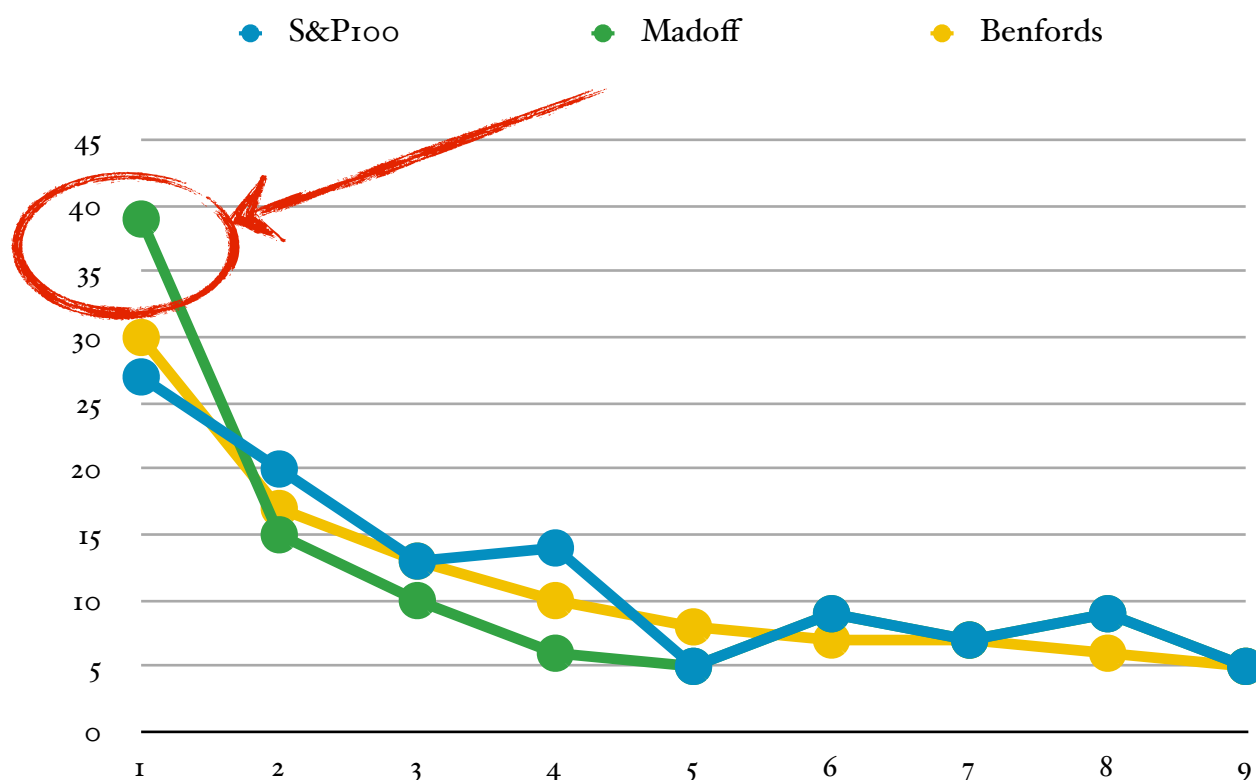


Figure 24: distribution

Note that the most obvious discrepancy between the Madoff data and Benford's Law is that the Madoff data displays an excess occurrence of the number 1. The well-known Chi-Square test can be used to compare the actual and expected frequencies of the digits to assess the overall significance of departures of actual from expected. When this test was applied to the Madoff fund data the difference between actual and theoretical frequencies was not significant at the 5% level, although the p-value of 5.9% was close to significant. For comparison, when the Chi-squared test was applied to the S&P 100 data, its p-value was 13.5%. Other researchers have compared the Madoff data to the Benford's Law expectations and have been surprised by the findings. Kedroski opined, "It is interesting to see that any fraud here was sufficiently sophisticated such that the proffered performance numbers were credible from a distributional point of view." Thus, a test that is frequently used to detect fraud, in the case of the Madoff scheme, does not appear to provide compelling evidence.

## TEST 4: SCATTER PLOT OF RETURNS VS. A RELATED RETURN SERIES

Figure 25 displays a matrix scatter plot of the S&P 500 return versus that of the S&P 100 along with scatter plots of the Madoff returns versus both of those indices.

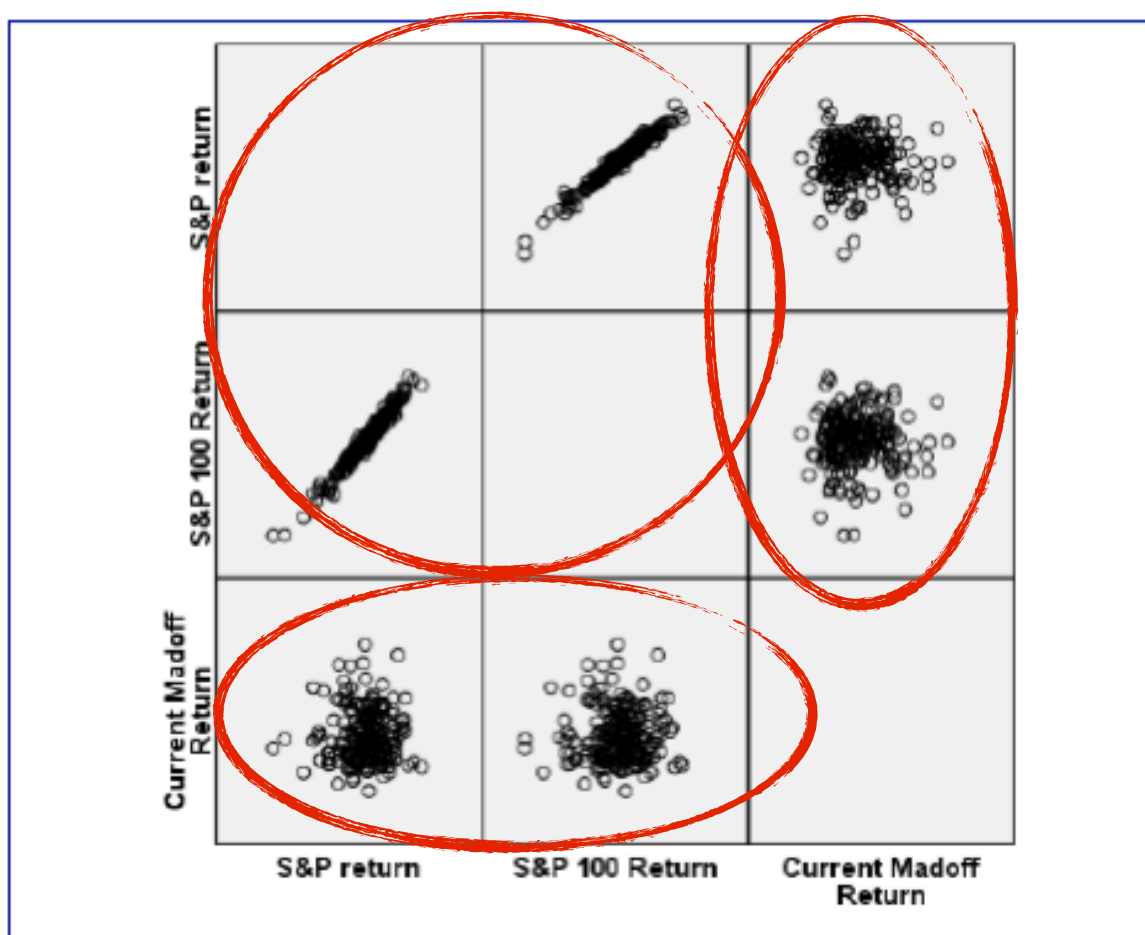


Figure 25: matrix scatter plot of the S&P 500 return vs that of the S&P 100

As one would expect, the scatter plot indicates a very high correlation between the S&P 500 and its relative, the S&P 100. However there is no apparent correlation between the S&P 100 and the Madoff fund, even though the Madoff Fund purportedly consists of S&P 100 stocks.

## TEST 5: THE SPLIT-STRIKE STRATEGY

In interpreting the graphs and tables, it is necessary to consider the “split-strike” options strategy that Madoff claimed to use. Forray described the strategy and evaluated their likely impact on the descriptive statistics and graphs such as those in this section. As described by Forray (2009), the split-strike strategy involved buying put options to limit downside volatility, while at the same time selling out-of-the-money call options to fund the purchase of the put options. Figure 26 is provided to illustrate the split strike options strategy.

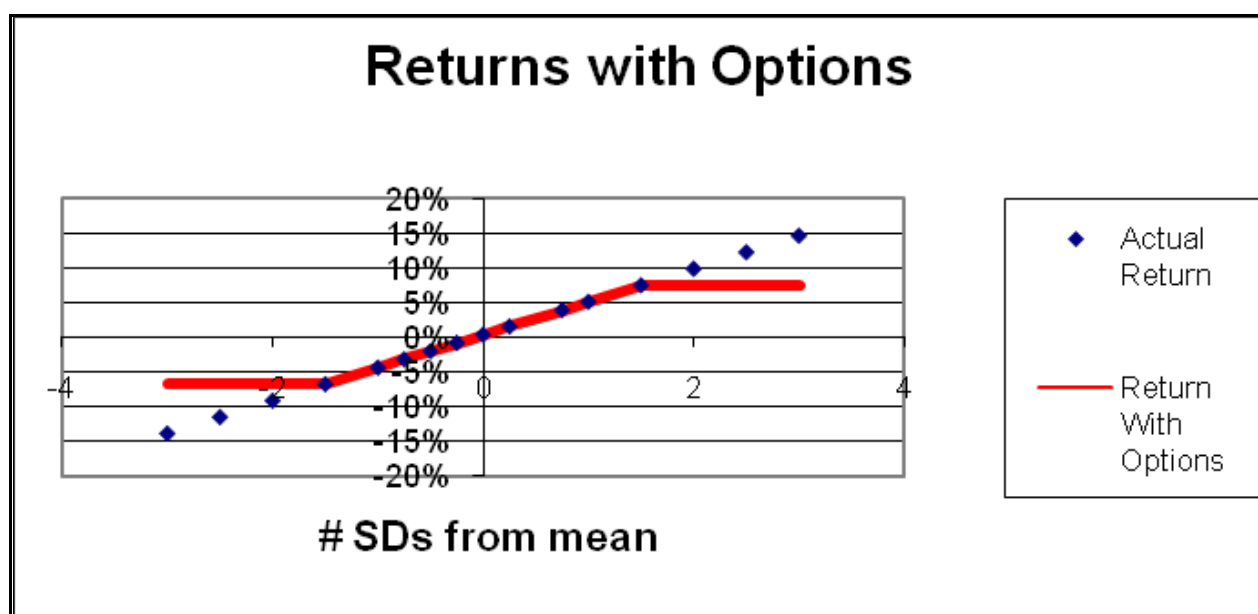


Figure 26: Effect of Options on Return

The use of options censors the return of stock funds. The sale of the call options limits the upside potential for the fund. On the down side the purchase of put options limits the downside negative return. For example, if a fund manager buys put options with a strike price of 1.5 standard deviations below the mean (for the S&P 100, approximately -7%), the fund’s monthly return will never drop below the strike price (i.e., -7% is the minimum possible return). Alternatively, if returns exceed the strike price of the call options sold by the fund, the funds return is limited by the strike price (say to approximately +7.5%, if the strike price is at +1.5 standard deviations). We could expect the use of the options to reduce the correlations (especially in the tails) between the Madoff Fund and the S&P 100, but that it should still be high. Moreover, transaction costs are incurred to buy and sell

options, and these costs depress the returns of the fund. Forray (2009) estimated the net cost of the option transactions to be 0.5% per month, suggesting that the excess return of the Madoff fund compared to the S&P 100 is much more suspect. To provide a rough assessment of the impact of limiting returns with options, I capped S&P 100 returns below at -0.6% and above at +3.3%, approximating the 18-year minimum and maximum in the Madoff fund data. In Figure 27 below I display the histogram of the limited data and note that it is quite different from the histogram in Figure 19. In particular, the limiting of the returns causes two spikes in the histogram at the lower and upper limit values.

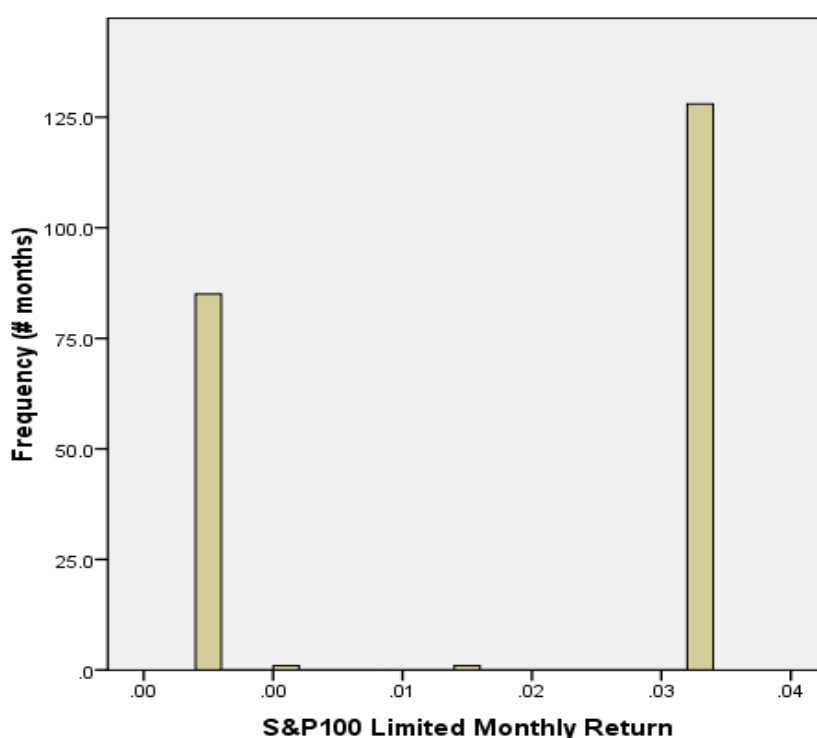


Figure 27: Histogram of S&P 100 Returns Limited Above and Below

Mean = .0173  
 Std deviation = .01909  
 N = 215

I also provide a scatter plot matrix displaying the S&P 100, the limited S&P 100 and the Madoff returns. Note that there is still virtually no correlation between the Madoff data and the limited S&P 100 series, while there is still a meaningful correlation (the measured correlation was 0.775) between the S&P 100 and the limited S&P 100.

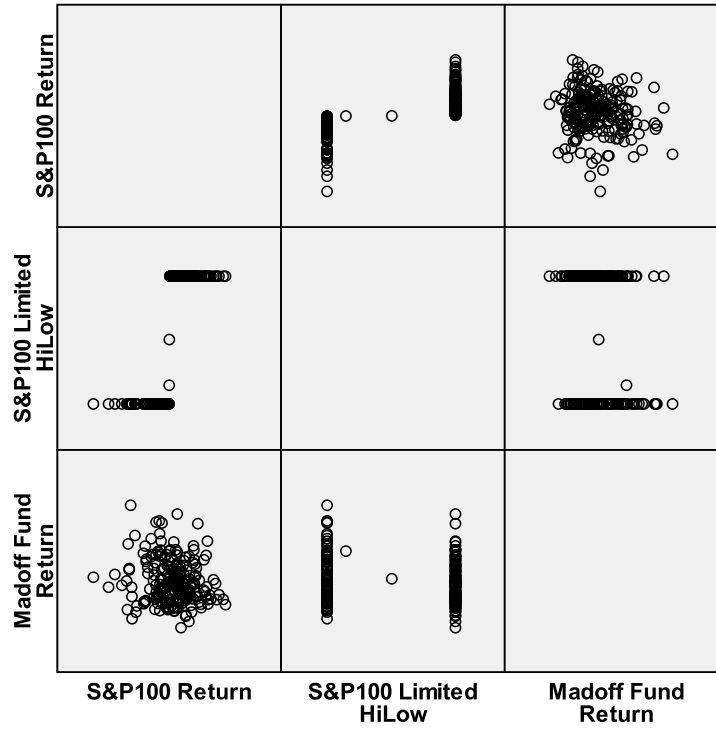


Figure 28: Scatter Plot Matrix, S&P 100, S&P 100 Limited and Madoff Fund

## .CHAPTER NINE: GRC MODEL AND RISK MANAGEMENT.

In this chapter I will introduce the GRC Model (Governance - Risk Management - Compliance), how it's composed and how it can be interpreted. From the three parts listed, I have chosen to deeper develop the Risk Management one since nowadays is one of the hottest topic in the financial world. The order I will follow in this chapter will be the following:

- Introduction to the GRC model
- Description of each single part
- Survey evidences on Risk Management Topic

Starting from the general description of what is the GRC Model, I will go throw each components by analyzing and describing all their functionalities in details. I will start with the Governance, then I will develop the Compliance in order to leave at the end the Risk Management case and survey. Business Intelligence is an essential component to a successful governance, risk and compliance (GRC) strategy, it involves what it's usually known as *risk and regulatory intelligence*. I will go throw the concept that business has to monitor its internal environment, as well as the external environment the company operates in. For this very reason the goal is to be intelligent to maximize opportunities while mitigating or avoiding negative events. In the Business Intelligence world this means implementing tools that have the ability to integrate into the company environment to monitor changes, collect information, and report on the state of GRC across systems, processes and business relationships.

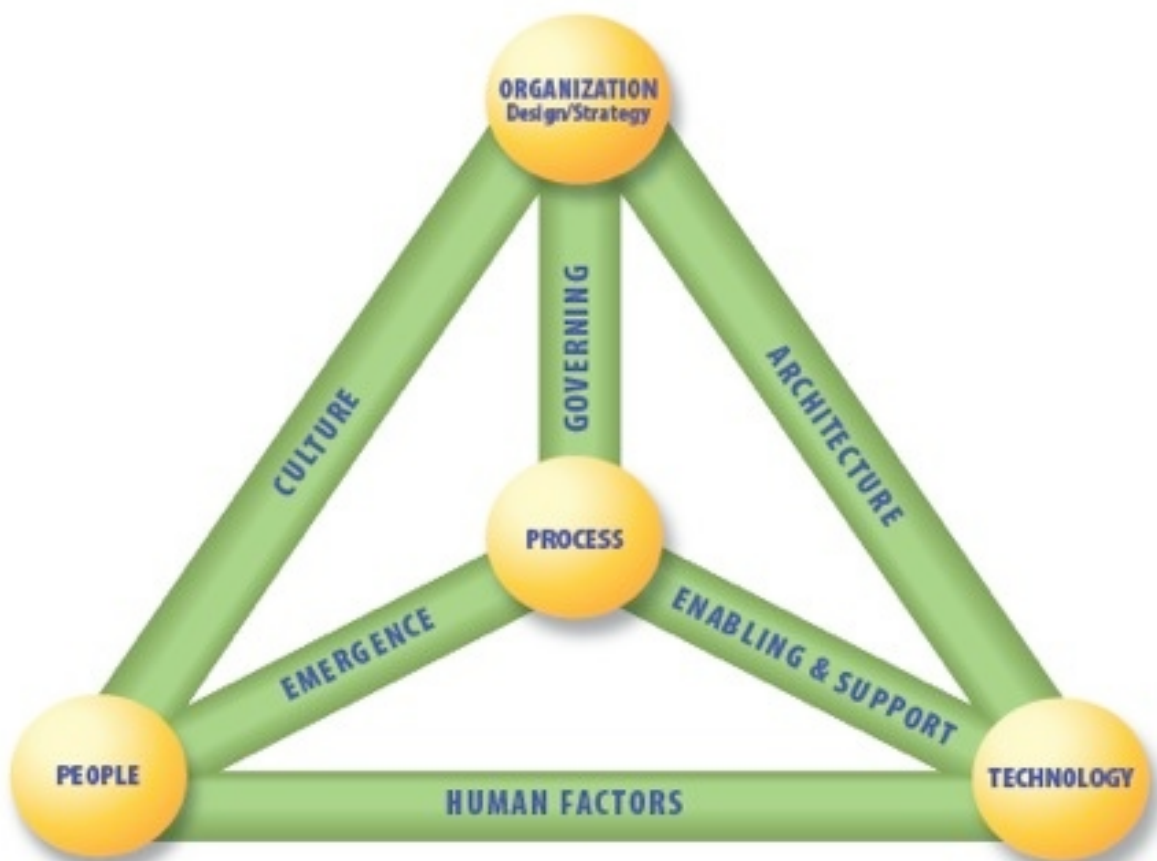
## 9.1 Introduction to GRC Management

The Executive Board of any large enterprise wants to know that the organization is appropriately protected against potential risk. The ultimate objective of risk management is to define and understand the risk tolerances of the enterprise and manage to those tolerances, optimizing the risk/return of the business. In addition, increased accountability and transparency is being demanded of corporate executives and boards of directors from both customers and regulatory agencies. Renewed enforcement and enhancements of regulatory requirements are becoming more evident and the costs associated with compliance are increasing significantly. This is occurring at the same time that resources are being stretched thin, if not all together eliminated.

It has been estimated that spending on Governance, Risk & Compliance (GRC) exceeded \$32 billion in 2008. Budget priorities are becoming more focused on enterprise and operational risk management. As enterprises continue to spend time, money and resources on GRC, finding effective and economically sound ways to identify and manage the processes and procedures implicit in GRC is an enterprise imperative. Indeed, GRC is not just one particular subject, discipline or endeavor. It is the attempt to develop a unified approach to interrelated tasks and events within an enterprise, including among other things:

- risk management
- policy management
- compliance management
- continuity of business management
- asset management
- audit management
- threat management
- incident/event management
- vendor management

Many organizations either lack formalized GRC programs or their GRC programs are not well developed or mature. C-level executives, Chief Information Security Officers, Chief Information Officers, and Chief Risk Officers struggle to link risk management efforts in information security, privacy, business continuity, and compliance to the value they provide at line-of-business and executive levels. According to leading experts few companies have created this linkage. An effective model for GRC will encompass people, process, technology, and organizational factors, as shown in Figure 29 below.





## 9.2 Governance

BI Governance can be defined from three different, unique perspectives:

### I. AS A RESOURCE RATIONALIZATION EXERCISE

This is the traditional definition of BI Governance. A prioritization mechanism by which BI projects can be approved, rejected and sequenced based on specific criteria. Many companies today have some kind of process to prioritize BI requests; however most of them still rely on subjective factors to determine how a project should move forward.

### 2. AS A SERIES OF GUIDELINES/RULES /RECOMMENDATIONS

This is relatively a new way of defining BI Governance. Traditionally, IT has been solely responsible for defining the Architecture, Standards and Best Practices to follow in Business Intelligence. However as business started realizing the impact that these decisions have on the BI Projects there has been a trend to make these topics a part of the BI Governance process.

### 3. AS THE DEFINITION OF ROLES AND RESPONSIBILITIES FOR BOTH IT AND BUSINESS STAKEHOLDERS

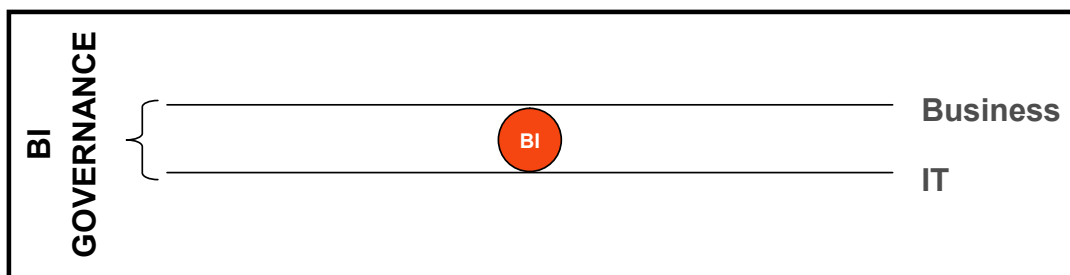
Business Intelligence projects are by nature highly complex. Establishing the proper interaction and outlining areas of responsibility between IT and Business becomes critical for a project to succeed.

### 9.2.1 UNDERSTANDING THE NEED FOR BI GOVERNANCE

Despite the apparent benefits that implementing a properly defined BI Governance process can bring to the organization, there is still a significant number of companies in the market place who are yet to start similar efforts. When talking to people from these companies one of the frequent reasons given to justify the inaction is that implementing BI Governance is a costly and complex exercise that does not provide any value, as the management has already decided which projects to execute first. While it is true that a good management team should have a general understanding of the priorities of the organization, establishing an adequate BI Governance process provides a framework by which the proper resources can be aligned to the business priorities.

Furthermore, a good, solid, BI Governance process will establish proper change management (CM) and training policies that facilitate the user adoption process and promote the overall use of BI minimizing the amount of fear and resistance to new technologies from the business users.

Proper BI Governance processes will drive the infrastructure and technology decisions. Since both business and IT are considered, the risk of choosing the wrong platform by only looking at one side of the criteria is greatly reduced. (Figure 30)



## 9.2.2 ESTABLISHING THE ORGANIZATIONAL STRUCTURE OF A BI GOVERNANCE COMMITTEE

The first step in establishing an organizational structure for the BI Governance members is identifying the stakeholders within the organization. A stakeholder can be defined as someone who has “*skin the game*”. Stakeholders usually come from three areas:

### I. BUSINESS

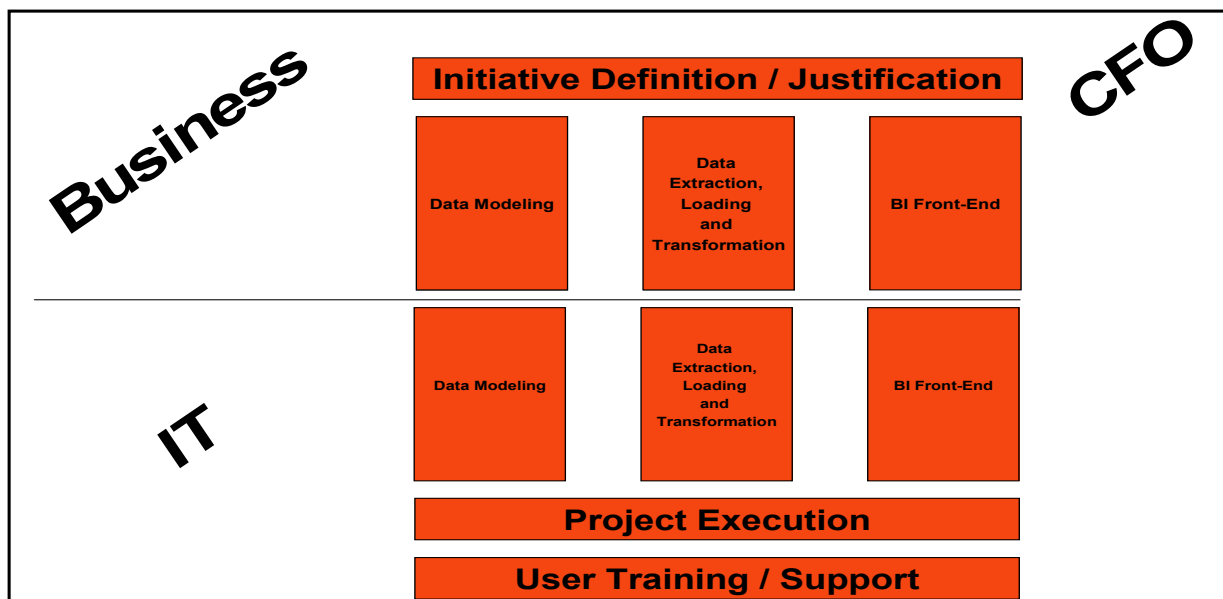
Every business area/department should nominate who their representative is going to be. This will enable equal representation from business areas across the organization, and thus provide the right forum to make decisions that impact the revenue and budget for a particular business unit. The business area representatives will be responsible for sponsoring particular projects for their units, explaining to the committee the benefits of the initiatives. They will outline a high level impact and CM plan to enable the committee understand the project being proposed from different perspectives. Part of their responsibilities will include identifying people in their functional areas to support the Data Modeling, Data Integration and BI-Front End efforts from a business perspective.

### 2. IT

IT provides the back office support for the committee. Its responsibility is to provide the roles of a Program Manager, Data Modeler Lead, Data Integration Lead, BI Front-End Lead, Enterprise BI Architect and Trainer Lead, along with the BI team’s manager. The project manager will be the facilitator for the committee, making sure the meetings take place at the right place, right time and with the right people. The Data Modeler will be in charge of creating a data model that supports the business needs across projects. It will be the Data Integration Lead’s responsibility to implement the appropriate data integration framework to populate the enterprise data model. The BI Front-End Lead will interact heavily with the business users to define the report and standards to follow. The Enterprise BI Architect will own the Enterprise BI solution and the bottom line for each project, along with each initiative’s Project Manager. The Trainer Lead will be responsible for creating the material that will be used to coach the trainers, and create an infrastructure to train the user universe in a quick and effective manner. And the BI manager will be IT’s escalation manager to the business.

3. CFO OFFICE

As BI projects are considered strategic in nature, and as the implementation cost can easily escalate to the millions of dollars, it is recommended to have a direct line to the CFO. This link will facilitate the prioritization of projects based on alignment to the corporate strategy, at the same time provides an opportunity for the team to justify the infrastructure and development costs directly to the ultimate approver. Each group of stakeholders needs to play their role and commit to their responsibilities in order to establish a good BI Governance process. Figure 31 outlines how the different groups interact through the life cycle of a BI initiative.



### 9.2.3 BUSINESS ROLES AND RESPONSIBILITIES IN BI GOVERNANCE

The Business area representatives play a key role during the initiatives definition phase. In fact, they actually play a dual role, one inside their particular area, and a slightly different one in the BI Governance committee. Inside their department, it is their responsibility to participate in the internal discussions to analyze the impact that different BI initiatives might have on their organization. They have to take an impartial decision to pick a handful of initiatives that will be taken to the BI Governance committee. Once at the committee, the business area representatives need to clearly articulate to the organization the benefits of the initiatives they are sponsoring, as they will be “*competing*” for resources against other business areas. In a traditional BI Governance paradigm, the job of a business area representative is “*complete*” when one of their initiatives is approved by the committee. However this is rapidly changing to accommodate other responsibilities like participating in data modeling, data integration and the users’ BI experience, not to mention owning the CM strategy. Business user participation during the data modeling exercise is highly requested as they are the ones who know the operation of the business; they can help the data modeler understand the business processes that are established and identify current and future business scenarios. The business users’ involvement in data integration is critical to the success of the initiatives. Their knowledge of the data and the business processes makes them ideal candidates to become or designate the data stewards: the person responsible to define the data loading exception scenarios and approve the recovery strategies proposed by IT. Furthermore, the business area representatives have ownership of the Data Quality criteria and the enforcement of policies for the initiative. As the business area representatives speak for everyone in their areas, it is their responsibility to take ownership of the user experience. The definition of naming standards, folder structures and the report organization in general impacts this user experience. As subject matter experts, they also own the metadata and object descriptions. The establishment of guidelines to govern the creation of additional end user objects (e.g. reports, metrics, etc) also belongs to them as it significantly contributes to define the user experience. Last but not least, the business user representatives need to spend some time on the conceptualization of the CM strategies that they will execute in their particular business area (i.e. Establishing workshops defined by users, lunch & learns, contests and other activities that encourage the early adopters to share their best practices).

#### 9.2.4 IT ROLES AND RESPONSIBILITIES IN BI GOVERNANCE

Traditionally, IT participated in the BI Governance committee from the project management and BI Front-End work perspective. While these two responsibilities are certainly important, they are not sufficient to be successful. Other roles that are slowly becoming critical in governance are: data modeling, data integration, enterprise BI architecture and training. The Project Manager on the BI governance committee will liaison with the Project Management Office (PMO), making sure a Project Manager (PM) is assigned to each initiative lined-up for execution. The BI Front-end work has seen a significant change over the last couple of years, before IT used to set the direction and the business was expected to follow. Given that this approach did not take into consideration many of the business needs and it did not encompass a seamlessly defined user experience across initiatives, we are seeing a trend where the business users representatives are stepping up to the plate to participate in the decision making; effectively creating a Joint Action Team (JAT). While it's a team effort, the Front-End BI lead and the Enterprise BI architect are still on the hook for critical decisions such as: selecting the proper tools, defining the BI architecture, establishing the proper infrastructure, implementing the training for users and coordinating support and maintenance across the business areas projects.

Data Modeling, which traditionally was done behind the scenes is now being introduced as part of the BI Governance model to ensure the business users will participate in the data modeling sessions to capture the right elements and accurately reflect business processes. The Data Modeler lead will chair these sessions and interact with the appropriate business users as required by the project.

Data Integration, also known as data plumbing, was not something the business users had visibility into before. No wonder IT did not get much traction from the business users and had to resort to escalation processes to solve particular data challenges. In the new model, IT partners with business to ensure success of the initiatives. In addition to providing the proper infrastructure, the Data Integration lead, along with the Enterprise BI Architect lead own the tool selection process, the data integration architecture and the implementation of data and data quality policies.

Training is another key role that traditionally has been bounced between IT and the business. In the past nobody wanted to take ownership of training as it implied a significant invest in time to prepare the material and probably even more to teach it. As the organization evolves, developing the training material and coaching the trainer is starting to become IT's responsibility, while the business areas provide end trainers. The BI manager will be available for escalation of project issues, if needed.

### 9.2.5 IMPLEMENTING BI GOVERNANCE, WHAT ARE THE FIRST STEPS?

Implementing BI Governance can be related to writing an article; in both, writing the first sentence or giving the first step is always the toughest one.

1. The first step sets the direction of the whole program as it will tell the people in the organization how they are conceptualizing the whole process to work. It is simply a recommendation that the first step be to get executive sponsorship, preferably from the CFO.
2. Second, it is extremely important to identify who the business stakeholders are in the organization, communicate the benefits that BI governance can bring to their areas and discuss their specific BI pain areas and opportunities. Outlining how the BI Governance process can help them attenuate and solve their situations will give them a compelling reason to support the initiative.
3. Next, the stakeholders in IT will have to be identified. Furthermore, the responsibilities among Data Modeling, Data Sourcing and BI Front-end will have to be clearly defined. The BI Architect and the project manager will have to be designated.
4. Once the stakeholders are identified and executive sponsorship is obtained, it will be time to bring the people together. A mission statement and specific strategies and goals will have to be crafted and approved during the first session.
5. During this meeting sub-committees might be defined to discuss specific topics that do not require the whole group. If possible, it is also suggested to schedule at least the next four meetings of the group so everyone knows the dates and commits.



## 9.3 Compliance

Basel II and similar regulatory and compliance initiatives (such as the Turnbull Report in the U.K., the Sarbanes-Oxley Act and International Accounting Standards) have created a significant challenge and opportunity for financial services providers to grasp. BI enables banks to satisfy the requirements of all three pillars of Basel II, calculate and aggregate market, credit and operational risk measures, and minimize efforts and investments in risk management. For Sarbanes-Oxley compliance, BI can allowing financial institutions to define, communicate, assess, certify and improve compliance procedures and processes. For anti-money laundering vigilance, BI empowers banks to automatically identify, classify and surface suspicious activities to meet stringent government regulations, protect shareholder confidence and maintain a strong reputation. For financial institutions, a growing diversity of regulations on a variety of levels, state, federal, and international, now make up a patchwork of compliance requirements with sometimes overlapping applications. Each of these emerging regulatory challenges, Sarbanes-Oxley compliance (SOX), international accounting standards compliance (IAS), anti-money-laundering reporting, and Basel II Capital Accord reporting for both internal and regulator use, depend on demonstrating the transparency of financial and risk information and require the consolidation of vast amounts of data. Implementing compliance will be costly for many, placing more demands on resources, taking time to implement, and requiring additional funding if external expertise must be brought in. The purpose of Basel is to revise the existing international standards used to measure the viability of a bank's capital. To calculate the required capital adequacy and offer a transparent view of risk information, financial institutions must store and maintain records dating back at least seven years and covering every part of their organization. Providing reporting at this level is very time consuming as it involves wading through vast quantities of risk data relating to millions of customers across all their products. Basel II then requires institutions to be able to quickly and accurately publish enterprise-wide consolidated reports on risks, capital and risk management, an onerous task if data is trapped in multiple silos. Demonstrating good corporate governance for SOX compliance requires a similarly transparent view of bank accounting data from multiple sources. Powerful Business Intelligence solutions, however, enable banks to consolidate mountains of risk data from systems and spreadsheets into a risk data warehouse. BI then identifies the overlapping information that needs to be available for inspectors and reports. It is then possible to ensure the soundness of internal

controls with reports on control status, improvement plans and actions. When making efforts to comply with SOX, for example, BI tools deter the use of any loopholes or misrepresentation of data before a CEO can sign off on the data and attest that it is correct. For Basel compliance, advanced BI solutions facilitate the improvement of capital allocation by consolidating, analyzing and reporting on risk information. This allows critical information to be captured and communicated across the company, giving executives one place to monitor priority out-of-bounds controls, accounting information and KPIs. It also gives analysts and accountants the access they need to drill down and explore data in granular detail.

## 9.4 Risk Management

The global financial crisis had many causes but failures in risk management were clearly a contributory factor. Although there were technical shortcomings, especially related to the use of risk models and metrics, a more widespread problem was a failure of governance, which meant that the legitimate warnings of risk managers went either unheeded or unnoticed. In the euphoria of the credit bubble preceding the crash, a culture in banking and insurance that prioritized short-term gains over prudence all too often rode roughshod over the concerns of risk managers. Many senior executives were more concerned with outperforming revenue and profit targets than paying heed to growing risk concentrations. The crisis has changed that and across the financial services industry, risk management has moved to the centre of strategic decision-making. Many banks and insurers have come a long way in their efforts to strengthen risk capabilities, discussions about risk have become a key part of the boardroom agenda, chief risk officers have a prominent seat at the top table and there is a renewed zeal for instilling a greater awareness of risk principles in the front office, the so-called first line of defense. Despite this progress, however, weaknesses remain. The enthusiasm for a large-scale overhaul of risk management in the industry has created human capital shortages as companies and regulators scramble to acquire suitable expertise. Data and information management systems remain significant impediments to an overall understanding of risk exposures, while regulatory uncertainty makes it difficult for organizations to plan for the long term. In February 2010, the Economist Intelligence Unit conducted a global survey on behalf of SAS to track the progress of financial institutions in strengthening their risk management since the crisis. The survey attracted 346 respondents from across the banking and insurance industries.

Key findings from this research include the following:

- Confidence levels are high but there is a risk of complacency. Financial institutions are feeling much more confident about the future compared with 12 months ago. Around three-quarters of respondents believe that prospects for revenue growth over the next year are good, whereas 68% are positive about the prospects for profitability. These levels of confidence, which are around double the levels reported in a similar survey conducted last year, reflect a widely held view that the financial system has stabilized. There is a risk of complacency, however. As governments withdraw stimulus packages and liquidity support for the financial sector, revenues and profitability could yet fail to meet expectations.
- The focus on regulatory compliance could distract attention from emerging risks. Around the world, regulators have stepped up their scrutiny of financial institutions. While few people would argue against a tougher regulatory regime in financial services, respondents to the survey highlight uncertainty regarding regulation as the main barrier to effective risk management. There is a danger that the focus on compliance could be “crowding out” day-to-day risk management at a time when formerly low probability risks, such as sovereign debt crises, are becoming more commonplace.
- A clearly defined risk strategy is in place at most institutions, but significant areas of weakness remain. Investment in risk management is increasing almost across the board, with risk processes, data, information systems and training being key areas of focus for the majority of institutions. Six out of 10 respondents now say that they have a clearly defined risk strategy in place at their organizations that is updated on a regular basis. However, this still leaves a worrying 40% whose companies do not conduct regular updates or do not have a clear risk strategy in place.

- Banks and insurers are filling gaps in risk expertise with investment in training and recruitment. Respondents recognize that shortfalls in the quality and quantity of risk experts have been an important part of the problem in risk management. Asked about key areas in which shortcomings need to be addressed, respondents list issues related to expertise as three of their top four priorities. More than one-half of respondents say that they are increasing their investment in training, both of risk professionals and across the broader business, and a similar proportion say that they are spending more on recruitment.
- The silo-based approach to risk management continues to pose problems. In the days leading up to the financial crisis, the separation of risk management into separate departments led many financial institutions to underestimate risk concentrations and correlations. Even now, less than one-half of respondents to our survey are confident that they understand the interaction of risks across business lines and poor communication between departments is seen as a key barrier to effective risk management.
- Financial institutions need to further improve data quality and availability. An over-reliance on risk models, and problems with the data used to populate those models, have been widely seen as a key failure in financial risk management. Financial services firms recognize that data quality and availability need to improve further. Collecting, storing and aggregating data is an area of weakness for many institutions, with only 39% of respondents believing that they are effective at all these activities.

#### 9.4.1 THE NEW RISK LANDSCAPE

The financial services industry entered 2010 on a much more stable footing than last year. Since the darkest days of the financial crisis, the share prices of major banks have rebounded, economic conditions have improved and the industry has benefited from a surge in liquidity facilitated by the actions of policymakers around the world. These short-term improvements in the economic landscape have fostered a mood of surprising optimism among the respondents questioned for the survey. Three-quarters see their prospects for revenue growth over the next year as positive, while 68% feel the same on the outlook for profitability. In last year's Economist Intelligence Unit survey for SAS, just 34% saw the prospects for revenue growth, and 33% for profitability, as being positive. Optimism is particularly high within the Asia-Pacific region where financial institutions have been less affected by the crisis and where economic growth remains relatively robust. Within the region, 86% of respondents see prospects for revenue as positive, and 77% think similarly on the outlook for profit. Although the outlook has undoubtedly improved significantly across the whole industry, it would be wrong to be complacent. Sluggish economic growth in developed countries, combined with high unemployment, are likely to lead to further difficulties in mature markets. New regulations and the imposition of more conservative capital and liquidity buffers will drive down corporate profitability, while new macroeconomic risks, such as the sovereign debt crisis in Greece, could derail any nascent recovery.

In the medium term, policymakers will be looking to withdraw fiscal stimulus packages and return debt and equity capital holdings to private investors. Over the same period, a more stringent regulatory environment will emerge. Banks, for example, face the prospect of tighter restrictions on capital reserves under proposals dubbed as the "Basel 3 rules". The emphasis in regulation is shifting from issues related to individual institutions towards macro-prudential ones associated with systemic risk. *"Previously, regulators were just not focused on systemic issues,"* says Viral Acharya, professor of finance at the New York University Stern School of Business. *"It was almost as if the micro objective of making each bank safe was somehow clouding the focus of regulation from what it really should be doing, which is to guard the system as a whole."*

There is an emerging consensus that good risk management starts at the top of the organization. Board members need to have sufficient knowledge and information to be able to challenge and question executive management, and they need to devote an appropriate amount of time to understanding the business. *“If you are going to have a risk culture that is embedded within an organization, it has to start from the top,”* says Richard Apostolik, president of the Global Association of Risk Professionals, a trade association. Survey respondents consider board-level expertise to be one of the top three risk management issues that they would like to address. Yet somewhat surprisingly, less than one-half say that they are devoting resources to improving risk governance by board members. Many institutions are addressing these shortcomings by forming board-level risk committees. This is one of the key changes proposed by the UK government-sponsored Walker Review of corporate governance in the banking industry. There is also a strong focus on board competencies in the US. Proposed rules from the Securities and Exchange Commission will require disclosure of the board’s qualifications and its role in risk management. Among respondents to the survey, almost three-quarters say that they have a board-level risk committee in place. Not everyone believes, however, that stand-alone risk committees are essential in every organization. *“It depends what the firm is doing and the scope and depth of its activities,”* says Mr Apostolik. *“In some cases, this role can be performed perfectly adequately as part of an audit committee.”* More important than the existence of a risk committee is the content of the board’s discussions and their interaction with executive management and the risk function. *“The board needs to know what they don’t know and they need to find a way of finding out what that information is,”* notes Andy Clinton, managing director of Protiviti, a risk consultancy. Boards across the industry are facing a significant increase in their workload and responsibilities. Key among these is the need to set and monitor the overall risk appetite, which should articulate the institution’s willingness to take risk in order to pursue business objectives.

A recent report from the Senior Supervisors Group, a collection of financial regulators from Canada, France, Germany, Japan, Switzerland, the UK and US, found that financial institutions still have some progress to make in setting and monitoring a robust risk appetite. Until recently, risk appetite was generally regarded as a mechanical, compliance-driven activity that required the approval of boards but little active involvement from them. *“Most of the risk appetite work that we see now is trying to get boards to own the risk profile of the organization, and talk openly about what kind of risks the company should be running and under what circumstances it might need to take certain precautionary actions,”*

comments Andrew Rear, head of European insurance at Oliver Wyman.

David Allen, a partner at law firm Mayer Brown, says that an organization's risk appetite should be informed by the broader economic outlook, but he warns that this could be a source of tension. *"There is much to be said for having a risk committee to look over the horizon while the board steers the ship, but economic storms arrive unexpectedly, and it will take robust committee members to persuade the board to reduce its risk exposure when the waters still appear calm,"* he says.



#### 9.4.2 ROLE OF THE CRO

Many financial institutions are changing reporting lines for the chief risk officer (CRO) in order to strengthen their overall risk governance. It is increasingly common for CROs to have a dual reporting line to the chief executive and to the risk committee or equivalent. Among the survey respondents, 57% say that their companies have a CRO with a direct reporting line into the board. A dual reporting line ensures that the CRO has access to executives at the very top of the company and it also enables an open and unfettered access to the board, with an information exchange that flows both ways. *“The CRO needs to be at the top table and be involved in the strategic decisions the company makes, so that he or she can provide an independent view over whether they fit with the risk appetite of the company,”* says Bruce Munro, group CRO of National Australia Bank, who himself reports into the CEO and has a veto over any decision in the organization.

#### 9.4.3 REPORTING

The success of these new reporting lines and governance structures depends on a robust, two-way communication between the board and senior risk managers. A key area of focus for many firms has been the strengthening of their management information systems and responding to the more diverse and frequent reporting requirements of the board. *“It becomes a much more two-way interactive process rather than a mechanical monthly meeting where you just talk about whatever has come through the system that month,”* says Mr Munro.

Axel Lehmann, group CRO of Zurich Financial Services, one of the world’s largest insurers, says that boards are typically requesting more forward-looking data, and expect both a holistic overview of the key risk exposures as well as more granular information on specific risk categories. *“They also want to have a better awareness of the risk models that the company is using and a good understanding of the assumptions that go into those models,”* he adds.

Yet respondents to the survey admit that they still have improvements to make in risk reporting. Just 47% say that they are effective at providing timely and relevant risk reports to the board. Given that boards expect to get both greater detail from reports and an insightful summary of overall risk exposure, all in a highly accelerated time frame, it seems clear that many organizations still have some way to go to satisfy these new requirements.

#### 9.4.4 WAR FOR TALENT

Greater expectations from boards, combined with sustained pressure from regulators and other stakeholders, are placing significant pressure on risk functions. With many financial institutions actively recruiting and embarking on major risk projects, risk expertise is becoming a scarce and expensive commodity. According to a report in Risk magazine, shortages of risk professionals in the UK are forcing salaries to rise by between 20% and 30%. Among all respondents, 50% say that their organizations are spending more on recruiting risk professionals, and just over half say their companies are increasing investment in training programs to improve the risk function's skills. Asked about the areas where shortages are most acute, respondents list compliance and governance by a considerable margin. The problem is compounded by the fact that recruiters are becoming increasingly demanding. *"Before the collapse of Lehman Brothers, banks hired candidates who ticked seven out of 10 boxes,"* says Blair Cashin, a risk management consultant at Joslin Rowe, a recruitment firm. *"Now they want people who tick eleven out of ten."* The development of a formal certification program, established by organizations such as the Global Association of Risk Professionals, is helping risk management to gain more recognition as a business discipline, and gives financial institutions a better yardstick for measuring expertise. *"Banks need to know from an objective point of view that the people they are entrusting their risk management function to possess the baseline competencies to perform their role,"* says Mr Apostolik.

But beyond the technical capabilities required by risk professionals, there is also a growing emphasis on softer skills. *"You have to be able to take a relatively complex activity and describe it in simple terms so that people on the board or in the business can quickly understand it and be able to act on it,"* says Mr Apostolik. *"Even the smartest risk managers in the world will fail in the role if they don't have the ability to communicate."* Many commentators believe that greater movement of managers between the front and back offices can help to address talent shortages and, perhaps more importantly, build bridges between the risk function and the business at large. *"You've got to get more movement between the two,"* says Mr Munro. *"I think companies ought to insist that their top talent have significant stints in risk during their career. I also think it's important that people who want a career in risk spend time in the business so they understand one another better."*

Within the risk function itself, there is a recognition that not enough has been done to encourage communication across risk silos. In many institutions, market and credit risk

were managed by different teams using separate systems, which made it difficult to gain an overall aggregate view of risk exposures, and meant that some problems inevitably fell through the cracks. Recognizing these shortcomings, some banks are seeking to combine or improve co-ordination between risk departments. Last year, for example, HSBC combined its market and credit risk functions. Although financial institutions are making progress on aggregating risk exposures at the enterprise level, a firm-wide view of risk remains a work in progress for the vast majority of them. Just 47% of respondents consider themselves effective at understanding the interaction of risks across business lines, and 58% are confident in their ability to aggregate risks at the firm-wide level. Poor communication across departments is also identified as the second most significant barrier to effective risk management. This ongoing reassessment of organizational structures reflects a general trend whereby financial institutions are examining risk processes and considering whether they are still fit for purpose. Asked about the changes to levels of investment in key aspects of risk, almost three-quarters of respondents say that they are increasing expenditure on the improvement of processes at the operational level. A slightly smaller proportion of 70% say that they are increasing investment in risk processes at the strategic level. Processes and systems are also seen as the aspect of risk that is in most need of attention. There are obstacles for initiatives designed to break down risk silos, however. *“Credit risk and market risk tend to be big departments and have very different cultures,”* says Mr Wilkinson from the consultancy Oliver Wyman. *“Trying to get those guys to work as a single team is easier said than done.”* There are significant data infrastructure challenges too, as credit risk and market risk typically operate separate systems that cannot easily be integrated. Even if the two functions are not formally combined, better co-ordination between them can help to serve as an early warning system of emerging risk correlations. *“The best way to break down a silo is to have a culture where people in different departments know each other and can figure out what links there might be between particular risks under certain circumstances,”* says Mr Munro. Financial organizations also recognize that their existing risk structures and processes failed to account for the liquidity crunch that crippled the industry following the collapse of Lehman Brothers. Often liquidity was something that was managed by the treasury function, and not seen as a risk category in its own right. Even regulators tended to neglect it. *“Liquidity risk was always a bit of a sleeper risk,”* says Mr Munro. *“Like many banks, we have given it greater focus, more sophistication in the way we manage it and more conservatism in the buffers that we hold.”*

# .CHAPTER TEN: CASE STUDY.

## 10.1 Unicredit Bulgaria

The case study I am going to present in this chapter deals with the way a big bank such as Unicredit decided to manage all its risks. I have chosen the Bulgarian dislocation of the Group since it was the only one providing complete data and methodologies concerning its models to face all the major risks possibles. As it will be shown during the following pages, the use of Business Intelligence techniques will be crucial for the global management of the bank, income statements and balance sheets indeed will clearly demonstrate that.

### 10.1.1 GENERAL FRAMEWORK

UniCredit Group, like most of all the other big banks in the world, is exposed to the following risks from financial instruments:

- Market risk
- Liquidity risk
- Credit risk
- Operational risk

All these different types of risks are managed by specialized departments and bodies within the Bank's structure. The applicable policies entirely correspond to the requirements of Risk Management Group Standards as well as all respective requirements set by Bulgarian banking legislation. Bank manages risk positions on aggregate basis, focusing in reaching optimal risk/return ratio. Assets and Liabilities Committee (ALCO) is a specialized body established in the Bank for the purposes of market risk and structural liquidity management.

As part of the internal management, UniCredit has approved by the Management, Financial Instruments Management Policy, where all deals and exposures in financial instruments, excluding loans, are defined. Credit risk in the Bank is specifically monitored through Provisioning and Restructuring Committee (PRC), a specialized body responsible for credit risk assessment, classification of credit risk exposures and impairment losses estimation. Assessment of the credit risk is in accordance with the Group standards and for regulatory purposes in accordance with Bulgaria National Bank requirements. Management of the Bank has approved certain limits aiming to mitigate the risk impact on the Bank's result. These limits are within the overall risk limits of the banking group. The limits for credit risk depend on size of the exposure. Management Board approves the big exposure, 10 % of the capital of the Bank (requirement of Law on Credit Institutions). There is an effective procedure established in the Bank for limits monitoring, including early warning in case of limits breaches. Additionally a system for operational risk management, approved by the Management Board, is introduced in the Bank.

#### 10.1.2 MARKET RISK

Risk monitoring and measurement in the area of market risks, along with trading activities control is performed by Market Risk department. Market risks control function is organized independently from the trading and sales activities. Prudent market risk management policies and limits are explicitly defined in Market Risk Rule Book and International Markets Rule Book, reviewed at least annually.

Market risk management in UniCredit Bulbank encompasses all activities in connection with Markets and Investment Banking operations and management of the assets and liabilities structure. Risk positions are aggregated at least daily, analyzed by the independent Market risk management unit and compared with the risk limits set by the Management Board and ALCO. The risk control function also includes ongoing monitoring and reporting of the risk positions, limit utilization, and daily presentation of results of Markets & Investment Banking and Assets and Liabilities Management (ALM) operations. UniCredit Bulbank applies uniform Group risk management procedures. These procedures make available the major risk parameters for the various trading operations at least once a day. Besides Value at Risk, other factors of equal importance are stress-oriented volume and position limits. Additional element is the loss-warning level limit, providing early

indication of any accumulation of position losses. For internal risk management and Group compliant risk measurement, the Bank applies *UniCredit Bank Austria's internal model NoRISK*.

It is based on *historical and Monte Carlo Simulation* of returns and accounts for risk reducing effects between the risk categories interest, credit spread, foreign exchange, equity, volatilities, and commodities. The simulation results, supplemented with distribution metrics and limit utilization are reported on a daily basis to the management. In addition to the risk model results, income data from market risk activities are also determined and communicated on a daily basis. Reporting covers the components reflected in IFRS-based profit and the marking to market of all investment positions regardless of their recognition in the IFRS-based financial statements ("total return").

#### Monte-Carlo Pricing of Structured Derivatives for Unicredit

Monte-Carlo Pricing method randomly generates a high number of possible future market development, i.e. it simulates prices for relevant stock and relevant future dates. The stochastic distribution of the samples must fit with certain model assumptions and market observations. For each generated possible future the method computes the resulting future payments, discounts each future to its present value and add it up (if there are multiple payments). Finally it takes the average over all generated futures as an approximation of the "fair price". This kind of methods is computationally expensive since it's a short simulation steps and it has a slow convergence,  $O(1/\sqrt{n})$ .

Monte Carlo simulation includes the full evaluation of individual positions taken in options, with VaR calculated as 1-day expected loss with 99% confidence level. This simulation is based on a variance-covariance matrix calculated on a one-year historical observation period without weighting scheme.

During 2009, VaR (1 day holding period, confidence interval of 99 %) moved in a range between EUR 1.6 million and EUR 10.4 million, averaging EUR 4.1 million, with the credit spreads being main driver of total risk in both, trading and banking books.

VaR of UniCredit Bulbank AD by risk category in EUR million for 2009 is as follows:

<b>Risk Category</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Average</b>	<b>Year-end</b>
Interest rate risk	0.6	3.8	1.2	0.6
Credit spread	1.3	9.7	3.8	1.4
Exchange risk	0.0	0.3	0.1	0.2
<b>VaR overall<sup>1</sup></b>	<b>1.6</b>	<b>10.4</b>	<b>4.1</b>	<b>1.7</b>

Reliability and accuracy of the internal model is monitored via daily back-testing, comparing the simulated results with actually observed fluctuations in market parameters and in the total value of books. Back-testing results for 2009 continued to confirm the reliability of the model. Apart from VaR figures, daily reporting includes details of volume-oriented sensitivities that are compared with respective limits. The most important detailed presentations include: basis point shift value (interest rate /spread changes of 0.01 % by maturity bucket) and FX sensitivities. In the interest rate sector, the Basis-Point-Value (BPV) limit restricts the maximum open position by currency and time buckets, with valuation changes based on shift by 0.01% (1 basis point). The following sensitivities' table provides summary of the interest rate risk exposure of UniCredit Bulbank AD (trading and banking book) as of December 31, 2009 (change in value due to 1 basis point shift, amounts in EUR):

<b>Currency</b>	<b>0-3M</b>	<b>3M-1Y</b>	<b>1Y-3Y</b>	<b>3Y-10Y</b>	<b>Above 10Y</b>	<b>Total</b>
BGN	1,215	4,401	(10,729)	(14,331)	(596)	(20,040)
CHF	323	17	(54)	(252)	(76)	(42)
EUR	9,741	9,885	(7,006)	18,064	(1,731)	28,953
GBP	70	118	5	-	-	193
JPY	(3)	-	-	-	-	(3)
USD	616	1,728	(2,011)	(12,766)	-	(12,433)
<b>Total sensitivity<sup>1</sup></b>	<b>11,968</b>	<b>16,149</b>	<b>19,805</b>	<b>45,413</b>	<b>2,403</b>	<b>61,664</b>

Value-at-risk calculations are complemented by various stress scenarios to identify the potential effects of stressful market conditions on the Bank's earnings. The assumptions under such stress scenarios include extreme movements in prices or rates and dramatic deterioration in market liquidity. Stress results for major asset classes and portfolios (credit, rates and FX) and estimated impact on liquidity position up to 60 days are reported at least monthly to ALCO. In 2009 markets rebounded and volatilities went down from 2008 record levels. The Management continued vigilant risk management practices by limiting risk taking and focus on client-driven business solutions. UniCredit Bulbank AD is exposed to exchange rate risk through transactions in foreign currencies. Net FX open positions in trading and banking book are monitored on daily basis and are restricted by volume overnight limits. During 2009, the Bank maintained long EURBGN position of EUR 105 million on average, with insignificant open position in other crosses.



	<i>In thousands of BGN</i>		
	<b>EUR and BGN</b>	<b>Other currencies</b>	<b>Total</b>
<b>ASSETS</b>			
Cash and balances with Central bank	824,887	7,277	832,164
Financial assets held for trading	115,450	-	115,450
Derivatives held for trading	42,987	2,155	45,142
Derivatives used for hedging	84	1,437	1,521
Financial assets designated at fair value through profit or loss	127,516	8,555	136,071
Loans and advances to banks	2,050,172	21,395	2,071,567
Loans and advances to customers	7,252,251	126,427	7,378,678
Available for sale Investments	283,912	1,573	285,485
Held to maturity Investments	147,462	167,287	314,749
Investments in associates	22,511	-	22,511
Property, plant, equipment and investment properties	247,022	-	247,022
Intangible assets	34,866	-	34,866
Current tax assets	9,796	-	9,796
Deferred tax assets	6,696	-	6,696
Non-current assets and disposal group classified as held for sale	2,236	-	2,236
Other assets	19,698	77	19,775
<b>TOTAL ASSETS</b>	<b>11,187,546</b>	<b>336,183</b>	<b>11,523,729</b>
<b>LIABILITIES</b>			
Financial liabilities held for trading	38,165	2,046	40,211
Derivatives used for hedging	6	-	6
Deposits from banks	3,099,413	14,589	3,114,002
Deposits from customers	5,825,041	588,056	6,413,097
Subordinated liabilities	212,123	-	212,123
Provisions	19,256	17,308	36,564
Current tax liabilities	27	-	27
Deferred tax liabilities	21,041	-	21,041
Other liabilities	45,393	1,131	46,524
<b>TOTAL LIABILITIES</b>	<b>9,260,465</b>	<b>623,130</b>	<b>9,883,595</b>
<b>EQUITY</b>	<b>1,640,134</b>	<b>-</b>	<b>1,640,134</b>
<b>Net off-balance sheet spot and forward position</b>	<b>(291,379)</b>	<b>295,179</b>	<b>3,800</b>
<b>Net position</b>	<b>(4,432)</b>	<b>8,232</b>	<b>3,800</b>

	<i>In thousands of BGN</i>		
	<b>EUR and BGN</b>	<b>Other currencies</b>	<b>Total</b>
<b>ASSETS</b>			
Cash and balances with Central bank	893,509	12,422	<b>905,931</b>
Financial assets held for trading	122,594	-	<b>122,594</b>
Derivatives held for trading	34,933	3,370	<b>38,303</b>
Financial assets designated at fair value through profit or loss	172,527	12,040	<b>184,567</b>
Loans and advances to banks	1,540,268	9,728	<b>1,549,996</b>
Loans and advances to customers	7,079,490	159,143	<b>7,238,633</b>
Available for sale Investments	354,182	3,272	<b>357,454</b>
Held to maturity Investments	154,976	201,026	<b>356,002</b>
Investments in associates	17,720	-	<b>17,720</b>
Property, plant, equipment and investment properties	195,275	-	<b>195,275</b>
Intangible assets	38,175	-	<b>38,175</b>
Deferred tax assets	9,651	-	<b>9,651</b>
Non-current assets and disposal group classified as held for sale	3,136	-	<b>3,136</b>
Other assets	16,716	56	<b>16,772</b>
<b>TOTAL ASSETS</b>	<b>10,633,152</b>	<b>401,057</b>	<b>11,034,209</b>
<b>LIABILITIES</b>			
Financial liabilities held for trading	57,031	3,080	<b>60,111</b>
Deposits from banks	3,187,416	40,313	<b>3,227,729</b>
Deposits from customers	5,421,338	603,168	<b>6,024,506</b>
Subordinated liabilities	209,368	-	<b>209,368</b>
Provisions	33,862	22,912	<b>56,774</b>
Current tax liabilities	774	-	<b>774</b>
Deferred tax liabilities	15,272	-	<b>15,272</b>
Other liabilities	60,183	1,203	<b>61,386</b>
<b>TOTAL LIABILITIES</b>	<b>8,985,244</b>	<b>670,676</b>	<b>9,655,920</b>
<b>EQUITY</b>	<b>1,378,289</b>	<b>-</b>	<b>1,378,289</b>
<b>Net off-balance sheet spot and forward position</b>	<b>(291,534)</b>	<b>267,793</b>	<b>(23,741)</b>
<b>Net position</b>	<b>(21,915)</b>	<b>(1,826)</b>	<b>(23,741)</b>

### 10.1.3 LIQUIDITY RISK

Liquidity risk is the risk that the Bank will encounter difficulty in meeting obligations from its financial liabilities. The collective Bank's body for liquidity management is ALCO (Assets and Liabilities Committee). Operative management rules, as well as contingency plan and funding plan procedures are laid down in the Bank's Liquidity Management Policy. The liquidity is operationally managed through Markets and Sales Division and the structural liquidity through Assets and Liabilities Division. According to the Liquidity Policy, Assets and Liabilities Division monitors on a daily basis short term flows, arising from treasury activities with a time horizon up to three months. The structural liquidity is monitored on a weekly basis prepared under three scenarios, going concern, liquidity crisis and name crisis. For the purposes of liquidity management are monitored daily short-term limits, defined as function of the primary funds and liquidity stress-test results. Structural liquidity limit ratios define minimum required coverage of long-term assets with coherent liabilities. During 2009 the Bank was in compliance with the Group liquidity limit requirements. The following tables provide basic analysis of the financial liabilities of the Bank into relevant maturity bands based on the remaining contractual periods to repayment for items with defined maturity and model mapping for items with no defined maturity. The gross amounts include also estimated or contractual interest payments. Actual outflows may materially differ from those presented in the tables as historically most of the clients' attracted deposit have economic maturity much longer than contractual one (deposits are consistently rolled over).

In thousands of BGN

Maturity table as at 31 December 2009	Carrying amount	Gross in (out) flow	Up to 1 month	From 1 to 3 months	From 3 months to 1 year	From 1 to 5 years	Over 5 years
<b>Non derivative instruments</b>							
Deposits from banks	3,114,002	(3,164,174)	(2,190,418)	(5,775)	(58,755)	(817,503)	(91,723)
Deposits from customers	6,413,097	(6,456,177)	(3,264,012)	(1,473,029)	(1,307,060)	(412,064)	(12)
Subordinated liabilities	212,123	(256,051)	-	-	-	(52,784)	(203,267)
Issued financial guarantee contracts	19,285	(19,285)	-	-	-	(19,285)	-
Unutilized credit lines	-	(922,835)	(13,929)	-	-	(908,906)	-
<b>Total non-derivative instruments</b>	<b>9,758,507</b>	<b>(10,818,522)</b>	<b>(5,468,359)</b>	<b>(1,478,804)</b>	<b>(1,365,815)</b>	<b>(2,210,542)</b>	<b>(295,002)</b>
<b>Trading derivatives, net</b>							
Outflow	4,931	(880,472)	(619,490)	(100,617)	(30,809)	(116,921)	(12,635)
Inflow		889,617	622,591	101,271	35,919	117,169	12,667
<b>Derivatives used for hedging, net</b>							
Outflow	1,515	(13,599)	(350)	(33)	(1,175)	(11,415)	(626)
Inflow		15,388	68	22	930	13,718	650
<b>Total derivatives</b>	<b>6,446</b>	<b>10,934</b>	<b>2,819</b>	<b>643</b>	<b>4,865</b>	<b>2,551</b>	<b>56</b>
<b>Total financial liabilities</b>	<b>9,764,953</b>	<b>(10,807,588)</b>	<b>(5,465,540)</b>	<b>(1,478,161)</b>	<b>(1,360,950)</b>	<b>(2,207,991)</b>	<b>(294,946)</b>

In thousands of BGN

Maturity table as at 31 December 2008	Carrying amount	Gross in (out) flow	Up to 1 month	From 1 to 3 months	From 3 months to 1 year	From 1 to 5 years	Over 5 years
<b>Non derivative instruments</b>							
Deposits from banks	3,227,729	(3,312,273)	(2,130,904)	-	(505,078)	(360,146)	(316,145)
Deposits from customers	6,024,506	(6,048,956)	(2,981,654)	(1,118,486)	(1,087,176)	(502,173)	(359,467)
Subordinated liabilities	209,368	(304,952)	-	-	-	-	(304,952)
Issued financial guarantee contracts	24,292	(24,292)	-	-	-	(24,292)	-
Unutilized credit lines	-	(1,442,245)	(21,634)	-	-	(1,420,611)	-
<b>Total non-derivative instruments</b>	<b>9,485,895</b>	<b>(11,132,718)</b>	<b>(5,134,192)</b>	<b>(1,118,486)</b>	<b>(1,592,254)</b>	<b>(2,307,222)</b>	<b>(980,564)</b>
<b>Trading derivatives, net</b>							
Outflow	(21,808)	(2,327,358)	(2,133,737)	(81,249)	(29,191)	(64,155)	(19,026)
Inflow		2,315,728	2,109,542	83,523	33,323	70,303	19,037
<b>Total derivatives</b>	<b>(21,808)</b>	<b>(11,630)</b>	<b>(24,195)</b>	<b>2,274</b>	<b>4,132</b>	<b>6,148</b>	<b>11</b>
<b>Total financial liabilities</b>	<b>9,464,087</b>	<b>(11,144,348)</b>	<b>(5,158,387)</b>	<b>(1,116,212)</b>	<b>(1,588,122)</b>	<b>(2,301,074)</b>	<b>(980,553)</b>

## 10.1.4 CREDIT RISK

Credit risk is defined as potential losses arising from not fulfillment of any contractual obligation with regard to issued or originated financial instrument. Bank effectively manages credit risk inherent to its trading and banking book. Bank applies different approach and has established different departments with regard to monitoring the credit risk related to corporate clients, small and middle enterprises and individuals.

## 10.1.5 CREDIT RISK IN THE TRADING BOOK

For the purposes of mitigating the counterparty risk and settlement risk with regard to the deals in the trading book, Bank concludes deals only with approved counterparts (banks or corporate clients) that have got assigned treasury credit lines. Derivatives are offered to corporate and institutional clients exclusively for hedging purpose. Regulatory trading book includes financial assets held for trading purposes and derivatives.

The analysis based on client credit quality and rating (where available) as of December 31, 2009 and December 31, 2008 is as shown in the next table:

	<i>In thousands of BGN</i>	
	<b>2009</b>	<b>2008</b>
Government bonds		
Rated BBB	331	15,325
Rated BBB+	5,187	377
Bonds of credit institutions		
Rated AAA	35,220	40,970
Rated BB	39,637	40,848
Unrated	1,165	15,910
Corporate bonds		
Unrated	30,570	9,164
Equities	3,340	-
Derivatives (net)		
Banks and financial institution counterparties	(31,642)	(33,714)
Corporate counterparties	36,573	11,906
<b>Total trading assets</b>	<b>120,381</b>	<b>100,786</b>

#### 10.1.6 CREDIT RISK IN THE BANKING BOOK

Credit risk, inherent in the banking book, is managed as the creditworthiness of Bank's clients is assessed for the whole life of the loan, from the date of initial loan application till the date of final repayment. Issued Letters of Guarantees, Letters of Credit and all other irrevocable credit commitments fall also within the scope of Bank's credit risk monitoring. As a credit risk mitigation policy, Bank accepts different types of collaterals depending on the product and client. As a rule collaterals are registered on behalf of the Bank prior to the effective disbursement of the loans.

The competent body for assessing impairment allowances is the Provisioning and Restructuring Committee (PRC). Risk exposures are classified in four major classes:

- Regular exposures
- Watch exposures
- Non-performing exposures
- Loss exposures

PRC regularly assess whether there is objective evidence that a loan or a group of loans is impaired. A loan or group of loans is impaired and impairment losses are incurred if:

- there is objective evidence of impairment as a result of a loss event that occurred after the initial recognition of the asset and up to the reporting date ("a loss event")
- the loss event had an impact on the estimated future cash flows of the financial asset or the group of financial assets
- a reliable estimate of the loss amount can be made

The Bank establishes an allowance for loan losses that represents the estimate of impairment losses in the loan portfolio. The components of this allowance are the individually and the collectively assessed loss allowance. The Bank first assess whether objective evidence of impairment exists individually for loans that are significant. Then collectively impairment assessment is performed for those loans that are not individually significant and loans which are significant but for which there is no objective evidence of impairment under the individual assessment. Risk assessment is done at least once per month. Credit risk methodology adopted by the Bank is explicitly defined in the Policy for

evaluation of risk exposures. The practice adopted in the Bank is to prepare internal rules for all credit products, especially in the Retail banking, setting the loan parameters, acceptable collaterals and the documentation required from the clients for credit risk assessment. Credit risk monitoring is also focused on fulfillment of statutory lending limits set in Law on Credit Institutions. Exposure to one client or group of related clients exceeding 10% of the capital base are treated as big exposures and it has to be approved by the Management Board. Maximum amount of an exposure to one client or group of related clients must not exceed 25% of the capital base of the Bank and in addition the total of all big exposures must not exceed 800% capital base.

As of December 31, 2009 and December 31, 2008 the Bank has fulfilled all statutory lending limits.

The table below analyses the breakdown of impairment allowances as of December 31, 2009 and December 31, 2008.

	<i>In thousands of BGN</i>					
	Carrying amount before impairment		Impairment allowance		Carrying amount	
	2009	2008	2009	2008	2009	2008
<b>Individually impaired</b>						
Watch	451,624	214,049	45,262	27,041	406,362	187,008
Non-performing	97,295	24,290	48,621	15,714	48,674	8,576
Loss	218,155	135,375	218,028	134,666	127	709
	<b>767,074</b>	<b>373,714</b>	<b>311,911</b>	<b>177,421</b>	<b>455,163</b>	<b>196,293</b>
<b>Collectively impaired</b>	<b>4,582,936</b>	<b>4,868,728</b>	<b>93,101</b>	<b>107,999</b>	<b>4,489,835</b>	<b>4,760,729</b>
<b>Past due but not impaired</b>						
Watch	-	173	-	-	-	173
Non-performing	35	13	-	-	35	13
Loss	165	160	-	-	165	160
	<b>200</b>	<b>346</b>	<b>-</b>	<b>-</b>	<b>200</b>	<b>346</b>
<i>Past due comprises</i>	-	-	-	-	-	-
<i>from 31 to 60 days</i>	2	188	-	-	2	188
<i>from 61 to 90 days</i>	-	22	-	-	-	22
<i>over 91 days</i>	198	136	-	-	198	136
	<b>200</b>	<b>346</b>	<b>-</b>	<b>-</b>	<b>200</b>	<b>346</b>
<b>Neither past due nor impaired</b>	<b>2,433,480</b>	<b>2,281,265</b>	<b>-</b>	<b>-</b>	<b>2,433,480</b>	<b>2,281,265</b>
<b>Total</b>	<b>7,783,690</b>	<b>7,524,053</b>	<b>405,012</b>	<b>285,420</b>	<b>7,378,678</b>	<b>7,238,633</b>

The breakdown of the fair value of collaterals pledged in favour of the Bank on loans and advances to customers is as follows:

	<i>In thousands of BGN</i>	
	<b>Loans and advances to customers</b>	
	<b>2009</b>	<b>2008</b>
<b>Against individually impaired</b>		
Cash collateral	579	443
Property	1,161,043	496,045
Debt securities	-	12,925
Other collateral	1,947,415	337,566
<b>Against collectively impaired</b>		
Cash collateral	1,308	983
Property	9,227,381	8,396,134
Debt securities	12	30,462
Other collateral	11,779,026	7,026,930
<b>Against past due but not impaired</b>		
Cash collateral	1,396	1,228
Property	646	832
Debt securities	-	-
Other collateral	1,417	3,535
<b>Against neither past due nor impaired</b>		
Cash collateral	58,354	46,223
Property	2,629,238	3,034,630
Debt securities	29,630	274,267
Other collateral	8,423,299	6,835,101
<b>Total</b>	<b>35,260,744</b>	<b>26,497,304</b>



The concentration of risk exposures in different sectors of the economy as well as geographical spread out as is as outlined in table below:

	<i>In thousands of BGN</i>					
	Loans and advances to customers		Loans and advances to banks		Investment securities	
	2009	2008	2009	2008	2009	2008
<b>Concentration by sectors</b>						
Sovereign	57,584	59,733	-	-	552,973	641,847
Manufacturing	1,553,106	1,472,239	-	-	-	-
Commerce	1,690,683	1,577,385	-	-	-	-
Construction	826,786	589,526	-	-	-	-
Agriculture and forestry	138,058	158,010	-	-	-	-
Transport and communication	171,105	331,812	-	-	-	-
Tourism	265,929	276,708	-	-	-	-
Services	579,903	545,303	-	-	-	-
Financial services	257,095	229,915	2,071,567	1,549,996	69,772	89,329
Retail (individuals)						
Housing loans	1,425,488	1,339,927	-	-	-	-
Consumer loans	817,953	943,495	-	-	-	-
	<b>7,783,690</b>	<b>7,524,053</b>	<b>2,071,567</b>	<b>1,549,996</b>	<b>622,745</b>	<b>731,176</b>
Impairment allowances	(405,012)	(285,420)	-	-	-	-
<b>Total</b>	<b>7,378,678</b>	<b>7,238,633</b>	<b>2,071,567</b>	<b>1,549,996</b>	<b>622,745</b>	<b>731,176</b>
<b>Concentration by geographic location</b>						
Europe	7,781,514	7,521,016	2,059,214	1,542,697	606,293	695,704
North America	113	5	12,033	6,533	5,491	8,368
Asia	1,807	2,867	164	567	10,961	27,104
Africa	153	113	-	-	-	-
South America	11	23	-	-	-	-
Australia	92	29	156	199	-	-
	<b>7,783,690</b>	<b>7,524,053</b>	<b>2,071,567</b>	<b>1,549,996</b>	<b>622,745</b>	<b>731,176</b>
Impairment allowances	(405,012)	(285,420)	-	-	-	-
<b>Total</b>	<b>7,378,678</b>	<b>7,238,633</b>	<b>2,071,567</b>	<b>1,549,996</b>	<b>622,745</b>	<b>731,176</b>

#### 10.1.7 OPERATIONAL RISK

UniCredit Bulbank defines as operational the risk of loss due to errors, infringements, interruptions, damages caused by internal processes or personnel or systems or caused by external events. Legal and compliance risk is a sub-category of operational risk: it is the risk to earnings from violations or non-compliance with laws, rules, regulations, agreements, prescribed practices or ethical standards. Operational events are those resulting from inadequate or failed internal processes, personnel and systems or from systemic and other external events: internal or external fraud, employment practices and workplace safety, clients claims, products distribution, fines and penalties due to regulation breaches, damage to Company's physical assets, business disruption and system failures, process management. The Operational risk unit in the bank is an independent unit in charge of regular operational risk monitoring and control. The unit's activity is regulated in the approved by the Management Board "Operational risk control rulebook", in compliance with "Operational risk control rulebook" of UniCredit Group, "Operational risk control rulebook" of Bank Austria Group and the national regulatory framework (Ordinance 8 on the Capital Adequacy of Credit Institutions). The Management Board is responsible for operational risk oversight with the support of the Operational Risk Committee, which has deliberative and suggestion functions on the decisions related to improvement of internal communication for finding proper risk mitigation solutions through information exchange among different units. The operational risk information, such as loss data, key risk indicators and scenarios is collected in the UniCredit Group database; a Group built decentralized risk management application. While the main task of the Operational risk unit is to define the methods used and to perform risk measurement and analysis, the risk managers in different areas working on decentralized basis are responsible for taking measures to reduce and prevent risks. The Operational risk unit is also responsible for carrying out the following activities: monitoring and analyzing the bank's operational risks exposure; verifying that operational loss data is regularly collected in the UniCredit Group database; validating that risk limits are respected and reporting breaches to the Management Board; cooperating in the analysis of the operational risk impact in significant new product introduction, providing regular training on operational risk control; developing and promoting an operational risk culture within the Bank. Other activities carried out are in compliance with the requirements of Basel II and Ordinance 8 of the Bulgarian National Bank. Since 2008 UniCredit Bulbank has reported the capital requirement for operational risk based on the Standardized Approach methodology, attesting that the bank's

operational risk system is conceptually sound and implemented with integrity and closely built into the risk management process of the bank. In December 2009 UniCredit Bulbank was the first Bulgarian bank to start official application proceedings with the Bulgarian National Bank to use the Advanced Measurement Approach (AMA) for the calculation of capital requirements for operational risk. AMA is the most sophisticated calculation approach, the use of which implies that the operational risk management system in the institution meets various quantitative and qualitative standards and its output is a fundamental part of the process of monitoring and controlling the exposure to risks.

#### 10.1.8 BASEL II DISCLOSURE

Since January 1st, 2007 Bulgarian banks apply BASEL II requirements for measurement of the capital adequacy. Under the regulatory framework, Bank allocates capital for covering three major types of risk, namely credit risk, market risk and operational risk. For the year 2007 UniCredit Bulbank applied allowing standardized approach for credit and market risks and the basic indicator approach for operational risk. In 2008 Bank has been given permission by Bulgarian National Bank to apply standardized approach also for operational risk. Statutory limits exposed to Banks require Bank to maintain total capital adequacy ratio not less than 12% and Tier I ratio not less than 6%. As a response to the ongoing world financial crisis Bulgarian National Bank strongly recommended all the Banks in Bulgaria to reached minimum Tier I ratio of 10% latest by June 2009. UniCredit Bulbank AD is in full compliance with this requirement even as of December 31, 2008. Under this Basel II disclosure, Bank represents regulatory requirements for consolidated reporting. These requirements may differ form IFRS basis for consolidation as it covers only financial institutions, being subsidiary or associate of a credit institution therefore consolidated Basel II figures does not include full consolidation of Hypovereins Immobilien EOOD and equity method of consolidation of Pirelli Real Estate AD, being both non-financial institutions. However Bank dully deduct the participation in those entities from its capital base (own funds).

## 10.1.9 CAPITAL BASE (OWN FUNDS)

Capital base (own funds) eligible for regulatory purposes include Tier I and Tier II capital as defined by Bulgarian National Bank.

As of December 31, 2009 and December 31, 2008 the consolidated Capital base of UniCredit Bulbank AD comprises as follows:

	<i>In thousands of BGN</i>	
	<b>2009</b>	<b>2008</b>
Share capital	239,256	239,256
Statutory reserve	51,155	51,155
Retained earnings	1,022,772	729,636
<b>Total capital and reserves</b>	<b>1,313,183</b>	<b>1,020,047</b>
<i>Deductions</i>		
Unrealized loss on available-for-sale instruments	(18,789)	(29,216)
Intangible assets	(34,859)	(38,167)
<b>Total deductions</b>	<b>(53,648)</b>	<b>(67,383)</b>
<b>Total Tier I capital</b>	<b>1,259,535</b>	<b>952,664</b>
Revaluation reserve on real estate occupied by the Bank	136,070	80,975
Subordinated long-term debt	183,848	191,671
<b>Total Tier II capital</b>	<b>319,918</b>	<b>272,646</b>
<b>Additional deductions from Tier I and Tier II capital</b>	<b>(26,060)</b>	<b>(21,391)</b>
<b>Total Capital base (Own funds)</b>	<b>1,553,393</b>	<b>1,203,919</b>

The additional deductions from the Capital base relates to Bank's participation in unconsolidated entities which represent 10% or more than 10% of the registered capital of such entities. For regulatory purposes the deduction is split equally between Tier I and Tier II capital. Subordinated long-term debt represents five loans provided by UniCredit Bank Austria AG for initial principal amount of EUR 98 million.

## 10.1.10 CAPITAL REQUIREMENTS

As of December 31, 2009 and December 31, 2008 the capital requirements for credit, market and operational risks are as follows:

	<i>In thousands of BGN</i>	
	<b>2009</b>	<b>2008</b>
<b>Capital requirements for credit risk</b>		
Exposures to:		
Central Governments and Central Banks	6,859	11,342
Regional Governments and local authorities	4,247	2,791
Administrative bodies and non-commercial undertakings	11	191
Institutions	12,569	14,193
Corporates	205,336	228,577
Retail	63,047	74,803
Exposures secured on real estate property	304,469	283,756
Past due items	2,582	-
High risk exposures	26	20
Short-term exposures to institutions and corporates	30,675	20,388
Other exposures	21,193	16,792
<b>Total capital requirements for credit risk</b>	<b>651,014</b>	<b>652,853</b>
<b>Capital requirements for market risk</b>	<b>12,147</b>	<b>8,994</b>
<b>Capital requirements for operational risk</b>	<b>79,017</b>	<b>70,363</b>
<b>Total capital requirements for credit, market and operational risk</b>	<b>742,178</b>	<b>732,210</b>
<b>Additional capital requirements subject to National discretions from the Regulator</b>	<b>371,088</b>	<b>366,104</b>
<b>Total regulatory capital requirements</b>	<b>1,113,266</b>	<b>1,098,314</b>
Capital Base (Own funds)	1,553,393	1,203,919
<i>there of Tier I</i>	<i>1,246,505</i>	<i>941,969</i>
Free equity (Own funds)	440,127	105,605
<b>Total capital adequacy ratio</b>	<b>16.74%</b>	<b>13.15%</b>
<b>Tier I ratio</b>	<b>13.44%</b>	<b>10.29%</b>

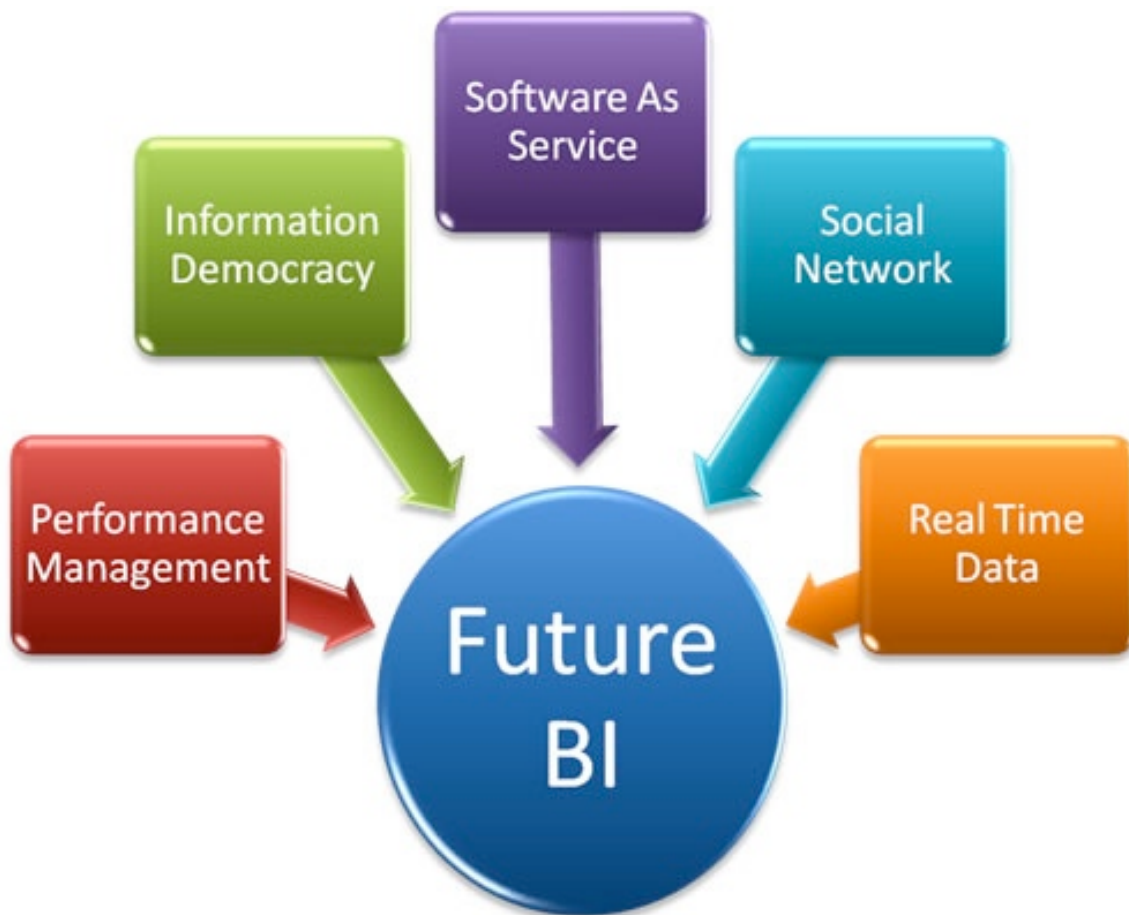
Capital requirements for credit risk cover credit risk and dilution risk in the banking book, counterpart risk in the overall business and settlement risk in the trading book. Capital requirements for market risk cover market risk in the trading book, foreign exchange and commodity risks in the overall business. Operational risk is calculated on applying standardized approaches. The additional capital requirements, presented above, are subject to National discretion of Bulgarian National Bank. They are calculated as 50% of the total capital requirements for credit risk, market risk and operational risk.

#### 10.1.11 CRITICAL SUCCESS FACTORS

- Simulation enables Unicredit to model and anticipate the risk of managing the credit portfolio. Unicredit custom-coded a sophisticated *Monte Carlo simulation* that could predict the outcome of changes to the credit portfolio before they were made.
- *Key Performance Indicators* such as expected portfolio loss, value of portfolio at risk and daily market-to-market movement, which are continuously monitored by the business stakeholders, ensure high usage of reports from the data warehouse.
- The BI initiative is the information backbone for the new business model, referred to internally as ACPM. Business stakeholders, such as portfolio managers and traders, have unfettered access to specific details on every deal, such as the risk contribution and the risk/return ratio of each loan. Users can also build aggregates to see the same information for bundles of loans.
- All data attributes are centrally managed by the *metadata environment*. When a single attribute is changed, Unicredit can identify where it is used across 1,000 jobs and 89 data sources, thereby giving a single point of control and change to monitor data attributes and avoid "collateral damage."
- *Agility and responsiveness* are keys to the project's success. If an analyst comes up with a new deal to execute, IT import needed data within a few hours to simulate the deal and then determine if it will have a positive or negative impact on the portfolio.

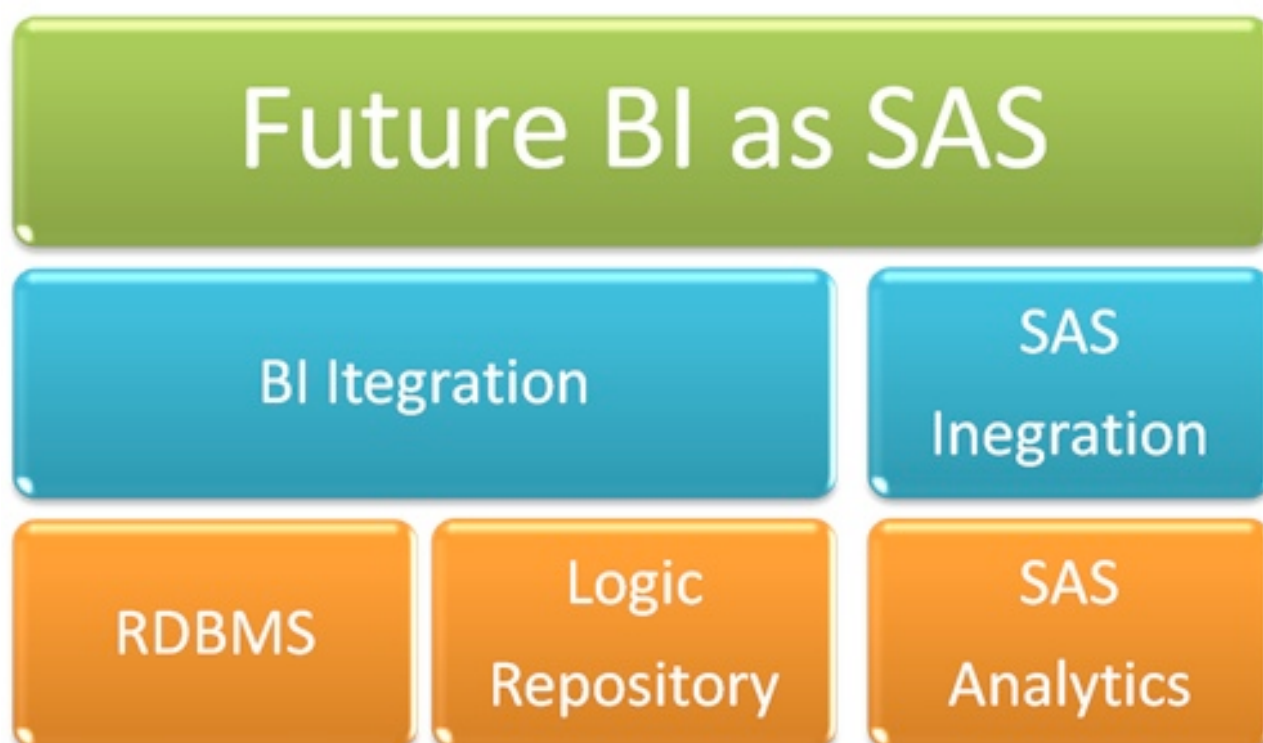
## .CHAPTER ELEVEN: FUTURE OF BUSINESS INTELLIGENCE.

The term Business Intelligence was coined by Howard Dresner in the early 1990s. He defined Business Intelligence as “a set of concepts and methodologies to improve decision making in business through use of facts and fact-based systems.” In a time when data warehousing was considered leading-edge he created the vision that led to the development of Business Intelligence, as it is known today. The once visionary BI is now commonplace and in near future a momentous transformation is about to take place. BI is all set to bring information democracy where end users across an organization will be able to view information related to their segment. Further, with the rising consumer expectations there will be demand for capability requirements of BI as well.





Talking about *Information Democracy*, nowadays BI plays a crucial role in providing cost-effective, comprehensive insights into business processes that help organizations make informed and strategic decisions that assure enhanced business results. Not long ago, BI was the domain of statisticians and corporate analysts. Only the selected few could access BI. Today, BI is spreading to nearly every strata of organizations, as companies attempt to provide critical data to business users who need it to perform their jobs. It is quite evident that BI is instrumental in bringing information democracy and it provides everyone the insights they require, delivering information to the right people at the right time across the enterprise. More and more organizations are expected to empower their employees with BI for productivity and operational gains. Today, indeed, when economic downturn is adversely affecting the world market, making insightful decisions about major changes in their business and markets has become crucial. Companies need to reconsider their strategies and operating plans and only those that are able to anticipate emerging trends and opportunities, refocus business strategy and vision, and align resources to maximize performance can effectively deal with the adversities of economic downturn and gain competitive advantage. BI and *Performance Management* brings business sensibility with enhanced visibility and insights, by delivering accurate and latest information to the right people for faster, improved, strategic and tactical decision making. Companies have increasingly starting realizing the importance of timely performance information to improve results, which will further make way for the rising demand for BI and Corporate Performance Management Solutions. Furthermore, it is being anticipated that in the coming years a number of organizations will have an industry-specific analytic application delivered via *software as a service (SaaS)* as a standard component of their BI portfolio. Information aggregators will bank on SaaS to deliver domain-specific analytic applications, which are made from industry data they assemble, and bring the balance of power in the BI platform market in their favor. Organizations will share their data with only those aggregators that can assure security as well as confidentiality. Thus, countless information aggregators offering SaaS analytic applications might appear; however, a virtual monopoly is expected to remain within each vertical niche owing to the high barricade that blocks the entry for others.



Collaborative decision making, another main future trend of Business Intelligence, will soon become the norm, which amalgamates *social software* with BI Platform capabilities. With social software users can tag assumptions made in the decision-making process to the BI framework, which significantly enhances the business value of BI as it ties all the good. Take for instance, in order to decide how much to invest in marketing a new product, users can tag their assumptions about the future sales of that product to a key performance indicator (KPI) that measures product sales. Whenever the KPI surpasses a threshold the BI platform would send alerts to the user to inform the decision makers about assumptions that no longer hold true. With the advent of social software it has become easier to utilize the upsurge of interest in informal collaboration. As an alternative to the advancing of the usual top-down decision-making initiative, social software will be employed to collaborate and make decisions. Considering this, we can say that BI is on its way to become an integral component of every type and size of organization across all sectors. It can effectively deal with industry-specific constraints, operations and objectives thereby helping organizations better understand their customers, optimize their operations, minimize risk, manage revenue, and ultimately improve their results. More importantly, it is expected that in a couple of years BI will soon replace the gut-feel management with real data-based decision-making. Today, consumers are demanding faster and improved services from businesses. As it has become imperative for companies to pay attention to

consumer satisfaction in order to stay competitive they are depending even more on BI. They now demand near real-time analysis for intelligent decisions for business success. The rising demand for near-real-time data analysis is making way for a new framework for Business Intelligence. *BI 2.0* is the recently-coined term to describe the acquisition, provision and analysis of real-time data, which was earlier lacking in BI. BI 2.0 is a part of the constantly developing Business Intelligence industry and indicates the next step for BI. In near future, companies will switch from the traditional model of making business adjustments on a quarterly basis to Business Intelligence and Performance Management tools to make real-time shifts in strategy to respond to changes in the marketplace. Over the coming years, Business Intelligence will undergo transformation that will have a broad and lasting impact. It will revolutionize the way that we think about business and the way business decisions are made. It's only when thoughtful analysis supersedes gut feeling and conventional perception, we will be able to enter the next level of Business Intelligence that will empower businesses with the capacity to reason, prepare, forecast, resolve issues and innovate.

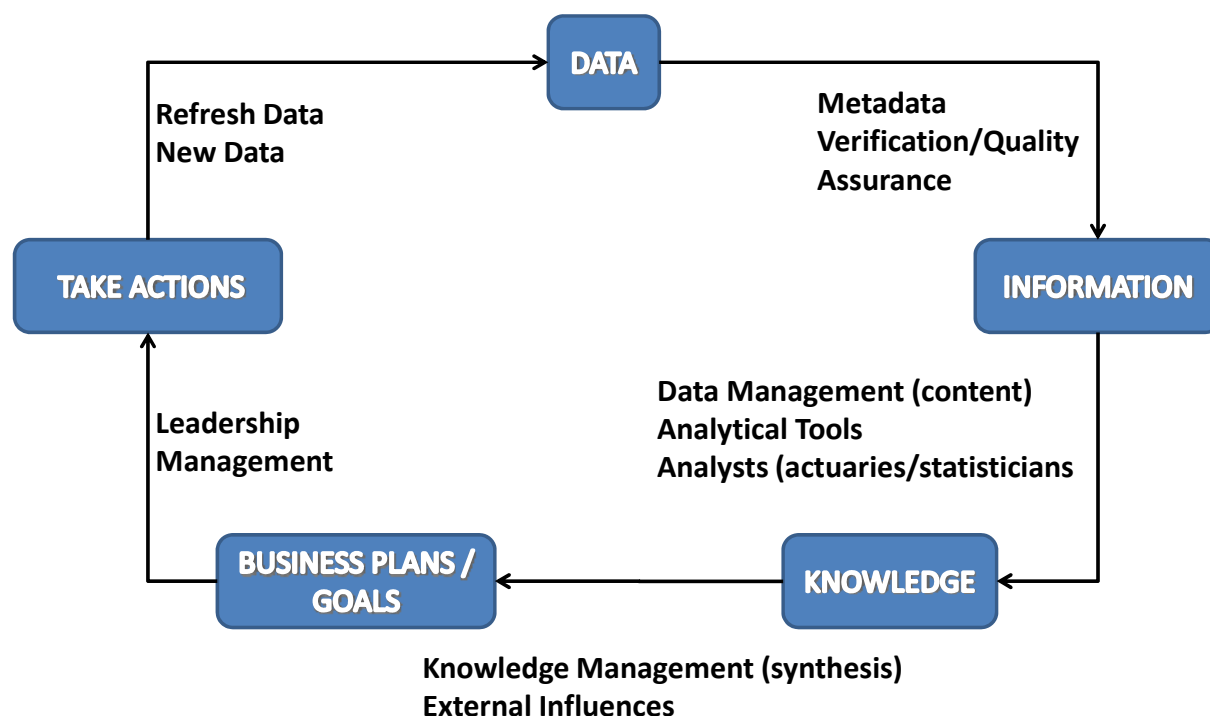
## CHAPTER TWELVE: CONCLUSIONS.

As a conclusion of all the researches and studies I have done I can finally state that accurate and reliable data are the cornerstones of good decision making process. Being able to collect and, above all, to analyze crucial information is the pillar of a company's success. As many articles and reports highlight, nowadays financial institutions and banks have information management systems that are still inadequate to support and help in taking strategic decision. Starting from internal issues, all those lacks can be transformed into something really big and globally dangerous. As directly related to this last concept, case studies I have analyzed during my work clearly demonstrate that signals were definitely there in the data, if only all those people involved had followed some basic principles:

- Developed systems to collect quality data
- Routinely reviewed simple descriptive statistics
- Used publicly available aggregate statistics to validate crucial model assumptions
- Used various analytical tools to convert the data into information to be used in the business process
- Applied leadership and business acumen to act on the analytics

I have reason to think that the financial crisis is the poster child for the failure to apply these Business IntelligenceBusiness Intelligence concepts, a simple cycle, to remind the introduction, that could have saved the world from many disasters.

### BUSINESS INTELLIGENCE CYCLE



In the case of the Bernard Madoff fraud, which is one of the hottest point of my work, a simple review of published return data for instance would have uncovered the unreasonableness of the data. *Would more training of the principals involved in the financial crisis on data quality and Business IntelligenceBusiness Intelligence have prevented some of the damage? Was the crisis a result of ignorance, or were the financial incentive so overwhelming that business fundamentals were ignored?* News sources indicated that inexperienced people were given significant responsibilities (Scheer 2009). Nevertheless, according to Bloomberg Markets (Helyar et al. 2009), some fund managers provided client funds to Madoff, even though they suspected that Madoff was involved in a fraud. The implication is that they were willing to go along with an illegal scheme if it brought extra returns to their funds and if they thought the risk to themselves and their

investors, should the fraud be detected, was low. Nowadays it's quite hard to find a precise motivation or better, a justification, of what really happened during those years. What I firmly believe, mainly thanks to what I have discovered during all my researches, is that both inexperience and "the moral hazard problem" appeared to have contributed to the poor use of data and to the failure to apply the concepts of Business IntelligenceBusiness Intelligence, leading the entire world in one of the biggest crisis ever.

# .APPENDIX A.

## COMPANY PROFILE

→ Name of the company

→ Belonged Group

→ Company address

→ Number of employees

- ≤ 20
- 20 – 99
- 100 – 500
- ≥ 500

→ Revenue (millions €)

- ≤ 10
- 10 – 50
- 51 – 100
- ≥ 100

→ Interview's credentials (opt.)

→ Job position (opt.)

→ Telephone number (opt.)

→ Mail (opt.)

→ In which market sector is the company?

- Finance
- Logistics
- Pharma

- PA e Sanity
- Manufacturing
- Telco
- Services
- Other

→ Is your company listed in the Stock Exchange?

- Yes
- No
- During listing process

## A P P L I C A T I O N   A R E A S

→ In which business processes the BI solution have been implemented?

- Commercial
- Marketing
- Purchasing
- BPM
- Operations and Supply Chain
- HR
- R&D
- Customer Care

→ Which is the BI architecture chosen?

- Unique BI module integrated natively into the ERP
- Unique BI module developed externally and implemented into the ERP
- More BI modules developed externally and implemented into the ERP
- Other



→ When the BI solution have been introduced for the very first time?

- During last 10 years
- More than 10 years ago

→ How much did the BI implementation cost? (millions €)

→ What is the percentage of the whole IT investment only dedicated to BI?

- 0 – 25%
- 25 – 50%
- 50 – 75%
- 75 – 100%

## DECISION MAKING PROCESS THAT LEADS TO BI IMPLEMENTATION

→ Why your company adopted a BI solution?

- Performance monitoring and improvement
- Segmentation and profiling
- Scenario analysis and what-if
- Improvement in the CRM (call center, customer care)
- Efficacy and efficiency improvement in the decision making process

→ How is BI felt inside the company?

- Strategic
- Tactic
- Support

→ How employees feel themselves towards BI ?

- Against
- Indifferent



## STRATEGIC AND COMPETITIVE ADVANTAGES

→ Which one are the strategic and competitive advantages gained ?

- Performance improvement
- Fastening of the decision making process
- More rapidity in taking decisions
- Better information exchange inside the company
- Be able to react quickly to pressures
- Data usage a source of information
- Process automatization

→ How the above advantages have been measured ?

- Technical performances
- Daily usage of BI tools (login, data extraction, etc..)
- Users increment
- Data quality level
- Software quality level (bugs, incidents, etc.)
- Not measured

→ To quantify, for each division, the advantage level obtained

	None	Low	Medium	High	Very high
Commercial	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Marketing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Purchasing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
BPM	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Operations & Supply Chain	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
HR	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
R&D	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Customer Care	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

## ORGANIZATIONAL IMPACT

- Have you created a specific division only for BI issues?
  - Yes
  - No
  
- If yes, which is its positioning inside the company?
  - It's a function in line with other units (Marketing, R&D, etc)
  - It's a function depending from other units
  - It's a separated entity
  
- What have been the entity of the impact over processes and HR?
  - None
  - Low
  - Medium
  - High
  
- Was it necessary to develop a training program?
  - Yes
  - No

## FUTURE TRENDS

- In the following years, BI will be oriented towards specific realities. Which one, among the following listed, do you think should be more considered?
  - Increase in data governance
  - Semantic technologies usage (semantic web, etc.)
  - Increase in the usage of advanced analytics tools
  - 'Gap' reduction among operation systems and data warehouse
  - Integration and analysis on semi-unstructured information

- Social computing introduction in a company context (social networks,etc.)
- Cloud computing introduction in a company context
- SOA impact on BI architectures
- Mobile BI development
- BI Open Source system introduction

→ In the specific case of your company, which level of importance have following trends?

	Irrelevant	Modest	High	Crucial
Data Governance	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Semantic technologies	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Semi-unstructured information	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Social computing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Cloud computing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SOA impact	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Mobile BI	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
BI Open Source	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

→ In the future, do you want to extend BI tools to other SBUs?

- Yes
- No

## .APPENDIX B.

### FIFTY PERCENT OF BUSINESSES FILED BANKRUPTCY DUE TO DATA LOSS

If you are an owner of a small business, the above statement may strike a bitter reality. “A recent national survey in the United States found that fifty-five percent of small businesses rate themselves as “fair” or “poor” in terms of having a documented disaster recovery plan or have no documented disaster recovery plan at all”. What many of these small businesses fail to realize is that generally their business relies on the data they have on their computers. Everything they learn, develop, and gather gets logged and recorded on their PCs. However, according to a study conducted by Pepperdine University, “6% of all PCs will suffer an episode of data loss in any given year, requiring specialized data recovery services”. Loss of their precious information through various events such as the corruption, failure of recovery, theft, accident, destruction, and/or human error, will have a gruesome effect on their business, if they are not prepared well in advance. Recreating these files can be very costly, time consuming and sometimes impossible. As found on the Disaster Recovery Journal, “the rate of failure for laptops is as high as 20-25 percent per year and every year 30 percent of all these are lost or stolen. According to another survey results “93% of companies that lost their data center for 10 days or more due to a disaster filed for bankruptcy within one year of the disaster. 50% of businesses that found themselves without data management for this same time period filed for bankruptcy immediately. 4. This comes no surprise since the 2001 Cost of Downtime Survey indicates that “46% of the survey participants said each hour of downtime would cost their companies up to \$50k, 28% said each hour would cost between \$51K and \$250K, 18% said each hour would cost between \$251K and \$1 million, 8% said it would cost their companies more than \$1million per hour”. Although many still forget to save, others have taken these tasks as their regular activity. After all, data loss not only costs you and your business, but also puts you on the strain of having to deal with the legal matters. According to Report on Business magazine, “awareness of the need for data and systems security has been growing, due to recent events such as the summer 2003 power outage, Internet virus proliferation and 9/11”. A recent survey by IDC, a leading market survey firm, concluded that we should expect worldwide spending on security and business continuity to grow twice as fast as IT spending over the next several years. More than ever before,

businesses are spending on security technology, and the cost of security is eating up a greater proportion of corporate technology budgets. According to Gartner, Inc., there is a 28%-a-year increase in security spending since 2001, even though technology budgets have grown by only 6% a year. Gartner also predicts that 20% of enterprises will experience a serious Internet security incident-excluding virus attacks-before the end of 2005. While awareness of the importance of backup and recovery planning is present, only about 1 of the 5 of small business has a consistent backup policy or recovery plan and this was only implemented after a significant data loss. We have learned that many technical personnel in small to medium sized businesses simply do not have the time to deal with backups and recovery, and therefore a hole exists which is often filled unsatisfactorily by the software vendor". Software support contracts are very expensive, and this kind of customer can often turn to a reseller for the technical services necessary to maintain an adequate backup and recovery system. As much we rely on the technology to progress with the changes, we must not fail to recognize its potential of failures. According to a Gartner analyst "35% of all PCs sold to businesses are laptops and 1 in 5 of these laptops will suffer hardware failure in the first 3 years". Similarly, notebook thefts have also been haunting businesses. As indicated by a survey result "The average financial loss resulting from a laptop theft grew by 44% from 2000 to 2001 (\$62,000 to \$89,000). Although technology is the foothold to many businesses, it also possesses many potential threats. Thus, in order to harness it and use it efficiently, we must be able to identify potential data loss situations and take the necessary precautions to prevent them from happening. Most of all, we must not forget to do rehearsals of data failures. Having adequate, tested and restored, as well as current backups in place is critical. Data is a valuable corporate asset and should be managed as such, like cash, facilities or any other corporate asset.

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