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**Panoramic and main features
of Business Analytics**

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Alla mia famiglia

Abstract

This thesis investigates the world of Business Analytics, an emerging set of trends, technologies, practices that has started to attract the attentions of a growing number of companies who recognize its value. Starting with the definition of what Business Analytics is, its description and state of the art, the thesis explains its most relevant features, depicts the characteristics of a much more “intelligent” enterprise, guides the reader through a sort of “how-to” manual to make a company more analytical with particular attention to the type of company, unveils both current and future techniques and trends, presents cases of companies who have successfully implemented and embraced an analytical culture.

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1 Chapter 1

1.1 Business Analytics definition

Business Analytics (BA) refers to a set of trends, technologies, practices, applications, skills used to analyze the historical data collected by a company with the intent to project or predict possibilities of outcomes in the future, providing new insights and the chance for the company to know a lot more about itself. In order to do so, companies make an extensive use of data, statistical and quantitative analysis, develop predictive models and base their decisions and actions on rational facts rather than on irrational elements like intuition, instinct or “gut feeling”. Even when intuition is appropriate, it’s useful to track the intuition applied, the decisions made and the results and in this way gain and extract “rules of thumb” to be applied on future and similar situations.

BA is slightly different from the so called Business Intelligence (BI), that refers to practices like reporting, querying, OLAP (On-Line Analytical Processing) which only analyze quantitatively *what* happened, because it strives to know *why* all that happened, allowing companies to concentrate on optimization, forecasting, extrapolation, discovery of new trends, patterns, relationships, sectors on which to intervene or to exploit more. A keyword is *insight*: it means a clear and deep perception of a complex situation or condition, the ability to “see inside” the situation. Insightful analytics are those that create the ability to look inside deeply enough to understand the causes of a situation or condition. Insight builds on understanding, but requires that *why* questions are answered in addition to *what*, *when* and *how much*. The key to high-impact analytics is a strong connection and understanding of cause and effect, the path to knowing why things happen and deciding what to do about them.

Depending on the degree of intelligence needed and the competitive advantage gained, there are lots of techniques that can be applied, as shown in Figure 1.

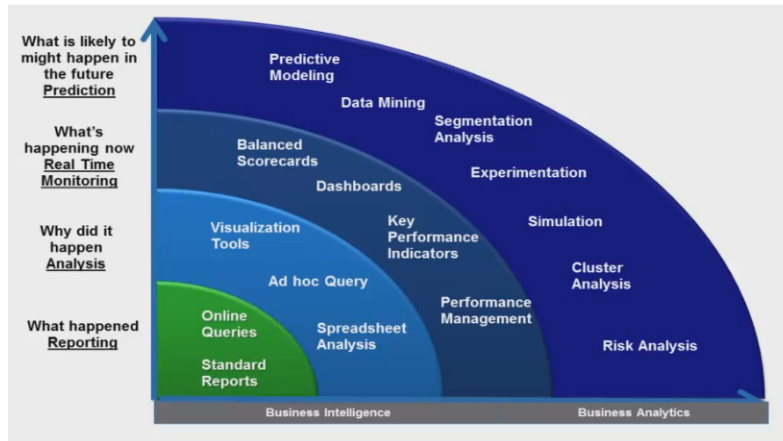


Figure 1: Tools used, questions asked

The utilization of these techniques and, more generally, a more analytical and less instinctive approach in the decision-making process is very important, both to exploit to the fullest each and every single resource and to appreciably reduce waste of precious money and disastrous decisions, especially during a tough economical period, in which every error can cause huge damage. Due to these reasons, every company that has or is able to analyze a certain amount of data (on suppliers, clients, sellings..) can and should be interested in this new kind of approach, that has proved to be reliable and absolutely crucial to the birth of new successful companies or to the revival of the ones in a tight spot. It is a proven fact that top-performing organizations use analytics five times more than lower performers, and that is the main reason why they are on top.

A simple path to advanced analytics begins with some kind of analysis (usually SQL-based) of some data, a process called “data crunching”, a descriptive statistic is added to describe the data of the past applying math; next is predictive analytics during which techniques like data mining and machine learning are applied to predict future outcomes, which later either feed a process of simulation of multiple scenarios or are applied to trade-off kind of decisions during a process of optimization based on the particular constraints of the company. These prediction can help both the clients, who will know what to buy next, and the producers, who will know what is best to offer. In addition to this, tools used now like standardize reporting are going to be replaced by data visualization (dashboards and scorecards), analytics applied within business processes, advanced statistical techniques (regression analysis, discrete choice modeling, mathematical optimization).

1.2 Main players

Many middle and big size companies or even entire governmental agencies can benefit from these procedures and capabilities, for example in sectors like public health or internal revenue, areas that have always been very financially challenging and where even the minimum improvement can turn out to be a huge gain in terms of savings and cash flow.

Main players in this scenario are obviously industrial giants like SAS, SAP, Oracle and IBM, who provide countless solutions, services, applications to every company that decides to invest in this area. However, many other huge names like Google, Amazon, Netflix have become what they are nowadays thanks to the application of particular kinds of analytical techniques, as we will see in the following chapters.

Furthermore, it is reductive to think only about companies in the IT area, because, as stated before, every kind of area can benefit from BA. That's why names from every possible area started to tap into this useful world: Procter & Gamble, the supermarket chain Tesco, delivery firms like FedEx or UPS, companies in the entertaining industry like Harrah's or even sport teams like AC Milan or Boston Red Sox, just to cite some names.

These companies not only improve their financial results reducing expenses, better exploiting their resources and increasing revenues, but also manage to better and better please their clients, gleaning from historical data and new trends analysis the right ideas to offer more satisfying and interesting products and services.

1.3 Analytical competitors

Some of the most successful companies in the world, like the ones cited before, have become such thanks to their analytical capabilities, that represent their starting point of every strategy, process and decision: they became what the strategy expert Thomas H. Davenport has dubbed "analytical competitors".[1] To follow his definition, analytical competitors are organizations that have selected one or a few distinctive capabilities on which to base their strategies and have applied analytics to support them. The road to becoming one of them it's not easy due to the particular features needed, like high-quality data, capable technology environment and quantitative expertise, but has proven to be worthy. The four pillars of analytical competition are distinctive capabilities, enterprise-wide analytics, senior management commitment, large-scale ambition and will be discussed in the following paragraph.

1.3.1 Attributes

Analytical competitors have discovered and carefully chosen a strategic, distinctive capability that allows them to gain a sensible competitive advantage; this peculiar capability could be among every sector, from supply chain to pricing, from customer service or loyalty to human resources. The importance lays in the non-stop improvement and exploitation of the chosen feature, in order to distinguish themselves and emerge as the best.

All data and analysis are made available broadly throughout the company, allowing different departments to work together and on the same level of knowledge: that is what enterprise-wide approach and management of analytics means. Obviously to make this happen, there's an absolute need for only one version of critical business information and analytical results, because if a decision that involves the collaboration of more than one department must be made, it seems perfectly clear that they must work on the same data, to prevent any flaws and undesired outcomes. It is not unusual that a company decides to build a special "team" to address these kinds of problematics. That's why many of them build a so called BICC, that stands for Business Intelligence Competency Center: a cross-functional team with defined tasks, roles, responsibilities and processes for supporting and promoting the effective use of data and applications across the organization. This unit makes it possible to share analytics resources efficiently and effectively without replacing distributed and localized capabilities; the central unit is additive, built upon existing capabilities that may have already developed in functions, departments and line of businesses.

This kind of resolutions and decisions must come from "above", that means that the senior management must be the first believer and promoter of it all. Without their example and decisive push, all the other members of the company not only lack the motivation and willingness to adopt them, but also do not fully grasp their importance.

The last fundamental attribute for an analytical competitor is a large-scale ambition: to obtain the desired expansion analytics must be applied to every aspect of the life of the company, to both internal and external factors. Internal factors include financial, manufacturing, research & development, human resources matters, external ones include customers and suppliers.

To optimize each and every one of these aspects the company must develop predictive models to identify the most profitable areas, the ones where the greatest profit potential is, must integrate in-house customer data (usually managed through a CRM, Customer Relationship Management) with external data to have a more comprehensive understanding of customers, optimize the supply chain and the pricing policies, conduct experiments to measure the overall impact and lift of the new techniques.

1.3.2 Stages

To become an analytical competitor a company must start a campaign of renewal, with lots of changes, both technological and cultural. Innovating to achieve competitive differentiation is a top business challenge. In his books Davenport suggest that there are five stages through which a company must go: analytically impaired, localized analytics, analytical aspirators, analytical companies and finally the fifth of them being the analytical competitor. A study on MIT Sloan Management Review [2] suggests that the stages are just three: aspirational, experienced and transformed. Regardless of the exact number of stages, there are many common attributes found in these studies, that perfectly explain the features of this evolving process.

At first companies lack not only the prerequisites for analytics but also a general understanding on how to leverage analytics for business value; there are little or missing skills, no executive sponsorship, poor quality data, unintegrated systems, limited ability to capture, aggregate, analyze or share information and insights, and these insights do not guide future strategies and decisions that are still made out of instinct.

One of the first needs is consistent, quality data on which the decision making process will be based: in this way executives could provide more fact-based decisions. At the same time, it is important to spot key areas, distinctive capabilities and opportunities, in order to focus on the biggest and highest value ones: it is in fact imperative not to start doing analytics without a strategic business direction. To this end, within each opportunity, although data's importance, it is better to start with asking questions: organizations should implement analytics by first defining the insights and questions needed to meet the big business objective and then identify those pieces of data needed for answers; by narrowing the scope of these tasks to the specific subject areas needed to answer key questions, value can be realized more quickly, while the insights are still relevant.

To reinforce what just said, it is notable that for analytic-driven insights to be consumed, they must be closely linked to business strategy, easy for end users to understand and embedded into organizational processes in order to take action at the right time.

To move forward could be useful to implement a localized project that can produce measurable benefits, in order to discuss the documented results with key shareholders and gain their respect and sponsorship. These autonomous activities can build experience and confidence in using analytics, as well as create new analytically based insights. However, the other side of the coin is that these are pockets of isolated analytics, disconnected from one another, where most data remains unintegrated, non standardized and not accessible. These are the problems that must be addressed next.

That is why the next step is being much more coordinated, with the development of enterprise-level plans, architectures, strategies and enterprise performance metrics to be applied on major projects regarding the distinctive capabilities previously found. At this stage a proliferation of BI tools can be seen, as well as an improvement of the usage of data marts and data warehouses.

Little by little the organization starts to accomplish goals like high-quality data, enterprise-wide analytical plan, some embedded or automated analytics, more robust belief in the fact-base culture, IT processes and governance principles in place, top executives' view of analytical capabilities as a corporate priority.

Keeping this level of improvement alive and running, the company soon can find itself as being an analytical competitor, that reckon analytics the key to strategy and competitive advantage. That's why the focus now is on a continuous analytics renewal and improvement process in order to maintain the enterprise wide capabilities, big results, deeply meaningful insights gained so far. The top general manager\CEO will be passionate and enthusiast, and certainly the first promoter of the full-fledged analytical architecture and culture reached up to this point.

1.4 State of the art

Nowadays the percentage of companies that considers analytics as a key activity on which to base their strategies is still quite small, and probably it doesn't exceed 20%, even if it is destined to grow in the next future. The remaining 80% either adopts just partially this kind of techniques, or it is still not able to coordinate them, or just doesn't have the right data or instruments to exploit them.

One of the greatest obstacles that companies willing to become analytical competitors have to face is the lack of data or, more frequently, the presence of poor quality, not standardized, ambiguous, nonconforming data used by not integrated systems. The cause of the latter of these problems is the common practice of storing a great amount of data in disks or even data warehouses that, however, remain completely isolated and not at all integrated with an ad-hoc system. Given the lack of an univocal definition and standardization of the data, they are destined to be an isolated pocket of information, whose range of utilization is, in many cases, just localized to a little area. In addition to this, it is a common fact that a big percentage of the data is accessible only to a limited and closed group, when instead it could be extremely useful to many other departments, in order to achieve a much more widespread utilization to create stronger and more productive relationships.

A technology that has become really popular is the so called OLAP, that are replacing the traditional relational databases (RDBMS). Instead of storing data in tables, these applications store them in *cubes*, that are multidimensional structures (even seven or more) that allow more effective and incisive analysis through the many variables of the data. There are three basic operations allowed by these tools: consolidation, drill-down, and “slicing and dicing”. Consolidation is simply the aggregation of data in a multi-dimensional fashion; in contrast, the drill-down operation allows users to “move” freely through and around data and its details; slicing and dicing is a feature whereby users can take out (slicing) a specific set of data of the cube and view (dicing) the slices from different viewpoints, as showed in the following picture, that can help in conveying a visual of this kind of operation in a query performed on a simple three dimensional cube.

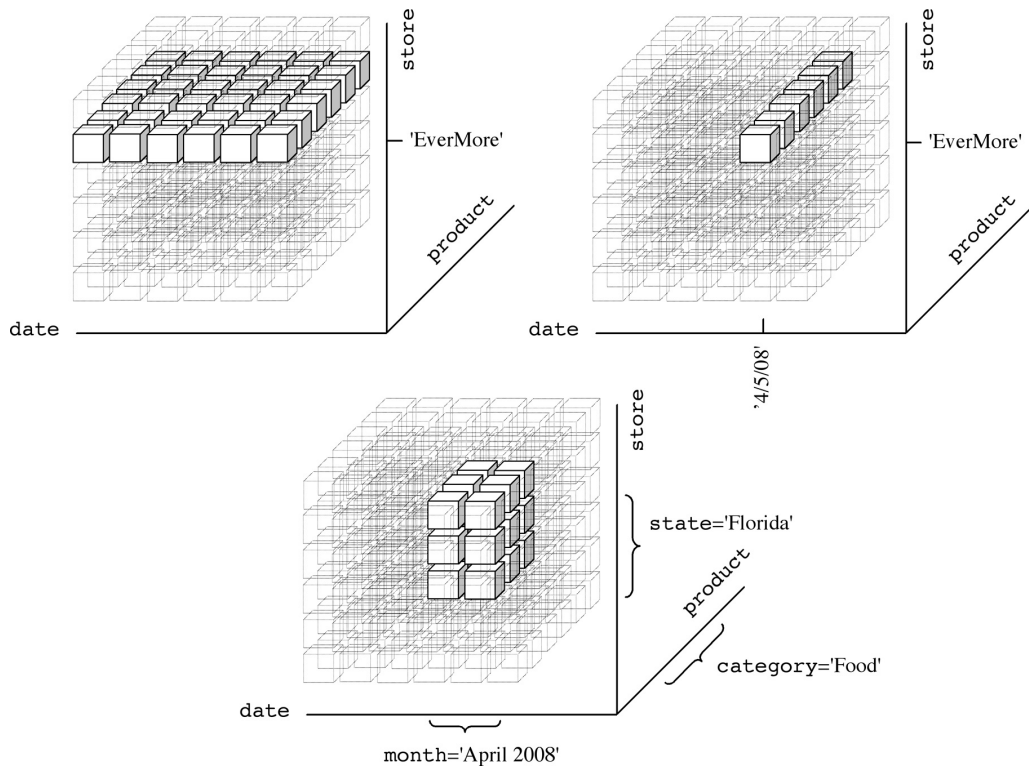


Figure 2: Slicing & dicing

Considering the fact that many levels of sophistication for this technology exist, these applications, associated to data and text mining techniques, statistical algorithms and simulation tools, represent what has been commonly used up until now in the national and international panorama.

However, the most worldwide used technology to collect and elaborate data is still, without a doubt, the so called “spreadsheet”, of which Microsoft Excel is the example par excellence. It is a very easy to use tool, that naturally lends itself to represent the mental organizational “model” of its user. The truth is though, that this easiness really hides lots of problems related to them: human errors (it is calculated that, even when used properly, about 20% of them is affected by errors), presence of possible multiple copies of the same spreadsheet available to different employees, creating in this way an exponential risk of having ambiguous, conflicting, unupdated data saved in them. That’s why they are worthy of a much closer look in the next paragraph.

1.4.1 Spreadmarts

According to Wikipedia, a spreadsheet is a computer application that simulates a paper accounting worksheet. It displays multiple cells usually in a two-dimensional matrix or grid consisting of rows and columns. Each cell contains alphanumeric text, numeric values or formulas. A formula defines how the content of that cell is to be calculated from the contents of any other cell (or combination of cells) each time any cell is updated. A spreadmart instead is a concept describing the tendency of spreadsheets to "run amok" in organizations. TDWI used the following definition of a spreadmart in a survey it conducted in 2008: a spreadmart is a reporting or analysis system running on a desktop database (e.g., spreadsheet, Access database, or dashboard) that is created and maintained by an individual or group that performs all the tasks normally done by a data mart or data warehouse, such as extracting, transforming, and formatting data as well as defining metrics, submitting queries, and formatting and publishing reports to others. [3] After a more careful look at this definition, one can begin to grasp why working with this kind of tools can be potentially dangerous: the fact that an individual has the chance to create, modify and publish documents or even define metrics without some kind of supervision can lead to serious problems. However, before starting to analyze in detail these problems, it can be useful to understand what kind of tools they are.

There are three main types of spreadmarts:

1. One-off reports: business people use spreadsheets to filter and transform data, create graphs, and format them into reports that they present to their management, customers, suppliers, or partners.
2. Ad hoc analysis: business analysts create spreadmarts to perform exploratory, ad hoc analysis for which they don't have a standard report. They use the spreadmart to probe around, not even sure what they're looking for, and they often bring in supplemental data that may not be available in the data warehouse. This exploration can also be time-sensitive and urgent.
3. Business systems: most spreadmarts start out as one-off reports or ad hoc analysis, then morph into full-fledged business systems to support ongoing processes like budgeting, planning, and forecasting. This type of spreadmart is called a "data shadow system."

It goes without saying that the third type is the most dangerous one because, as most “shadow systems”, it slowly becomes an integral part of the daily routine, making everyone forget the threats related to it.

One of the first problems that comes to mind and that plagues many companies is the presence of inconsistent views: employees use different data sources, calculations, calendars, data conversions, naming conventions, and filters to generate reports and analyses based on their view of the business. These parochial silos of data undermine cross-departmental and business unit synergies and economies of scale.

Strictly related to this are the risks caused by human errors because users often enter data into spreadmarts by hand, which leads to errors that often go undetected (usually there is no audit trail that tracks who changed what data or when to ensure adequate control and compliance), or they may create poorly constructed queries, resulting in incorrect data, or even embed logic in complex macros and hidden worksheets that few people understand but nevertheless copy when creating new applications, potentially leading to unreliable data.

In addition to these problems, there are other liabilities that come together with spreadmarts. To summarize, here is a simple list of the most common ones:

- no data integrity or consistency: spreadmarts quickly lose their connection to the rest of the enterprise, data no longer reflects updates to the corporate system where it may have originated.
- proliferation of data silos creating data that cannot be reconciled with other spreadmarts or the enterprise data warehouse.
- no scalability and are limited by how large and complicated a one-dimensional spreadsheet can grow.

Lastly there are also costs matters: while analysts often justify the use of spreadmarts because they don’t need to purchase a BI tool or hire a consultant to build them, there are many hidden costs. The biggest cost is the time it takes business analysts to create spreadmarts. Rather than analyzing data and making recommendations, analysts can spend an inordinate amount of time simply collecting, massaging, and formatting data. These are tasks that IT can and should be doing, allowing highly paid analysts to focus on what they were hired to do: analyze data and offer insights to the organization.

After reading this long list of issues, it may be natural to start questioning why these tools are still so commonly used. Despite the problems, there is often no acceptable alternative to spreadmarts. For example, the data that people need to do their jobs might not exist in a data warehouse or data mart, so individuals need to source, enter, and combine the data themselves to get the information. In addition to this, small and midsize businesses have historically relied on spreadmarts primarily due to cost and resource constraints. Spreadmarts represent business people making do with what they have. It can be also a cultural and knowledge matter, because changing a spreadmart-dependent culture usually requires top executives to both communicate the importance of having unified, consistent, enterprise data, and to apply incentives and penalties to drive the right behaviors, and that usually does not happen.

However, it must be said that there are also some benefits related to spreadmarts and these are the probable shield under what executives usually hide not to change the status quo of the company. Spreadmarts are easy and familiar to use, fast to create and modify, agile. Microsoft Excel, for example, supports analysis, formatting, and visualization capabilities that some BI tools do not. It can also be easier to integrate data from multiple sources in Excel than in BI tools that can't query multiple sources and join the results.

Obviously all this does not justify the non adoption of much more useful and efficient analytical tools. That is why there is a way to abandon them: the technical remedy for spreadmarts is to manage and store data and logic centrally in a uniform, consistent fashion and then let individuals access this data using their tools of choice. In other words, the presentation layer should be separated from the logic and data. The key to renovating a spreadmart is to split it into its data integration and analytical processes, and then work to understand each, to reverse-engineer its data integration and analytical processes.

Best practices to renovate spreadsheets include a first inventory phase: IT needs to work with the business to inventory the spreadmarts, jointly assess their value, understand what business processes are supported, and identify the key components to renovate or replace. In addition to this, IT needs to leverage the inherent business value of spreadmarts (content and purpose of the documents) while replacing or renovating them to take advantage of better design techniques and more appropriate tools. Given that they are used to fulfill many purposes, a different approach may be followed when dealing with different types of spreadsheet: if there is little business value in it, it can be eliminated; if only a few business users make use of it or

if it's used for one-off reporting or ad hoc, exploratory analysis, then leave it because it is not probably worth the effort; if there is significant business value or many business users, then target it for renovation or replacement.

1.4.2 Analytical techniques

As previously seen, the decision to rely on analytics involves changes not only to the technologic environment but also to culture and to all sorts of analytical techniques that challenge mindsets, biases and prejudices. Since technology related matters are discussed all over this thesis, this paragraph is dedicated to analytic techniques that are designed to help individual analysts, as well as teams, explore and challenge their analytical arguments and mindsets. It is in fact very important to be also mentally ready to embrace and exploit new instruments, tools, practices, applications.

The key risks of mindsets are that analysts perceive what they expect to perceive; once formed, they are resistant to change; new information is assimilated, sometimes erroneously, into existing mental models and conflicting information is often dismissed or ignored. That is how cognitive and perceptual biases in human perception and judgment are born. Far from being a psychological survey, the following lines present some techniques that are useful to gain another special perspective about the utilization of analytics.

At the beginning of an analytic project it can be helpful to list and review the key working assumptions on which fundamental judgments rest, to make them explicit and identify what information or developments would demand rethinking them. In this way it is easier to explain the logic of the analytic argument and expose faulty logic.

Knowing how ambiguous and contradictory data could be, it is wise to perform a check about the quality of information that evaluates completeness and soundness of available information sources, weighing their validity. All this until the progress made by the company regarding the quality of data reaches excellence and the organizations trusts the technologies used to make it happen.

When faced with a decision between controversial alternatives that even analytical tools cannot rule out because almost equally supported by data and with different scenarios involved, there are some techniques that can provide some extra insights. A particularly appropriate one is called analysis of competing hypotheses (ACH), that is the identification of alternative explanations (hypotheses) and evaluation of all evidence that will disconfirm rather than confirm hypotheses.

Another one is the so called Team A/Team B, that uses separate analytic teams to contrast two (or more) strongly held views or competing hypotheses, especially if facing a critical decision that has far-reaching implications.

In parallel with simulation tools, techniques like “what if” analysis, Red team analysis (that models the behavior of an individual or group by trying to replicate how an adversary would think about an issue), alternative futures analysis and outside-in thinking (used to identify the full range of basic forces, factors, and trends that would indirectly shape an issue) can provide some effective means of weighing multiple unknown or unknowable factors and presenting a set of plausible outcomes, and hopefully adding what was missing in the data.

1.4.3 Features of the intelligent enterprise

All the features presented up until now, united with the ones of the following chapters, contribute towards the same goal: the creation of an intelligent enterprise that has become so thanks to the exploitation of analytics. There are many intelligent enterprises in the world and everyone of them shares some characteristic traits that allowed them to become healthy, profitable, powerful. Thanks to a survey made by IBM we are now able to know these traits. [4]

A key point noted in this study suggests that by embracing advanced analytics across the enterprise, intelligent enterprises will optimize three interdependent business dimensions:

1. Intelligent profitable growth: these companies present a lot more opportunities for growing customers that choose to rely on them, they are better at improving relationships with them because they know them better, they are identifying new markets and developing new products and services because they have the right tools and applications to do so.
2. Cost take-out and efficiency: thanks to careful analyses they can optimize the allocation and deployment of resources and capital to create more efficiency and manage costs in a way that aligns to their business strategies and objectives.
3. Proactive risk management: less vulnerability and greater certainty in outcomes as a result of their enhanced ability to predict and identify risk events, coupled with their ability to prepare and respond to them.

To summarize with some adjectives, the intelligent enterprise is:

- **Aware:** it gathers, senses, and uses structured and unstructured information from every node, person, and sensor within the environment. It will stimulate its employees and partners to be in very close touch with the world 24 hours a day 365 days a year.
- **Linked:** it connects internal and external functions front to back across geographies in a way that aligns to desired business outcomes. It will link its talent to each other and with the outside world to allow complete access to all available information and ideas
- **Precise:** it uses only the most relevant information to support timely decisions and actions closer to the point of impact and consequence. It will reallocate mental bandwidth so people can focus on service, innovation and future improvement.
- **Questioning:** it reserves the right to get smarter by challenging its status quo while creating new opportunities. Mastering the job at hand will no longer be the endpoint, but the means for informing tomorrow's work day.
- **Empowering:** it enables and extends employees' memory, insight and reach, as well as the authority to decide and act. Empowering employees and automated agents requires a shift in culture from one of constant oversight to one of trust and enablement.
- **Anticipating:** it predicts and prepares for the future, and instead of just reacting to or correcting actions, it also steers and evaluates trade-offs. Because of its ability to anticipate possible paths, the intelligent enterprise knows what to do when new situations present themselves

This is how the most successful companies nowadays are and this should be aim and the target of all the other organizations.

1.5 Relationship between BA and BI

As mentioned in the definition of business analytics, there is a difference between BA and BI, even if someone uses only one of the two terms to define also the other one. Some even say that BA represents the evolution of BI, however the only thing that is certain is that they differ both in target and on an imaginary timeline. The target of BI is to quantify *what* happened

in the *past*, the target of BA is to understand *why* all that happened and to predict what will happen in the *future*.

Business Intelligence tools are common and largely used worldwide by business managers to look at historical data and to try to understand and gain some insights about what is going on. They are helpful to dig down on past situations and explain some numbers, results, situations but do not tell anything about the future, unlike BA applications. Nevertheless, they are equally important because without a complete and accurate knowledge of the past, it is impossible to move to the future with the right set of skills, capabilities and resources.

1.5.1 How BI should be

There is something that companies have learned about BI lately: it has to be pervasive. Pervasive BI means that it has to be deployed to all levels of the organization, across the entire organization (not just finance, sales, marketing but also human resources, supply chain, manufacturing, stores), inside and outside the organization (can be drawn huge value by sharing information across companies). Attention to this particular feature has already repayed the ones who believed in it, in fact organizations with pervasive BI saw an average 24% increase in operating profit.

With pervasive BI more employees should be involved in decision making (with the wariness that BI tools for casual users need to be intuitive, easy to use and easy to manage), more departments could have easy access to information. In this way there can be a time improvement when required to gather information or make decisions. BI output to field staff must be simple, delivered quickly, and highly tailored to the process they manage. Organizations either embed reports and analytics into other applications, or deliver dashboards or simple static reports that require only a quick glance to absorb the relevant information. That is why BI tools producers are working hard to deliver highly architected solutions that plug seamlessly into Web services and other standards-based architectures and don't require a lot of up-front configuration. The architecture supporting a BI solution is as important as a BI tool for ensuring proper uptake and usage. Fundamentally, data must be structured or delivered in a dimensional format that aligns with the way users think about the business; the real or perceived quality of data is a huge factor that determines whether the business uses a BI solution or not.

By parsing out functionality and data in a layered fashion, the so called “MAD framework” suggested by TDWI meets the information needs of casual users in an optimal way. This framework shows how different users should be able to see and interact with different kind of data and business applications, performing different operations on several levels. The following picture helps to understand this concept.

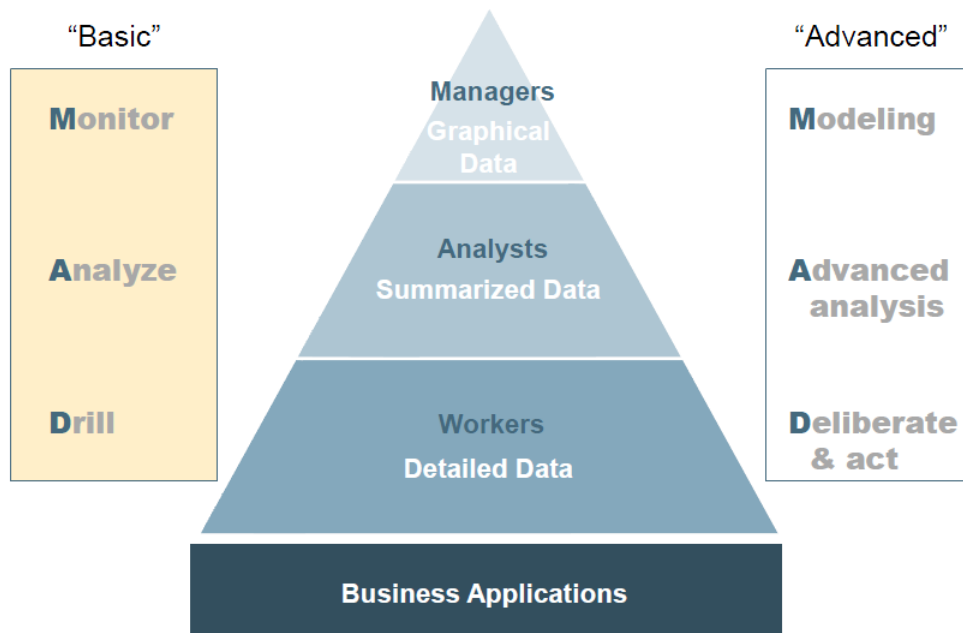


Figure 3: MAD framework

MAD framework creates an interactive environment that parcels out information and insights to users in layers, optimizing usability and usage. The monitoring layer consists of graphical key performance indicators (KPIs) that enable business users to assess the status and trend of KPIs with a glance. For example, if a KPI needs to be further investigated, users can drill down to the analysis layer to explore the issue from multiple perspectives or dimensions using filters. Once they discover the root cause of the problem, they can drill to atomic level data in the data warehouse or source system to identify the customers or products affected by the problem and take action.

To increase the usage of BI tools, there are some aspects that need to be carefully considered. One of them is the type of user that will be working with them. For example, among power users, the best way to intervene is to purchase BI tools with strong Excel integration and deep analytics and visualization capabilities. In addition to this, applications that offer tight integration with planning tools also are a boon to power users who seek to model business scenarios. Among casual users instead, the trick is to focus on usability. This means delivering a clean interface where extraneous functions are hidden. Offering Web 2.0 capabilities via Flash and AJAX also helps, since many (but not all) executives and managers are captivated by interactive graphics. Also, adopt the MAD framework when building dashboards and parametrized reports so that you parcel information to users on a just-in-time basis, giving them only the information they need, when they need it.

In all cases, deliver fast performance and high-quality data: data defects and slow response times will discourage BI tools usage among every kind of user. To ensure good performance, implement a robust BI platform and a sound BI architecture that allows to scale users and queries rapidly.

It is also quite powerful to develop a marketing plan that is tailored to every group in the organization and that leverages a variety of media and channels (e-mail, Web, meetings, events, posters, training, help desk, etc.).

It has been previously highlighted that working with data and these instruments should be easy and practical as much as possible, that is why even presentation tools and applications must be regarded as an important matter. The challenge lies not in amassing BI data, but in addressing and engagingly presenting data that already exists.

Companies should increase the use of reporting tools, scorecards and dedicated portals to communicate inputs and impart insights to every employee. There should be readable ad-hoc reports, it should be possible to visualize even complex data findings in a natural and generally known way, alerts to exceptions should be made clear at all times, the manipulation of data and analysis should be available through an intuitive visual interface. To this end the set of practices known as “Report Analytics” has emerged as a new category that turns disparate data into dynamic reports for easy analysis and visualization. This kind of approach ensures end users to easily access, extract, aggregate, mine, transform and incorporate data from any combination of existing reports already published inside or outside the enterprise, then create, distribute and publish dynamic, interactive reports, without requiring the time or expense of IT involvement.

If these instruments do not require years of training and are designed to be intuitive, some form of “self-service” is allowed: interactive graphics, menu-driven functions, and browser-based GUIs enable non-IT staff to analyze and report on large troves of data quickly and easily.

Thanks to all these improvements the company will be able to communicate the value of BI to individuals and teams in an optimal fashion, together with conveying its deep belief in this kind of tools.

2 Chapter 2

2.1 How to become more analytical

The purpose of this chapter is to present lots of ideas, suggestions, best practices for a company to be more analytical. Following these advices on topics like how to manage data or analytical people, how to practically apply them and even how to take advantage of new and future trends, any company can really perform a step forward towards a brighter future.

The following paragraphs put under the spotlight the success factors in this process, that Davenport summarized under the acronym DELTA, that is Data, Enterprise, Leadership, Targets, Analysts.[1]

2.1.1 Data

Nowadays lots of companies have a huge amount of data at their disposal, coming from applications like ERP (Enterprise Resource Planning), CRM (Customer Relationship Manager), tools from software houses like SAP, SAS or Oracle, financial transactions and many other sources. The problem is that they are not able to use it efficiently, neither to gain insights nor to inform their decision making.

Data can present itself in many ways: from multidimensional cubes, as previously seen, to arrays of structured content with fields and variables, to unstructured, non numeric data (just as an example, there are more or less 30 billion pieces of content shared every month on Facebook). Usually this whole amount of data is referred to as “Big data”, that is datasets whose size is beyond the ability of typical database software tools to capture, store, manage and analyze.[5]

It can be said that the “lifecycle” of data has four major steps: it all begins with its acquisition, that relies on a decision about what data is needed and comes together with an integration between IT systems and business processes. The next step is cleansing, to make sure to analyze, detect and remove as much as possible poor quality data. Immediately after comes the organizational and storage phase: data needs to be processed in order to extract valuable information and save it into a format that is ready to use and can be worked on. The final step, that actually is more like a non-stop task, is about maintenance: data should always be updated and privacy, security and integrity must be ensured at all times.

Given the great deal of sources and the natural confusion that can derive from disparate formats and standards, companies need some help to manage and consolidate all this. For data to become usable, it must first go through a

process named ETL, that is Extract, Transform, Load. The “extract” phase obviously requires gathering data from all the sources that are available. The general purpose of the extraction phase is to convert the data into a single format which is appropriate for transformation processing, that is the following step. During this phase many processes are applied to derive from the gathered data content suited for the subsequent destinations of use. Among them there are processes like translating coded values or encoding free-form values, deriving a new calculated value, sorting, joining data from multiple sources (e.g., lookup, merge) and generating surrogate-key values. The final phase allows to load the data into the end target, usually the data warehouse, taking into account the many different rules or constraints defined in every database.

An overall efficient solution to interact with data can be a Master Data Management (MDM) system that, according to Wikipedia, has the objective of providing processes for collecting, aggregating, matching, consolidating, quality-assuring, persisting and distributing data throughout an organization to ensure consistency and control in the ongoing maintenance and application use of the information.

It is equally important to standardize data definitions to enable cross-departmental utilization and, of course, to eliminate or correct inaccurate, incomplete or inconsistent data. Moreover, to improve the data quality can be really useful to design processes *up front* to capture and validate data instead of correct it in a following moment, allowing also in this way to discover persistent sources of poor-quality data in order to intervene on them.

Another way to leverage big data is first to discover, and then to exploit unique data, data that no one else possesses. If a company manages to do so, it can create an edge over the competitors, due to the insights drawn and a better understanding of a particular situation. For example, data about sellings is usually for internal use only: starting from that, the company can identify patterns and customer’s behaviour that no one else has seen and can start to profit from them.

In order to be analyzed, data must be separated from the transaction-oriented applications in which it was created. That is why access to data is a relevant matter. To accomplish this goal, an Enterprise Data Warehouse (EDW) is a perfectly reliable solution, because it grants both transparency (data easily accessible to relevant stakeholders in a timely manner) and rapid queries and analytics. Even if it could be expensive and problematic to abandon old legacy systems that seemed to be working, these new technologies and techniques allow companies to better analyze, integrate, visualize and

consume data.

Other issues that need to be addressed to capture the full potential of big data are those regarding privacy, security, intellectual property and liability. There need to be well defined data policies about them and a precise strategy to assure an efficient data governance. Certain roles need to be played, like executive decision makers who decide what kind of data is critical or what kinds of data assets correspond to particular strategic targets, or groups that ensure that data and information can easily be accessed and analyzed (see BICC, paragraph 1.3.1).

2.1.2 DDD: Data Driven Decisionmaking

As soon as data is reliable, endowed with good quality and well managed, the company is ready to start exploiting it. The best way to do it is to base its decisions on it, on indisputable facts rather than intuitions or leader's "gut instinct". These are the grounds for the so called process of Data-Driven Decisionmaking (DDD).

A study conducted at MIT [6] proves that DDD can explain a 5-6% increase in the output and productivity of a company that implements, beyond what can be explained by traditional inputs and IT usage. DDD is also associated with significantly higher profitability and market value. In addition to this, a more recent study [7] has reported that organizations using business information and analytics to differentiate themselves within their industry are twice as likely to be top performers as lower performers.

According to economic theory, as information becomes more fine-grained and current, decisionmakers should optimally put more weight on it and the overall quality of decision should improve on average, changing from intuitive management to more numbers-driven decision-making.

Put more weight on information requires a careful validation of the latter, and this can be achieved with more active business experimentation that consequently improves the quality of decision making. Thanks to new, broadly available software and given some straightforward investments to build capabilities, managers can now base more and more decisions on scientifically valid experiments. It is true as well that older firms, with well-established routines and business practices and thus a higher degree of organizational inertia, may find the adjustment cost to adopt DDD too high. Firm age is, therefore, likely to be negatively correlated with DDD.

A fundamental part of the experimentation process lies in testing: a formalized testing can provide a level of understanding about what really works that puts more intuitive approaches to shame. Moreover, having a

shared understanding of what constitutes a valid test enables the innovators to deliver on it and the senior executives to demand it. That is why having a precise policy about testing proves to be a very efficient measure.

Companies that want testing to be a reliable, effective element of their decision making need to create an infrastructure to make that happen. They need training programs to hone competencies, software to structure and analyze the tests, a means of capturing learning, a process for deciding when to repeat tests, and a central organization to provide expert support for all the above. To do so, most of the firms that do extensive testing have established a small, somewhat centralized organization to supervise it.

A “test & learn” strategy widely used requires a six stages cycle: first comes the creation of an hypothesis about how the change will help the business, then the design of a test on the hypothesis (always making sure that the number of test and control sites is sufficient for statistical significance); following are the execution and the analysis of the test, ensuring that “lift” from intervention is statistically significant, keeping in mind that the most reliable insights relate to the potential impact and value of tactical changes; final steps are a plan rollout (studying attributes of test sites to determine whether rollout should be universal or differentiated) and the definitive rollout.

To make sure that this whole process sticks within the culture of the company, senior managers have to become accustomed to, and even passionate about the idea that no major change in tactics should be adopted without being tested by people who understand testing.

2.1.3 Enterprise

There is an aspect that can be underestimated in the process of becoming more analytical: the perspective under which all these changes should be made. It may be normal to focus all the attentions to technological issues or financial problematics, at risk of losing sight of what must tie them all together.

It is a major cultural change to instil and infuse the notion of a broad enterprisewide perspective to each and every component of the company, from top managers to lower employees. In fact, to build this kind of view it is not sufficient to integrate data or a central managed IT department: this change must directly affect the mind model of the staff, that has to forget about just individual tasks, needs, agendas and start thinking about the company as a whole. Without this kind of perspective a company is not able to deal with strategic issues like driving performance factors and to

start planning its future; the leit-motiv should be no fractured perspective, no fragmented information.

Once accomplished this fundamental mission, the IT department plays a big role in allowing all those intentions to become real. To avoid fragmented information it should gradually eliminate legacy systems and all those independent “silos” of information like data marts or spreadmarts (see paragraph 1.4.1). A platform that can standardize and integrate data should be provided and all users should find it easy to use, making it become the only source and destination of their information. This platform should provide users with the applications they need when they need it, should adapt as needs and strategies change and should become the primal tool in their everyday work, always ensuring standards for data privacy and security.

Having this platform working, the company should start to develop cross-functional projects, in order to gain new insights as their scope spreads widely to more departments and business areas.

Starting to draw real value from those procedures and understanding the importance of the progresses made thanks to them, the company could find itself to a point in which internal improvement is not enough. Looking outside its borders, the company could start to share not only data, but also analytics and analytical expertise with both customers and suppliers, creating in this way an “extended enterprise” able to take advantage and profit from the entire and whole environment in which it operates.

2.1.4 Leadership

Leaders are, by definition, the ones who should guide all the others towards what they believe is the target to reach. According to this, for a company to become more analytical, the support of its leaders is not an option, it is a prerogative. As stated in the previous paragraphs, leaders are responsible for all sorts of changes that must affect the companies, from cultural to technological ones. The most efficient way to convey the importance of these changes and to make them permanent is to “lead by example”.

They should be the first ones to assess the value of analytical and fact-based decisions, always demanding more data and analysis before a decision rather than intuitive and out of the blue inspirations. To this end, data driven decision must be encouraged and, when possible, rewarded; in the same manner intuitive and instinctive approaches must be rejected and skewed towards facts, models and analysis. If they are passionate and confident about this, there is a high possibility that all the others will be “infected” with this kind of enthusiasm. That is why leaders should promote

the emergence of other analytical leaders in every department and business unit, in order to enlarge its “alliance” basis. Here lies the importance of engaging business users and other stakeholders as much as possible, as opposed to merely informing them after the fact. Explaining or clarifying the thinking behind a decision or, in this case, the analytical model or application is crucial in gaining trust; setting the right expectations at the beginning (for example, regarding the quality of the data and the applicability of the models) and managing them as the project progresses increases both acceptance and the chances that the project will be successful.

To further boost the importance of analytics, leaders should give forth and make very visible the results of analytical projects and data-driven decisions and promote the success of these procedures between both internal and external stakeholders, in sum to their whole “knowledge” network.

2.1.5 Targets

Especially during tough economical times like nowadays, it is essential not to waste or use poorly any kind of asset. That is the reason why a company should plan carefully its financial and human resources investments: key business processes and distinctive capabilities must be found and acted upon.

It could not be easy for a company that has just realized that analytics is the right path to follow to detect and identify those capabilities or the processes that need to be improved. As starting point the company could analyze its performances, to spot what can be improved and which are the factors that drive those performances. For example, a company could begin to evaluate its relationship with the suppliers, in order to understand if the supply chain runs smoothly or can be improved in any way. Another possibility is to understand whether the customers are satisfied or not, and act consequently.

Of course, high potential targets for business analytics can vary by industry type and by how firms add value to the marketplace; thereby every company should assess its own capabilities, perhaps taking into account some possible similarities in market share or areas in which to intervene with already successful organizations of the same field.

Some business processes are better suited for analytics than others, so it’s upon them that a company should start to act or at least consider worthy of being improved. Among them are, for example, processes that require quick response times and real-time decisions, or processes that need cross-functional or cross-departmental capabilities that a well design analytical tool could detect in no time. Not to mention all the processes with low

average success rate, that almost certainly are in need of an improvement to be finally useful.

There are always some very good opportunities whenever certain conditions or needs are met: complex decisions with lots of variables and steps, decisions in which relationships (like with different departments for example) need to be clear or decisions that need extremely careful forecasts or anticipations.

Once all these targets are found, could it be possible to find themselves in the opposite situation to the beginning (no targets at all), with too many areas to improve or too many actions to take? To avoid this kind of problematics, it is useful to prioritize targets and don't spread the analytical efforts too thin across too many processes. It is always the best choice to carefully calibrate benefits and capabilities, as well as resources in order to address the right areas and to solve the most urgent problems.

2.1.6 Analysts

The presence of good quality data or cutting edge technologies really means nothing if there are no analytically oriented people in the company. Following Davenport's definition, analysts are workers who use statistics, rigorous quantitative and qualitative analysis and information modeling techniques to shape and make business decisions. Within the company there must be this kind of workers, even if with different backgrounds or degree of knowledge on the subject.

Among them there should be passionate senior executives, eager to drive the analytical orientation and capability of their organization. The CFO (Chief Financial Officer) should focus on analytical domains in addition to finance and accounting, in order to commit some resources to that end as well; more importantly, the CIO (Chief Information Officer) holds the responsibility for changing the culture and the analytical behaviours of the employees and need to establish long term strategies, making sure that the analytical tools provided are well understood and efficiently used. If, at the same time, even the CEO (Chief Executive Officer) shares the same beliefs and passion in analytics, the rise of the company is just a matter of time.

Alongside those high-rank employees, there should be lots of professionals or semi-professionals deeply involved with analytics in their everyday worklife. They design and carry out experiments and tests, create analytical applications and algorithms, perform statistical analyses on key business problems to improve decision making, are in close relationship with the IT department and provide a sort of "bridge" between purely analytical people

and business managers.

There are also many workers that can be called analytical “amateurs”, because they are continually exposed to analytics and had become knowledgeable consumers of it; even if they are not so high-ranked within the company, they still are able to gain their own insights from the prolonged use of these tools and can apply them to their work.

The common denominator of all these workers must definitely be their analytical skills, regardless the degree and the extent of their knowledge. For some they would be basic, for others they would be very deep and typical: the important thing is that these skills are in place and tend to be continually improved.

There must be quantitative and technical skills: employees should be familiar with statistical analyses, should be able to develop models and algorithms, should be able to properly use the software tools at their disposal, should not blush in front of a business dashboard. Moreover, there must be more than just mathematical skills. Business knowledge should be broadly present, both to be able to work at the interface of business processes and to know the business drivers of the company, in order to recognize possible key opportunities and gain the right insights. In order to fulfill the enterprisewide approach previously described, there must also be relationship and consulting skills: analysts should be able to work with employees in every department (promoting rotational deployment of analysts could be a meaningful practice), should share their work and more importantly their insights and results with business managers, senior executives or even outside the company with customers or suppliers. Companies should consider also developing relationships with universities and associations.

Employees with the right mix of quantitative, technical and interpersonal skills are the best workforce that an analytical company can desire.

If a company is blessed with this kind of workforce, is this status enough to assure success and profit? In other words, how can a company get the best from their people? The answer is that analytics and some wordly wisdom are the key to manage the workforce.

In a survey about “talent” analytics [8], six areas of intervention are presented. Thanks to analytical tools human-capital facts like individual performances and enterprise-level data such as head count, contingent labor use, turnover, and recruiting are constantly monitored. Analytical human resources (HR) collects or segments HR data to gain insights into specific departments or functions and integrates individual performance data, such as personal achievement in key result areas, with HR process metrics, such as cost and time, and outcome metrics, such as engagement and retention.

Human-capital investment analysis helps an organization understand which actions have the greatest impact on business performance. Workforce forecasts analyze turnover, succession planning, and business opportunity data to identify potential shortages or excesses of key capabilities long before they happen. A talent value model can help managers design personalized performance incentives, assess whether to match a competitor's recruitment offer, or decide when to promote someone. Finally a developing trend is "talent supply chain", that helps companies make decisions in real time about talent-related demands, like for example next-day work schedules based on predictions and forecastings.

Besides these quantitative methods, there are also some advices to improve the work quality of an analyst. Motivation means a lot for them and the retribution alone is not sufficient to keep them satisfied. Interesting and challenging work that allow them to utilize their skills must be provided; the results of this work must be important and make a meaningful contribution. A certain degree of autonomy, freedom and flexibility should be granted, in order for them to leverage their skills and unleash their potential. Last but not least is the relevance of investing in the updating of the analysts' skills, particularly those that accelerate strategic business benefits.

2.2 How to apply analytics

Companies that really aim to be more analytical should consider all the features that were presented so far, asking themselves whether these capabilities are in place or not and if their people are ready for the changes that are going to happen. A good starting point could be to embed analytics and make them an integral part of every major business processes in order to get people used to them and make them gradually transparent to the everyday user, by that time able to profit from its usage during daily tasks. When automated processes are designed around repetitive decisions and tasks it's easier to spread this kind of tools, allowing to increasingly eliminate gaps between insights, decisions and actions. At the same time the company builds and strengthens a culture of analytical decisions, a "test and learn" philosophy and a commitment to fact-based decision making.

Implementing analytics-enabled processes requires applying four major perspectives. The first one is process implementation: given the iterative nature of many analytical applications, it is important to measure baseline process performance first and to run the enhanced process in parallel to the original, in order to refine the new one and measure its performance and value. The second one is model implementation: analytical projects

usually require different tools and development methodologies, that need to be performed by business analysts and programmers with special skills in statistical methods and modeling. Next comes system implementation: analytical system must be incorporated into the set of systems and technologies supporting the business process. The last one is human implementation: only people can tell if an embedded application produces good decisions, so employees should be involved in developing, managing and monitoring the assumptions and results of any embedded model. Companies should try to create the right mix, suited to their requirements, of these four perspectives.

2.2.1 Cultural changes and challenges

Building an analytical culture is as important as setting up every technical and technological detail to make analytics work. It may seem something abstract, but without the right mindset a company could have perfect analytical tools and still not draw value from them. If people do not understand and totally embrace the reasons that brought the company to such an orientation, the technology itself could not do wonders.

It is particularly significant for people to be really persuaded that this is the right way to operate, unless it will be very difficult to overcome the natural habit of, for example, taking a decision because it seems the right one at that moment, letting instinct and intuition prevail without a solid background of proofs. Instead, as previously seen, fact-based decision must be one of the pillars sustaining an analytical company and this could be achieved thanks to a gradual but relentless cultural change.

The fact that people do not just take something for granted and instead always try to find out real causes and proven facts to corroborate a theory or a business model, process, practice, is just a part in a more general search for the truth that allows and rewards only objective logic, without preconditions or biases and is based only on data, not stories or anecdotes. Even if some results clash with what the conventional wisdom suggests or are in some way unexpected, if they are consequent upon a deep experimentation or a precise analyses, they must be considered more than worthy of attention.

Moreover, results of fact-based analysis must become the only basis upon which decisions are made and actions are taken. It must also be said that negative results cannot be discarded, ignored or regarded as just an accident: they should be as useful as positive ones. Knowing that a certain practice, model, action does not work or does not put up results as forecast is a perfectly helpful information. If that wasn't the case, people could begin to skew results in a positive direction just to avoid bad outcomes, causing even

worse consequences.

Another relevant cultural element that must be achieved is the awareness that the status quo of the company, much as positive or profitable, must be continuously reviewed and renewed. The catchphrase “never rest on your laurels” is perfect for this matter and should be applied to every aspect of the company, especially to models and assumptions.

It is probably easier to understand when a technology is becoming obsolete and must be replaced rather than to recognize when a model, for example, of a business area of interest or some assumptions about customers has changed.

The financial crisis started in 2007 provides an excellent illustration of the importance of continuous review of analytics. In fact, financial models and assumptions were not timely reviewed: banks did not recognize that their models took for granted that house pricing would still rise and that customers would be able to pay off their mortgages; as a result, they continued to make subprime loans, eventually causing the chain reaction that made that whole market fall apart and collapse.

To prove that the lesson has been learned, companies need to regularly review their models to know when it’s time to change, constantly seek out new insights and carefully monitor their strategies; as a consequence, if the strategies change, their targets should be updated too.

In order to always stay at least one step ahead, companies should get into the habit of reviewing also the analytical activities of competitors, to understand how their own activities compare to theirs and to be sure of maintaining a competitive advantage or, if the latter was lost, to quickly figure out how to regain it.

Relentlessly looking for changes and updates outside the borders of the company, one thing that must not be forgotten is that customers and their preferences are extremely inconstant, moody, flighty and change for sure over time. Organizations need to make sure to frequently review models based on customers and customer opportunity, risk or behaviour in order to be always in line with the current trends and not be left behind competitors who could have a better understanding of these kind of shifts.

Customers, however, are not the only actors in the environment of a company. That is why organizations must be positive that all their partners or even suppliers keep up with the changes and the latest trends. The presence of a weak point in the “analytical ecosystem” cannot be allowed.

Lastly, an advice that should be obvious but that absolutely needs to be taken: companies should at least annually review the new technologies, information and data sources that might affect their businesses in the future.

The most important analytical companies didn't become such by always reacting to problems and opportunities, they anticipated and prepared for them. In addition to this, they were always ready to face any challenge that was put in front of them. For instance they were able to gain momentum for analytics, that means they were able to recognize when and why was the right time to develop that kind of capabilities. Whenever there is a problem or an improvement opportunity (need to raise performance, lower costs, increase innovation), an accumulation of potentially useful data or a strategic business opportunity, every company should make sure to be able to act upon them, learning from how successful ones already did.

2.2.2 Marketing and supply chain examples

Marketing and supply chain have always been two areas in which business intelligence and analytics solutions have blossomed and prospered. The availability of a huge amount of data and the proliferation and ramification of processes regarding those matters proved to be the perfect ingredients to be fed to new technologies and best practices. Lots of applications are tools have been developed and are currently used by many companies.

Some of the typical and most used applications in marketing are:

- CHAID (Chi-squared Automatic Interaction Detection): statistical technique used to select groups of consumers and predict how their responses to some variables affect other variables; a segmentation “tree” is created and the analyst can add different variables, or branches, as long as it is statistically significant. Like other decision trees, CHAID's advantages are that its output is highly visual and easy to interpret.
- Conjoint analysis (also called multi-attribute compositional models or stated preference analysis): statistical technique used to evaluate the strength and direction of customer preferences for a combination of products or service attributes. It requires research participants to make a series of trade-offs. Analysis of these trade-offs will reveal the relative importance of component attributes. To improve the predictive ability of this analysis, research participants should be grouped into similar segments based on objectives, values and/or other factors.
- Lifetime value analysis: analysis to assess the customer lifetime value (CLV), that is the net present value of the cash flows attributed to the relationship with a customer. The use of customer lifetime value as a marketing metric tends to place greater emphasis on customer service

and long-term customer satisfaction, rather than on maximizing short-term sales. In theory it represents exactly how much each customer is worth in monetary terms, and therefore exactly how much a marketing department should be willing to spend to acquire each customer.

- Market experiments: using promotions, changes in the website and other techniques, marketers test variables to determine what customer respond most to in a given offering. Normally involves different treatments based on assumed casual variables for different (ideally randomized) control groups, with an outcome measure and comparison from which the effect of the treatment can be observed.
- Multiple regression analysis: statistical technique for predicting the value of a dependent variable in relation to one or more independent variables. While basic regression assumes linear relationships, modifications of the model can deal with nonlinearity, logarithmic and other more complex relationships.
- Prize optimizations (also called Revenue Management): the application of disciplined analytics that predict consumer behavior at the micro-market level and optimize product availability and price to maximize revenue growth. The primary aim of Revenue Management is selling the right product to the right customer at the right time for the right price. The essence of this discipline is in understanding customers' perception of product value and accurately aligning product prices, placement and availability with each customer segment. Usually price elasticity curves are constructed in order to understand the impact of price across a range of changes and conditions.

Some of the typical and most used applications in supply chains are:

- Capacity planning: the process of determining the production capacity needed by an organization to meet changing demands for its products. In the context of capacity planning, "capacity" is the maximum amount of work that an organization is capable of completing in a given period of time and the aim is to identify and eliminate bottlenecks.
- Demand-supply matching: determining the intersections of demand and supply curves to optimize inventory and minimize overstocks as well as stockouts.
- Location analysis (also called Facility location): branch of operations research and computational geometry about mathematical modeling

and solution of problems concerning optimal placement of facilities (stores, distribution centers, manufacturing plants..) in order to minimize transportation costs, avoid placing hazardous materials near housing, outperform competitors' facilities, relate company locations to customer locations etc.

- Modeling: process of creation of models to simulate, explore contingencies and optimize supply chains. Many approaches employ some form of linear programming software and solvers to seek particular goals, given a set of variables and constraints.
- Routing: the process of selecting paths in a network along which to send network traffic, in this case delivery vehicles.

The adoption of Supply Chain Management (SCM) systems can lead to better financial performance through an improvement in inventory turnover and reduction of sales expenditure. Additional advantages in the supply chain can be realized taking advantage of the previously seen techniques. Yet, on the other hand, despite major investments in SCM systems in the last decade, those systems are often struggling to achieve a competitive advantage. That is why analytics must enter the picture and provide that kind of advantage.

Business process redesign and inclusion of inter-organizational business processes is needed in order to exploit the advantages of fact-based strategic supply chain planning. With collaborative business processes and the seamless integration of processes of different organizations, dynamic and flexible collaborations can be created in order to improve performance.

To address this issue some answers are found in a survey on the relationship between BA and the SCOR model. [9] Following Wikipedia definition, Supply-chain operations reference-model (SCOR) is a process reference model developed by the management consulting firm PRTM and endorsed by the Supply-Chain Council (SCC) as the cross-industry de-facto standard diagnostic tool for supply chain management. It is based on five distinct management processes: Plan (processes that balance aggregate demand and supply to develop a course of action which best meets sourcing, production, and delivery requirements), Source (processes that procure goods and services to meet planned or actual demand), Make (processes that transform product to a finished state to meet planned or actual demand), Deliver (processes that provide finished goods and services to meet planned or actual demand, typically including order management, transportation management, and distribution management), and Return (processes associated

with returning or receiving returned products for any reason).

Business analytics must penetrate into each of these aspects: in “plan” there should be an application analyzing data to predict market trends of products and services; in “source” the use of an agent-based procurement system could provide and improve supplier selection, price negotiation and supplier evaluation; in “make” a tool could check the correct production of each inventory item not only in terms of time, but also about each production belt and batch; in “deliver” various application of BA in logistics management have been made in order to bring products to market more efficiently.

Often companies do not use the information gained to fine-tune the day-to-day operations of their business processes and merely collect it in business data warehouses for later use. However, following these advices they can draw real value and optimize the performances of a complex area like the supply chain.

2.2.3 Retail analytics

Retail is a surprisingly active sector in regards to the discovery of areas of interest for analytical tools and an aggressive adoption and exploitation of analytics has led to competitive advantage among some of the world’s most successful retailers.

In a paper about the subject [10], Davenport illustrates some widely adopted trends that are best suited for this particular sector.

With the help of analytical tools, retailers can:

- Develop close relationships with customers based on a deep understanding of their behaviors and needs;
- Deliver the targeted advertising, promotions and product offers to customers that will motivate them to buy;
- Balance inventory with demand so you’re never out of stock or carrying excess inventory;
- Charge exactly the price that customers are willing to pay at any moment;
- Determine the best use of marketing investments;
- Locate stores, distribution centers, and other facilities in optimal locations.

The range of intervention that analytical tools provide nowadays is so wide that retailers need to concentrate only on the most relevant possible improvements and usually they choose the one that can reduce costs and improve profitability relatively quickly and with relatively low investment. Obviously, the more resources a retailer has, the more it can tap from this analytics source.

Not forgetting that many trends have already been presented in the previous paragraph about supply chain, some major adopted analytical trends in retail include:

- **Assortment Optimization and Shelf Space Allocation:** using analytics to determine what products to offer in what quantities. This process allows the retailer to know which are the most sold and the most profitable products. In addition to these, it tells retailers how to arrange products on the shelves in order to put together products that coupled sell even more than singularly. Assortment optimization can lead to a 7-15% increase in sales as well as a significant reduction in stockouts, lost sales and therefore dissatisfied customers
- **Customer-Driven Marketing:** use of customer data to segment, target, and personalize offerings. Thanks to loyalty programs like club cards retailers are now able to acquire knowledge and gain a better understanding of their customers. Analyzing data about selling they can detect, for example, which kind of customer buys a certain product, opening the possibility of much more targeted advertisements, promotions or offers.
- **Fraud Detection and Prevention:** the use of analytics to detect and prevent online and offline fraud, mostly on stolen credit card information and fraudulent merchandise returns.
- **Workforce Analytics:** optimization of staffing with regard to cost, customer shopping patterns, and locations. A combination of scheduling techniques that take into account factors like forecasted demand, promotions, upcoming inventory and applications that measure the performances of the employees, including the ability of recognizing potential store managers.
- **Store-Level Empowerment:** giving store managers and employees the ability to analyze their businesses. If managers and employees can analyze key store data, they can input local factors into models, and explore alternative approaches to performance improvement.

- **Multi-Channel Analytics and Data Integration:** integration of data and analytics across multiple customer channels or touchpoints. Techniques to connect with their customers through every possible channel, including online, call centers, mobile, email, direct mail, and physical stores.

There are also a couple of emerging trends that really try to open a window on the future and want to exploit the latest technologies and findings. The first one involves *real-time* offers and has the clear intent of both surprising and pleasing the customer with something unexpected. Taking into account the amount of data collected through loyalty cards and therefore the deep understanding of what a particular customer is willing or used to buy, and noticing the exponential increase in the use of smartphones or “intelligent” portable devices, retailers could start to design automated processes to propose individually targeted offers to the client right after he enters the store. In this way, thanks to the perfect timing and pertinence of the offer, the customer could buy products that he would have otherwise forgotten or that he had considered purchasing in other stores.

The second trend involves what has been called “sentiment analysis”. This technique allows to aggregate and analyze qualitative content found all over the Internet (web pages, blogs, social media..) and makes it possible to determine consumer sentiments about particular topics. Both the strength and direction of the sentiment can be determined. Once studied these contents, companies could launch suited slogans, advertisements or campaigns with the confidence that they will be very much appreciated because similar to what has already been liked so far.

2.3 How to capitalize on future applications

As briefly reported on the last lines of the previous paragraphs, there are new analytical trends that intend to explore some new and emerging areas, for example the worldwide know phenomenon of social networks. These apparently endless sources of data and ever-growing aggregators of users have become the primary target of companies which understood that there is more to exploit than just the classical advertisement. New ways of harnessing business intelligence and analytical tools are discovered as soon as brand new opportunities present themselves.

2.3.1 Real-time analytics at Twitter and Facebook

Facebook is the most visited website in the world, always “fighting” with Google for the first position, while Twitter and Amazon.com are in the top ten, along with Youtube and Wikipedia. So no wonder that even the experts in business analytics turned their eyes in that direction, discovering new ways of drawing value from them. By the way, as explained in the next chapter, business analytics is one of the reasons why they are in that position in the first place.

Twitter is an online social networking and microblogging service that enables its users to send and read text-based posts of up to 140 characters, informally known as “tweets”. It was created in March 2006 by Jack Dorsey and launched that July. Twitter rapidly gained worldwide popularity, with 200 million users as of 2011, generating over 200 million tweets and handling over 1.6 billion search queries per day.

In order to manage all this data Twitter uses Rainbird, a distributed, high-volume counting service built on top of Cassandra, an open source Apache project that allows horizontally scalability and very low latency. Rainbird is able to write 100,000s events per second, query them with hierarchy and multiple time granularities, and return results in less than 100 ms. This service allows Twitter to perform all kinds of analyses, from checking promoted products to counting tweeted URLs (by domain or subdomain), from evaluating per-user Tweet interactions (favourites, re-tweet, follow) to assess the presence of arbitrary terms in tweets or calculate the number of clicks on t.co URLs (a URL shortening service created by Twitter itself).

Facebook is a social networking service and Web site founded by Mark Zuckerberg and launched in February 2004, operated and privately owned by Facebook, Inc. As of July 2011, Facebook has more than 800 million active users. Users must register before using the site, after which they may create a personal profile, add other users as friends, and exchange messages, including automatic notifications when they update their profile.

Facebook’s real-time analytics system is based on an HBase architecture (an open source, non-relational, distributed database developed as part of Apache Software Foundation’s Apache Hadoop project) able to process 20 billion events per day.

Thanks to the widespread propagation of social plugins, anything that people can do is captured and fed back through Facebook and anything done on Facebook can be displayed on the website, building closer relationships between the two. For a business or brand, or even an individual, it seems

like a win-win situation, because the more engaging the content is, the more people see it, the more it pops up in news feeds, the more it drives traffic to the site.

Facebook provides also a service called “Facebook’s Insights System”: it is an analytics system that allows everyone to access all the data being collected up to that point. It offers statistics like *Like button* analytics, *Comments* box analytics, information about popular pages, demographics, and organic sharing.

Using this Insights System, content producers can see for themselves what people like; this knowledge will enable them to generate more of what people like, which raises the content quality of the web, which gives users a better Facebook experience and producers a better return on investments.

It is also extremely interesting to notice that *Likes* seem to follow something like a power law distribution: the long tail gets very few likes, but some resources get huge numbers of likes. Companies who noted this fact could start to exploit “hot” regions or “hot” keys, and lock contention.

2.3.2 Business Intelligence 3.0

An Unisys and IDC study predicts that, in corporations with more than 500 employees, the number of information workers using social networking platforms will almost double between 2009 and 2014. The same research report predicts that the number of business interactions will grow four-fold, from 3.5 trillion in 2010, to 12.7 trillion by 2013. These numbers convey the idea of an even bigger amount and stream of data that will characterize our next future.

Today “unstructured” data, such as social media posts, free-form web content, images and video files, can have a major impact on company performance, but it does not follow the same convenient rules as traditional data sources. The need to gather insight from these unstructured sources of information has given rise to a phenomenon that has been called “business intelligence 3.0”.

This new class of public information can be categorized into three distinct types:

1. Images and video and audio files: up until now these kinds of data have been almost ignored because not language based, therefore traditional BI solutions don’t have the capability to extract and transform the data into useful information.

2. Secured-access applications: all data that resides behind password-protected websites that are not under an organization's direct control and do not conform to its structured data standards. Examples include online banking or membership sites such as Twitter, LinkedIn and Facebook. Accessing information from these sources typically requires human intervention to manually search for the desired information.
3. User-generated content: this ever-growing data source includes all kinds of self-published product ratings and reviews, blogs and other online publications, market research reports and partner, supplier, customer or competitor websites.

To gain new insights about those topics companies should start to reason outside the box and to think about new ways of exploiting this huge and often overlooked amount of content. The following are just some examples of how to harness this kind of data:

- Competitive intelligence: traditional competitive campaigns rely on a time consuming, manual analysis of competitive products, pricing and promotions. By accessing competitor and supplier pricing on the web in real time, businesses can lock in the best deal at the point of purchase, monitor procurement cycles and track inventories. If this could be done automatically with a suited tool, companies would be able to speed up many processes and to better adapt to market and business expectations.
- Public opinion and perception: the entire spectrum of self-published, non-vetted public sentiment and feedback from social media and networking channels is very real and has measurable impact on company reputation, sales and market share. The ability to monitor, in real time, consumer conversations, competitor announcements and offers, and partner activities provides companies with up to the minute information that can be used in their business and marketing strategies to preserve and protect their position. Forward-thinking organizations use this new category of market intelligence to refine marketing programs and sales tactics to attract new customers and improve public perception. They can also reduce their risk of coming in late with a "me too" solution, and in a crisis situation, to gather intelligence on perceptions quickly to decrease any lasting damage to a corporate reputation. Moreover, before taking a decision, it could be useful to cross-reference its possible effects in the social network environment

or, more generally, in the World Wide Web, in order to understand if it has already been done and with what consequences and if it would be accepted or, on the contrary, rejected or marked as inappropriate, following actual trends and public tastes. It would be like feeling the public opinion's pulse in almost real time and react to it accordingly.

- Cloud and SaaS applications: most companies rely on a network of numerous CRM, accounting, procurement and other systems to optimize their operations, and today many of those applications are delivered as a service on the web or hosted in the cloud. While these systems offer convenience and low overhead, they are typically departmental in nature and not managed by a corporate IT staff. The result is a very complex application infrastructure that operates outside the bounds of traditional BI. Organizations that are able to synthesize cloud and SaaS based data alongside internal and legacy systems can provide decision makers with timely and complete insight they can use to identify and capitalize on trends, change a course of action or modify business processes to improve operations.
- Partner and supplier systems: many companies deal with a large and diverse supply chain that relies on numerous external applications. Critical and time sensitive data is often sequestered in portals and web applications that can only be accessed manually, which limits the information's usefulness because it is either obsolete or littered with errors due to manual re-keying. The power to automate the collection of data from any partner or supplier system, including supply chain intelligence, logistics performance, financial/cash flow reporting, benefits administration and order entry, can enable businesses to improve customer service, drive down operating costs, and build stronger, more competitive industry partnerships.

2.3.3 “Self-service” analytics

Many companies must everyday face problems and hear complaints from managers and employees about lots of issues, some of which regarding the inability of creating effective report upon which managers can work or the pressure of working with tools and resources that require too much of an effort both in time and difficulty.

Multiple data sources and ad-hoc reporting needs are problems common to many organizations. The extensive presence of spreadsheets and the parallel utilization of many different systems forces employees to be able to

interact with at least three or four disparate tools. The process of creating custom reports to many petitioners and of providing data access to the many resources available takes up a lot of IT's time, that could be certainly better spent on much more strategical IT tasks.

The purpose here is to be able to efficiently gather data in order to generate reports so that managers could determine how best to meet their objectives; besides, user's requirement must be fully understood because that is the key to a successful BI and BA implementation. The IT Team must take the time to understand business manager's needs before starting any project; moreover, they have to listen to what users at every levels need and want. The aim is to shift analytic tasks from the IT team to the actual users and providing even nontechnical users with the tools and capabilities to access, analyze, and share data on their own: that is the meaning of self-service analytics.

To do so, a solution can be to develop a unified presentation layer across multiple systems that has to be able to get answers from any data source. The software should be easy to use and should quickly generate powerful reports to the end users, that become the direct "consumer" of this unique set of tools, without having to ask or wait for IT to help.

Some best practices have been developed to help organizations correctly implement this kind of approach and technology. The first piece of advice is that understanding groups of users and their needs makes it easier to find a single solution that fits everyone. To make this task easier, it can be particularly useful to break users into separate groups, primarily based on their needs and characteristics such as:

- The frequency of data they need (dynamic, weekly, monthly)
- The level of data needed (daily operational data, strategic data)
- Which data sources they need to access
- Type of reporting (Monthly, ad-hoc, etc)
- Skills of users

Once the users are no longer a mystery, companies should include existing, familiar reports as part of an initial deployment to speed their adoption and then gradually drop them when users accustom themselves to the new system. To be better prepared for future situations it must be considered a solution that can scale with new data sources, more users and new requirements, should the necessity arise. Finally, even if this kind of solution has

proven to bring benefits, companies should consider anyway costs such as training and data reconciliation to draw their own conclusions and prevent them from taking a lightheaded decision. Questions like “How many systems does a user need to learn?” or “How much time are people spending on reconciling data versus understanding and using it?” should be asked in order to understand whether it is a good idea or not to move forward to the realization of the self-service approach.

If companies succeed to deploy this kind of solution, they will be experiencing multiple benefits: first, there will be a dramatic reduction in time needed to answer critical business questions. Users will be able to generate, on their own, the reports that they need from a trusted, updated and enterprisewide application so that the IT department will save time as well. In this way even manager’s dependency on IT will be reduced. Moreover, the overall user experience will improve and also the total cost of ownership will drop, due to the utilization of a more efficient unique solution.

3 Chapter 3

3.1 Success cases

The purpose of this chapter is to illustrate how and why a number of companies has become worldwide successful and famous thanks to analytics: some of them set an example to be followed and some others offer instruments and expertise to every other company willing to take that road. That is why the following paragraphs will present not only business cultures and philosophy but also best practices and concrete products.

3.1.1 SAP

SAP AG is a German software corporation that makes enterprise software to manage business operations and customer relations. Business analytics from SAP encompass a complete offering, from any analytics application to data warehousing and BI, from enterprise performance and information management to governance, risk and compliance. The product portfolio is meant to provide an holistic integrated approach to analytics and can be summarized with four main targets:

1. Tame information chaos
2. Turn information into insight
3. Use insight to drive performance
4. Optimize performance by taking account of risk.

The underlying and pervasive company's beliefs in BI and BA are based on four key themes: they must become simple, seamless, social and strategic.

Simplicity is a primary aim of many companies and in fact the market is filled with products and solutions that make your everyday life simpler; SAP is trying to transfer this concept also in the office environment because they recognized that ease of use is the number one barrier to the deployment of BI. "Easy" does not mean that the power of the tool is low or that the information processed must be basic, shallow, not at all complex and articulated. Simple here really means intuitive: employees should be able to use the provided tools without having to read a training manual or participate on a training course. They should easily see the available information, use Google-like techniques to search and drill through the data, use gestures to select values from, for example, clear graphs and generally be able to ask and answer new questions with just a few clicks. To facilitate their diffusion

it is useful to bring BI and BA directly into the environments the people are already using, for example providing access to information through a menu option within the tools: the catchphrase here is WYN - WYN - WYN, what you need - where you need it - when you need it.

The ubiquitous presence of “smart” mobile phones and tablets represents a great opportunity to have applications always close at hand and for marketing the information assets throughout the organization. Mobile devices can noticeably expand the horizon of BI because first almost everybody has one and second they can be used even in environments where it is not handy or possible to have a pc station or even a laptop.

Another feature linked with ease of use is the speed of a particular tool or application: if it’s not fast, an iterative analysis or the processing of big amounts of data takes forever to be executed. That is why a combination of new technologies like in-memory processing, column databases, hardware acceleration (among with lower memory costs) has been developed to create a faster version of the BusinessObjects suite.

Information use must also become more *seamless*, which means that throughout the organization people need to be able to access information form anywhere and trust the quality of the provided information. Top-to-bottom visibility is required so all the different layers of information are linked to each other and sources, updatings, modifications can always be tracked, making the overall system fluent, credible and trusted. On this matter SAP recognized that there must be same corporate tools to manage personal information instead of personal spreadsheets that contribute to create multiple “versions of the truth”.

Companies should also be able to analyze and extract value from unstructured information, like text messages: being able to synthesize positive or negative sentiment, to understand how urgent the issue is and on which product, to know if and how any competitor is mentioned, can give any organization an edge over the others because it allows them to automatically react, take note or fix whatever is being highlighted. Moreover, there are also voice-to-text tools that allow to apply the same procedures over, for example, all the conversations of the firm’s call center.

SAP also offers many services involving on-demand BI because it recognized that people are starting to be less reluctant to share their information and data with organizations they know they can trust, just as people trust banks with their money (it can be said that banks offer money on-demand!). These services grant more security and are more convenient because information is available and can be accessed from everywhere.

Business intelligence and analytics must become more *social*, because it has been proven that collaboration is incredibly important for business performance. In a research conducted by Frost & Sullivan in fact it has been found that a culture of openness contributed 36% to collaboration quality, more than twice the impact of a structure of decentralization (16%) or the use of collaborative technology in strategy implementation (16%), more than five times the impact of the breadth of collaboration in strategic planning (6%), and more than seven times the impact of the use of collaboration technology for strategic planning (5%) [11].

Collaborative decision making can combine social software with BI platform capabilities to share information and have a much better understanding of any issue and that is why a platform called StreamWork has been developed. Thanks to this platform users can create a so called “activity”: this activity brings together the people that need to collaborate, the information needed to make the decision and also methods to help making it, like comparisons, pro & cons shots, ranking or voting tools.

Finally BI and BA tools must become more *strategic* to the company because it happens that even having a good strategy people struggle to turning it into execution: 90% of organizations fail to execute their strategies successfully and 95% of a typical workforce does not understand its organization’s strategy. The first thing to do about this problem is have a single view of the strategy across the organization, there must be a unique place to go for employees to know it and from this strategy management site must cascade the high-level objectives down to initiatives, key performance indicators and goals that employees have to follow.

Performance and risk must always be monitored and great attention must be put on what’s unexpected, not only about financial but also on, for example, natural events to always be prepared and possibly foresee them rather than react to them. Tools and application like “what if” analyses should always be used to figure out what to do to achieve the goals and to actually use information to shape strategies.

Browsing through the SAP Web 2.0 Blog two applications similar to what was presented in paragraph 2.3 about future tools can be found.

The first one is the SAP BusinessObjects Social Network Analyzer (SNA), a platform that aggregates existing enterprise data to display and discover organizational relationships. SNA is able to create a so called “social network” within the organization by importing and aggregating all the corporate relationships between people that are already recorded in business applications, such as:

- Hierarchies from the human resources system
- Data on who worked on which deals from the sales force automation system
- Partner, customer, and partner supplier contacts along the supply chain
- People who work on similar transactions within the operational systems

Three main functions are provided:

1. Refine: allows to search, filter, aggregate information about people in the social network
2. Explore: allows to view and browse corporate connections and relationships
3. Connect: allows to visualize the connections and to determine the shortest number of relationship steps between various individuals

The following pictures show the power of this tool.

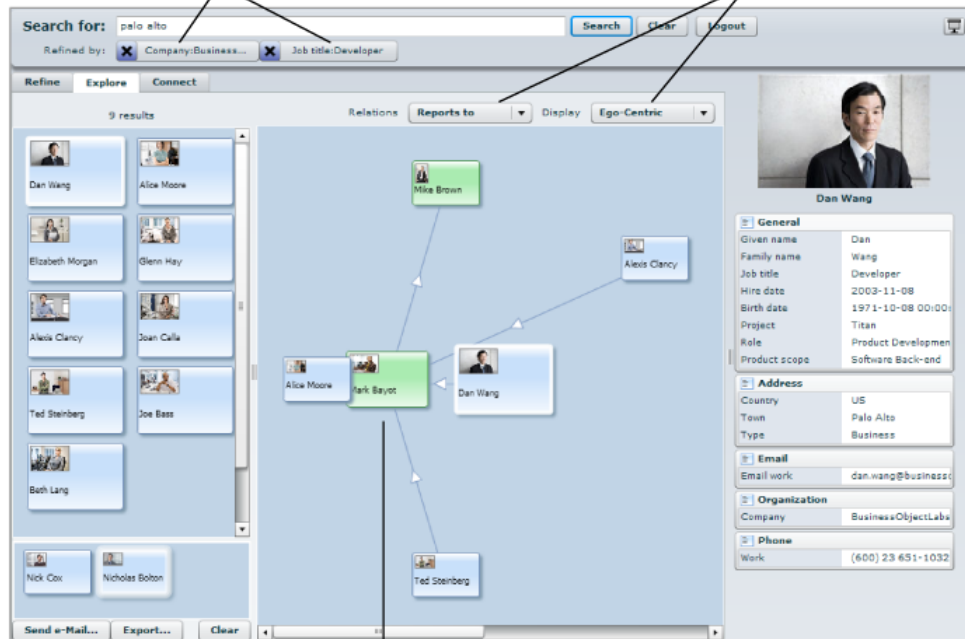
Refine Search the enterprise social network for people, groups, etc.

The screenshot displays an enterprise social network interface. At the top, there is a search bar with the text 'palo alto' and buttons for 'Search', 'Clear', and 'Logout'. Below the search bar are three tabs: 'Refine', 'Explore', and 'Connect'. The 'Refine' tab is active, showing a pie chart and a list of filters. The pie chart shows the distribution of job titles among the search results. The filters include 'Job title', 'Product scope', 'Role', 'Project', and 'Company'. The main area displays 33 search results in a grid of person cards. Each card shows a person's name and a small profile picture. On the right side, there is a detailed profile for Elizabeth Morgan, showing her general information, address, email, and phone number. Arrows point from text labels to specific parts of the interface: one points to the search bar, another to the 'Refine' sidebar, and a third to the profile information for Elizabeth Morgan.

Filter the results by any criteria available in the underlying data sources

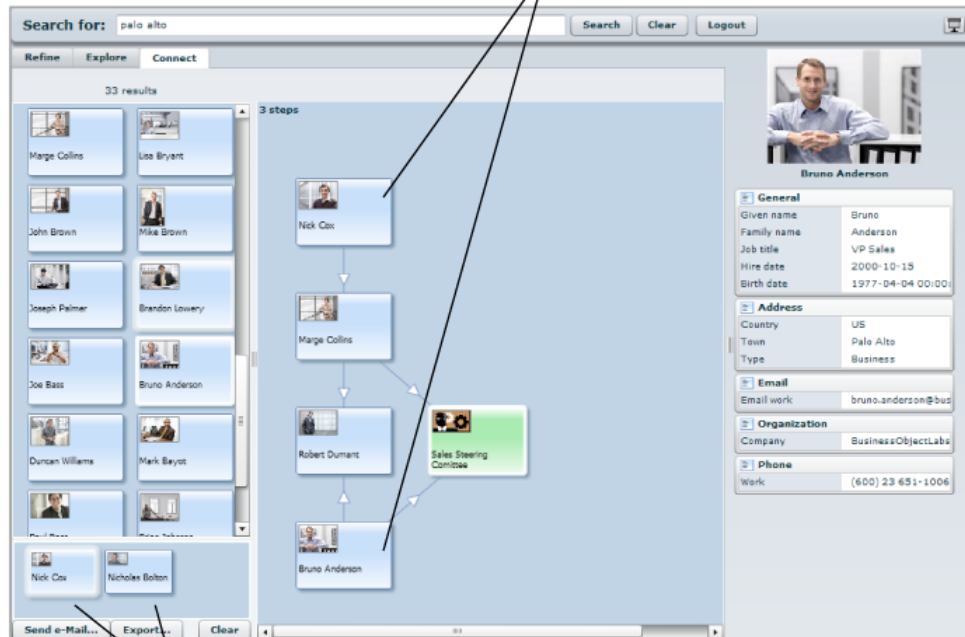
Information about the person, aggregated from multiple systems

Explore Result set refined through the use of filters Choose different views of a person's network



View and browse corporate connections (employee of, worked on project with, etc.)

Connect Find the shortest link(s) between two people



"Clipboard" area: create a collection of people (e.g. new cross-functional team, etc.), then send them an email, or copy their details to another system

Figure 4: Refine, Explore, Connect tools

This kind of tool can help to have a clear picture of the people working within the company, to highlight or discover relationships, to build communities or manage talent, for example, facilitating the sharing of time and experience between young new employees and old ones.



Figure 5: Augmented reality map



Figure 6: Augmented reality view

The second application is a SAP BusinessObjects Innovation Center project to build an “augmented corporate reality” prototype. The application has to run on mobile phones or tablets endowed with a camera and Internet connectivity: the aim is to use the camera to frame a particular place and connect to a business intelligence server (previously filled with a data set that includes Point of Interest) to get information about that place or the user businesses closest to the current location. Points of interest can be shown in a radar screen or a map or even superimposed on the real world using the phone’s camera, like the pictures in the previous page suggest.

Each point of interest has lots of information attached like sales performance, reports or any kind of intelligence related to the place that is completely and in real time available to the user. This tool is quite impressive and fascinating: it has the potential to change the way business and mobile technology interact, given the wide range of possible application and its effectiveness.

3.1.2 SAS

SAS Institute Inc. has been a major producer of software since it was founded in 1976 by Anthony Barr, James Goodnight, John Sall and Jane Helwig. SAS, with its broad and deep predictive analytics product set, has consistently been a leader in the advanced analytics market. According to Dr. Jim Goodnight, CEO, “No problem should be too difficult for SAS to solve.”

The company’s objective is to help organizations anticipate opportunity, empower action, and drive impact by making better decisions, doing them with confidence and a lot faster. Thanks to a seamless access to a variety of data sources in different formats and cutting-edge technologies SAS can immediately start producing reports of various degree of complexity in every area of competence, with the aim of being proactive in the decision making to capitalize on opportunities long before the competition.

There are several fiends in which SAS is a recognized leader, among which we can find:

- Information Management: SAS provides an agile, flexible, integrated, and high quality data platform. Analytical processes upon this platform allow to drive better business outcomes in the form of more appropriate treatment of customers using the most appropriate channel. Making a timely, relevant offer to the customers is the best way to increase retention, improve the customer experience and increase revenue. Organizational best practices grant IT the ability to align directly with the strategic goals of every company and the customer the ability to govern its data with the focus of delivering business value.
- Data visualization tools: SAS Visual Data Discovery provides exploratory data analysis and interactive data visualization in an extendable point-and-click environment, dynamically linking statistics with graphics, thus granting its customers immediacy and responsiveness for greater productivity. At the base of this tool there are some fundamental advanced technical features: all data is held in memory during visualization (no waiting while data is moved from and to disk) and takes advantage of multithreading to work faster in multiprocessor machines. In order to assure absolute ease of use it allows to export interactive animations to insert into presentations, Web pages and other documents, share them with the colleagues, create reports without having to code. It lets users build queries, manipulate and update data, perform simple to complex analyses and run analyses

in batch mode if desired. It even allows users to create and utilize custom add-ins (endowed with customizable menus and toolbars) to share with other users.

- Customer Intelligence: that is the name given to the process of collecting all available market and customer data in order to find better business opportunities and provide insights (especially patterns in customer behaviour and sentiment) to maximize profitable growth. SAS believes in the importance of creating a common view of customers and prospects: this means creating an enterprise look via a common data platform (like an enterprise data warehouse) of every customer. With the precise aim of having a deeper understanding of the customers, several techniques are applied like clustering, profiling, segmentation and predictive analytics: the company is then ready to answer questions like “Who are my customers? Who are the best ones? How best to activate and retain them?”. In addition to this, modeling and scoring are applied to the customer base to obtain likelihoods to respond, spend, attrite, etc. The company could then set thresholds for communication based on scores, understand customer value through their behavior, learn demographic make-ups and address personalized e-mail content. Combining that information with sentiment (how a customer feels about a product or service and behavior) and assessing how they react, purchase or engage with the organization allows to get an even deeper view into what motivates customers and into which customers or segments actually provide value. Being able to leverage the opportunities to drive loyalty, migration, retention, or growth inside the organization is essential to creating profitable revenue growth. SAS can set analytical insight free, by sharing and distributing it across the organization, in near real-time, allowing to maximize cross business impact.
- High-performance risk: SAS stresses the importance of this process to allow people to understand and manage the risk they take, to manage loss expectations, improve capital management and overall build a risk-aware culture throughout the company. Thanks to an excellent and modern technological environment SAS is able to cut the time it takes to run risk calculations: all portfolio and valuation information is analyzed and held in-memory, critical areas such as counterparty exposure, market, liquidity and portfolio risk management, dynamic stress management can be performed in near real time.

- Insurance Claims Fraud: responsible for \$30 billion losses in the USA alone, this problem receives special care by SAS. The company provides methods and tools to detect, prevent and manage frauds across all lines of business, software to perform anomaly detection, predictive modeling, text mining (also leveraging SAS social network analyzer). SAS approaches these issues by delivering services that allow to detect fraudulent claims before they are paid by thoroughly exploring structured and unstructured data using a hybrid of business rules, predictive analytics and social network analysis techniques, accurately forecast loss reserves by using advanced analytics to calculate loss reserve amounts and benchmark each claim based on similar characteristics, predict potential claims litigation far enough in advance to mitigate the severity of the claim and to prioritize resources most efficiently and effectively, optimize your claims processes with optimization techniques that include activity, payments and recovery optimization. With SAS every company can achieve more accurate loss reserving, discover unforeseen claims expenses, prevent fraud and optimize claims workflow, which ultimately leads to improved customer satisfaction and a greater competitive advantage. Only SAS provides: superior data integration capabilities that allows to pull data from multiple legacy claims management systems and automatically transform and cleanse the data, predictive analytics available for analyzing both structured and unstructured claims data to reveal previously hidden trends or hidden linkages among seemingly unrelated customers and claims, intuitive, Web-based reporting that enables easy communication of critical claims information to the right people within the organization.
- Text analytics: this relatively new trend in analytics is applied to understand and identify topics within thousands of comments, tweets, blog posts, model and segment customers by integrating unstructured and structured data, pinpoint how customers feel about brand, products, and services (and how those compare to competitor's brands), automatically categorize content, extract entities, and disambiguate text. SAS realizes that having access to a wealth of information is great, but the foremost challenge facing businesses is knowing what information to capture, where to find it, and how to filter it for pertinent information. The goal is to focus on relevant, high-quality content that informs and enables organizations to take strategic action. SAS identified some goals from which is possible to extract value that in-

clude: identify and respond to unhappy customers on social media, trace potential fraudulent activity within survey comments, insurance claims, and social media, gain a competitive advantage by monitoring the online reputation and that of competitors, automatically cluster and categorize call center logs to identify high-volume issues for employee training, monitor and forecast sentiment prior to and during a product launch, identify emerging issues before they become costly problems.

3.1.3 IBM

International Business Machines Corporation or IBM is an American multinational technology and consulting corporation headquartered in Armonk, New York, United States founded in 1911. Worldwide leader in computer hardware and software, in 2005 sold its personal computer business to Lenovo and shifted its attention to software application and services. As today is also an established leader in all of the relevant disciplines and solutions, from strategic planning services to information management and business analytics solutions: IBM has more than 7500 dedicated consultants who can draw on extensive industry expertise and best practice methodologies to guide and help execute the adoption of BA and optimization techniques. There is also a highly developed services portfolio to address everything from maturity assessments and strategy to solution design and implementation. The company has made more than US\$14 billion in business analytics and optimization-related acquisitions since 2005, complementing its robust set of solutions and service offerings. Moreover, IBM has decades of experience in successful business transformation initiatives around the world, across all industries.

IBM recognized that business leaders are more and more pressured to make faster, more proactive decisions that maximize profitability and drive new competitive advantage, that is why it decided that the best way to address this issue is to empower all people with analytics that facilitate individuals to apply their skills in the right directions and support all decisions. The so called “Data Deluge”, that is the overwhelming volume of data being generated, is seen not as a problem but rather as an opportunity to gain competitive advantage. Ten years ago 20% of data was unstructured so there was the perfect environment for simple database solutions; nowadays the situation has been completely reversed as unstructured data counts for 80% of the total: texts, emails, documents and all kinds of information in the web exponentially increased over the years.

IBM provides business analytics tools to make sense of all this data and gain valuable insight from it; for example, thanks to the technology named Cognos, it is possible to perform long-term forecasting and at the same time remove all Excel and email based forecasting processes, create real time dashboards or allow real time product tracking; the finance department can more effectively govern access to sensitive information and manage risk or the IT department can gain the ability to better enable the business with low cost on time applications.

To classify companies on the base of their analytical capabilities IBM

developed the “AQ”, analytic quotient, in resemblance to the renown IQ: the analytic quotient is a metric that measures the readiness, ability and capacity to locate and apply insights, to reorient your business and to help you make better decisions that will allow your organization to excel. The peculiarity of IBM though is that it is very much interested in applying complex data analytics in the context of the physical world systems: for example IBM helped to design and exploit more efficient railroads, energy grids, or even oil wells. This does not mean that traditional businesses are left behind but rather than IBM believes that analytics must have a broader application field.

Taking for granted that IBM reaches the same level of excellence in BI and BA products as other vendors like SAP or SAS, there is a particular feature that makes this company absolutely unique: its incredible attention to artificial intelligence that eventually led to the development of the “supercomputer” named Watson.

IBM Watson DeepQA is the world’s most advanced question-answering machine, which uncovers answers by understanding the meaning buried in the context of a natural language question. By combining advanced natural language processing (NLP) and DeepQA automatic question-answering technology, Watson represents the future of analytics, systems design, and content and data management. Watson leverages core content analysis, along with a number of other advanced technologies, to arrive at a single, precise answer within a very short period of time, allowing to make better informed and optimized decisions and to reach new levels of operational excellence to be applied in fields like customer insights, market performance, sustainability and social good, like for example fighting crimes or healthcare. The business applications for this technology are virtually limitless!

The term “Content Analytics” was created to address those software able to unlock the value embedded in the massive amounts of unstructured information in the many systems and formats that can be found in any business environment. For a machine to be able to *understand*, in the “real” and deep meaning of the term, both the content and the context of this unstructured information, just like a human and even better, is extraordinary and utterly innovative. The amount of valuable insight that can be rapidly generated is unprecedented: it will be possible to aggregate and extract content from various internal and external sources, including enterprise repositories, structured data, social media, call center logs, research reports, transcripts, email, safety reports and legal contracts; thanks to the natural language processing capabilities and other analytics it will be easier to identify trends, patterns, correlations and spot anomalies.

IBM developed the Content Analytics with Enterprise Search as an advanced search and analytics platform that enables better decision making regardless of the source or format. It allows deep, rich text analysis of any information and helps organizations surface undetected problems, fix content-centric process inefficiencies, improve customer service and corporate accountability, reduce operating costs and risks and discover new revenue opportunities.

The ability to recognize trends and patterns can be particularly useful in a context like, for example, healthcare in which a rapid and efficient diagnoses would save many lives. Unstructured clinical notes could be quickly examined and disease progression, treatment effectiveness or long-term outcomes could be better monitored.

To address this issue IBM created the “Content and Predictive Analytics for Healthcare”, a first of a kind solution for healthcare available to help healthcare organizations with transformation opportunities. This solution has the power to apply predictive root cause analysis, natural language processing and built-in medical terminology support and has the purpose of identifying trends, patterns and deviations revealing clinical and operational insights to better target future researches, diagnoses and improving (lowering) re-admission rates.

3.1.4 Amazon.com

Amazon.com is a multinational electronic commerce company founded by Jeff Bezos in 1994, while the site went online in 1995. It is the world's largest online retailer and has separate websites for United States, Canada, United Kingdom, Germany, France, Italy, Spain, Japan, and China.

Amazon's business strategy is based on low prices on a very wide selection of merchandise with millions of unique products available, each provided with feature-rich content like user recommendations, wishlists, registries, a secure and trusted transaction environment and fast, reliable fulfillment. The website is not only an online retailer but it also allows other merchants to integrate their products into it.

Amazon's website is fundamental and the starting point for the company's strategy, that is why it is always closely monitored and metrics like service availability, upper or lower bounds in per-minute-site-revenue and internal performance service-level-agreements receive particular attention. Lots of analytical techniques are applied in this process and, for example, sites changes are mostly made by experimentation. Jeff Bezos greatly prefers to rigorously quantify users' reactions before rolling out new features so before any modification becomes final many tests are run, mainly A/B tests: this kind of test allows to randomly show one or more new features to visitors for a limited period of time, collecting all kinds of measure parameters, such units and revenue by category (and total), session time, session length or number of clicks in certain portions of the page. A/B tests are particularly suitable for these purposes because they can insulate the actual test from external factors; they have been used to experiment on a new home page design, on the effect of moving features around the page, on different algorithms for recommendations or on the possibility of changing search relevance rankings. Usually the new feature is launched only if the desired metrics are statistically significantly better than the present ones.

Multiple A/B tests are running every day and Amazon has to face many challenges related to them, like:

- Conflicting A/B tests: two experiments different from each other touch the same feature and obtain similar results
- Long term effects: some features are "cool" for the first two weeks but then may die down
- Primacy effect: changing navigation may degrade performance only temporarily

- Consistency: the same person may get different treatment when they work from home or when they are at their work station
- Statistical tests: statistical distributions are far from normal. They have large mass at zero (e.g. no purchase) that must be further analyzed

Amazon constantly tests ideas and data is always the starting point of every strategic decision; there are many examples of data driven automation in fields like merchandising (suggestion and recommendation system or charts related to new releases and top sellers) and advertising (automatic ad generation and bidding). Amazon's signature feature, the famous suggestion "Customers who bought X also bought...", relies on having and crunching massive data on every purchase, every page and every search, with the help of techniques for sifting patterns from noise or sensitivity filtering.

Another insightful use of analytics within the website is the careful analysis of all the advertisement placed on a web page. As mentioned before, Amazon already allows the user to buy from affiliates on its site, obtaining a percentage of the revenue in exchange for allowing customers to buy directly through Amazon.

The news is that now it is selling ads for "related items" alongside the products it sells, and these ads link directly to competitors' web sites where, presumably, consumers can get the product they were searching for cheaper. Amazon takes this one step further by allowing advertisers to post their own competing prices for the exact product the customer is looking at on Amazon.com, right on the same page with Amazon's own listing. This could sound like a risky and disadvantageous strategy, but instead is really an ingenious one: the bottom line is taking advertising money from the competitors and let them onto the site so that their activity can be monitored and there is the chance to learn how to retain those customers and ensure that others do not steal any sales.

Thanks to this kind of ads, Amazon is keeping its competitors close at hand, in a position that can be carefully monitored and analyzed. Amazon can use analytics to observe the clicks those ads produce, determine where, when and from what customers they are losing sales, and then modify its own pricing, marketing and product mix accordingly. Amazon has taken a potential competitive threat and turned it into a competitive weapon, one that its (unsuspecting or not) competitors appear more than happy to pay for. The company projects to obtain over \$400 million per year by selling ads. This amount could appear to be trivial for a nearly \$50 billion company, but with a closer look it can be discovered that the margins on advertising

are so lucrative, in what is an otherwise low-margin business, that it could account for 10% of the company's net income.

Jeff Bezos is a true analytics enthusiast so even when it comes to hiring he does not forget that analytical firms hire analytical people. When Amazon needed a new head for its global supply chain, for example, it recruited Gang Yu, a professor of management science and software entrepreneur who is one of the world's leading authorities on optimization analytics. Amazon's business model requires the company to manage a constant flow of new products, suppliers, customers, and promotions, as well as deliver orders by promised dates. Since his arrival, Yu and his team have been designing and building sophisticated supply chain systems to optimize those processes.

A distinguishing trait that makes Amazon rather unique is, though, not only its ability to harness data or apply analytics to make better decisions and discover new product opportunities but also the decision to make available to the public its analytical capabilities through its platform called Amazon Web Services. Launched in 2002, Amazon Web Services (AWS) is a collection of remote computing services (also called web services) that together make up a cloud computing platform, offered over the Internet. Using AWS, businesses can take advantage of Amazon's expertise and economies of scale to access resources when their business needs them, delivering results faster and at a lower cost.

AWS provides a highly reliable, scalable, low-cost infrastructure platform in the cloud that powers hundreds of thousands of businesses in 190 countries around the world. It offers low, pay-as-you-go pricing with no upfront expenses or long-term commitments. Companies are able to eliminate capital expenses and lower IT operating costs because they can pay only for those resources that they actually use instead of setting up costly data centers and technologies in-house. It also provides agility and instant elasticity because, usually, IT is not always able to respond quickly to changes and innovation cycles are slow, instead, thanks to Amazon, organizations can deploy new applications in no time or instantly scale up as the workload grows and instantly scale down based on application demand. Moreover, AWS is open and flexible, because it lets the user choose the development platform or programming model, but most of all is secure and endowed with industry-recognized certifications, providing multiple layers of operational and physical security to ensure the integrity and safety of all the uploaded data.

Amazon believes in this *Analytics-as-a-service* project because it recognized that there is a huge business opportunity in providing this kind of

services to companies that cannot keep up with technology evolution, the quality and execution speed that the market requires or that need to lower the cost of ownership of in-house solutions. Thanks to Amazon organizations are able to address issues like the vast amount of data that needs to be processed to produce accurate and actionable results, the speed at which they need to analyze data to produce results and the type of data that they analyze, both structured and unstructured. They can bypass the development of a complex infrastructure by entering the cloud and exploiting elastic on demand and pay-as-you-go services.

In addition to this, even if nowadays the price of hard drives has sensibly dropped, companies must deal with such a huge amount of data that is neither feasible nor convenient to store it before analyzing it. Moreover, even if there was space to store the data first, additional time is required to store and then analyze and this time delay is often not acceptable in some use cases. That is why Amazon is offering the chance to perform data “in motion” analytics, that is the analysis of data before it has come to rest on a hard drive or other storage medium.

Technically, AWS can count on massive storage space provided by Amazon S3 (Simple Storage Service), able to store and retrieve any amount of data, at any time, from anywhere on the web. The key point is Amazon’s ability to work in parallel and provide an effective way of distributing large amounts of workload over pools and grids of servers coupled with techniques like MapReduce and Hadoop. Indeed Amazon Elastic MapReduce is a web service that enables businesses, researchers, data analysts, and developers to easily and cost-effectively process vast amounts of data, utilizing a hosted Hadoop framework running on the web-scale infrastructure of Amazon Elastic Compute Cloud (EC2). This system allows to perform data-intensive tasks for applications such as web indexing, data mining, log file analysis, data warehousing, machine learning, financial analysis, scientific simulation, or bioinformatics research.

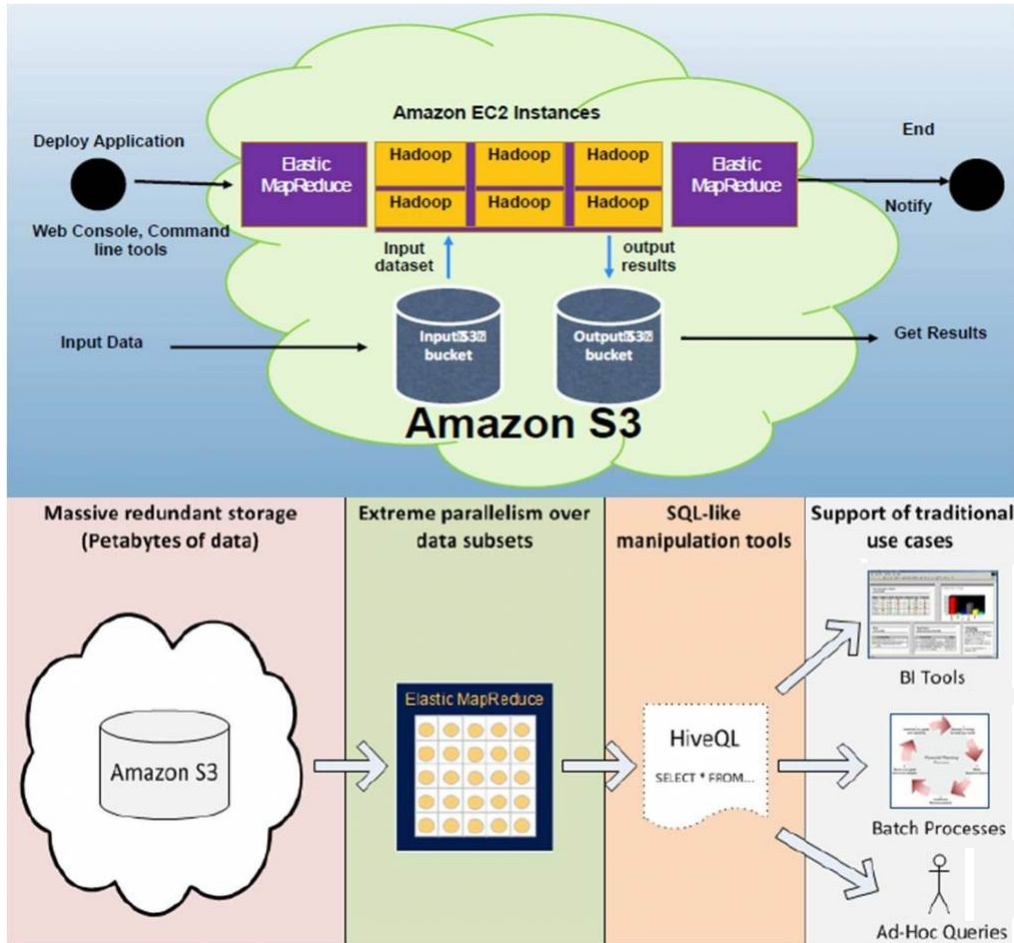


Figure 7: Amazon Analytics-as-a-service infrastructure

These capabilities and Amazon's constant commitment to update any technology and to present always new services represent the perfect solution to any company that intends to exploit analytics but is not able to do it by itself. The demand for analytics grows rapidly: Amazon knows it and its services surely can satisfy it.

3.1.5 Tesco

Tesco is a global grocery and general merchandise retailer founded in 1919 by Sir Jack Cohen and headquartered in Cheshunt, United Kingdom. It has stores in 14 countries across Asia, Europe and North America and is the grocery market leader in the UK (where it has a market share of around 30%), Malaysia, the Republic of Ireland and Thailand. Originally a UK-focused grocery retailer, since the early 1990s Tesco has increasingly diversified geographically and into areas such as the retailing of books, clothing, electronics, furniture, petrol and software, financial services, telecoms and internet services, DVD rental and music downloads.

Nowadays the company heavily relies on its strong brand image, which is associated with good quality and trustworthy goods that represent excellent value, and has become an established leader thanks to its analytical capabilities, that allowed Tesco first to surpass and then to almost double its UK market share compared to competitors like Sainsbury or ASDA. It can count on efficient technologies that support daily business operations like wireless devices, intelligent scale, electronic shelf labeling, self check-out machine and radio frequency identification (RFID) systems. This technology is an effort to maintain Tesco's ability to handle an increase in product/service volume while controlling costs; it also enables to be innovative and market oriented.

Tesco recognized that analytics could give them the competitive advantage they needed to outperform competitors and decided to focus its attention on a fundamental part of a retailer's business: its customers. Sir Terry Leahy, former CEO, said that "the company's mission is to earn and grow the lifetime loyalty of its customers and to understand customers better than anyone".

Towards this end Tesco was the first UK grocer to launch a loyalty card and has been the most effective. The famous *Clubcard* proved to be a very successful customer retention strategy that significantly increases the profitability of Tesco's business. Leaning heavily on the customer portraits delivered by Dunnhumby, a retail media group later acquired, Tesco is able to meet customer needs, customize service and pricing to perceived value, ensure low prices, better choices, more effective supply chain, efficient staffing, constant flow of in-store promotions and, most of all, control and retain about 12 million unique profiles of its over 15 million customers.

The analysis of this data allowed to perform both an effective customer segmentation, developing different lines of products (from Tesco Finest to healthy\organic or "value" ones) that yielded an increase and an empowering of its private label product selling, and a careful study of the store format

in order to tailor the stores to meet individual customers' requirements and provide a different shopping experience: for example, we can now find Tesco Extra (very large stores offering the maximum food and non-food range), Tesco Metro (high street store/shops in large city centre shopping areas aimed at workers, shoppers and local residents) or Tesco Express (Petrol station forecourt shops selling a range of everyday products).

This has a dramatic impact on performances because the company is able to drive sales through more focused, effective marketing, advertising, ranging, pricing, availability, space planning and new product innovations. Tesco realized that it is easier to give people what they want when you know what that is.

In developing the Tesco Clubcard, a business gap analysis showed that loyalty could only be achieved if there is something to keep customers returning to Tesco and this is where the card fulfills its function: it is a permanent, physical reminder in the customer's wallet and the customer can only make significant amounts of Clubcard points by returning frequently to Tesco.

However, the real turning point was when Tesco realized that customer loyalty is not about customers demonstrating their loyalty to a company, but rather the company demonstrating its loyalty to its customers: this new reversed point of view moves to the company the responsibility to retain its customers, due to the fact that customers have to make rational decisions based on their needs and a brand is only as good as the customer's last experience.

The company decided that "customer analytics" was the solution to the problem and started to develop a veritable loyalty programme and approach, deployed as a four-stage cyclical process. The first stage sees the collection of customer data from a variety of sources, one being the Clubcard. A careful analysis of that data enables the company to develop customer insight (second stage) that allows to fully understand its customers, to divide them into segments by the type of behaviour they exhibit as well as understanding the motivations behind the behaviour. Such a deep level of understanding allows to lay the foundations for informed decisions that can improve the customer experience across the entire business (third stage), from price and promotions to ranging and availability. Understanding the differences between customers also means that the company can communicate and reward customers in a relevant way. Improving the customer experience (fourth stage) ultimately drives desired customer behaviour, which sees customers buying one more product, one more time and of course improves the company's business performance.

Finally another step towards customer satisfaction was made develop-

ing Tesco's website for online shopping: last years have seen a tremendous growth of on-line sales thanks to a strong platform providing a friendly environment and an efficient service that has lead to an ever growing revenue stream. Simply considering the fact the nowadays majority of people have less time for shopping and willing to offer an even more satisfying service to its customers, Tesco employed this on-line systems and now became the biggest online supermarket in UK.

Looking into the future, Tesco could start to tap into the world of behavior rich, truth telling social media, getting involved with companies that include Infegy, Choicestream, Facebook, Twitter and Amazon. How they use that data for horizontal and vertical expansion will be interesting to say the least and competitively devastating for some.

3.1.6 Sport and entertainment franchises

The purpose of this paragraph is to show that analytics has been and is still used in many other areas, apparently far from this level of technical competence but instead very aware of the power of these tools and that the analytical world is not a walled garden. Following are the cases of some companies belonging to the world of sport that want to extract more value from their well-paid talent and of a company belonging to the world of entertainment that wants to improve the overall experience of its clients.

A.C. Milan A.C. Milan is a professional Italian football club based in Milan founded in 1899. This worldwide famous company decided to build in 2002 a special and one of its kind medical laboratory named MilanLab that has become a high tech interdisciplinary scientific research centre. It provides technological support within the decision making process that aims to provide the best possible management of individual well being and health. Apart from assuring the best medical treatment available, this lab was also intended to solve a thorny problem: hire a player for a lot of money and then be forced to play the whole season without him due to an injury.

They understood that statistics like, for example, previous scoring capability do not represent a good enough ensemble picture: what needs to be considered is the overall potential for playing and contributing to the team, and health is a big component in this. The research group analyzes every aspect of a player's moves, for example how they run, how they jump and also the likelihood that they are going to become injured. Moreover, they are able to deeply understand the consequences of every little detail discovered during the training and actually advice the players to act in a certain way, like "You're turning your left foot out too much. You are going to injure your ankle if you do that." Technicians meet with each player about twice a month to help them analyze the latest data around their movements, tracking 60,000 data points on every single player (200 on one jumping motion alone) and analyzing the statistics to ensure his health and fitness. MilanLab is able to map a person's entire life in their own individual numbers. Every player is unique: MilanLab's strength lies in being able to map out this uniqueness.

This unwavering emphasis on using data to make better decisions and the constant tapping into the power of analytics has helped them to ceaselessly be one of Europe's top soccer teams.

New England Patriots The New England Patriots are a professional football team based in the Greater Boston area founded in 1959. The team has seen an incredible success in the last years, since between 2001 and 2010 the Patriots set a record for most wins in a decade: 126. This incredible number is the result of a renewed policy when it comes to take important decisions about players.

The revolution has become together with the involvement in the team by Jonathan Kraft, the son of the owner Bob Kraft and a former management consultant, who decided to drive the team in a more analytical direction both in terms of on-field issues such as play selection and team composition, and off-field issues affecting the fan experience. The team uses data and analytical models extensively even when it comes to select the most profitable tactic in a particular situation during the game. Both its coaches and players are renowned for their extensive study of game films and statistics, and Head Coach Bill Belichick collects and carefully reads articles by academic economists on statistical probabilities of football outcomes.

The most profitable application of analytics is the use of statistical analysis to identify the most promising players to draft. The Patriots do not use the same scouting services that other teams employ because they evaluate college players even at the smallest schools and gauge potential draft picks with criteria that other teams do not use. They rank potential recruits even on the basis of intangible attributes that other teams don't assess, including intelligence, commitment, coachability, and a willingness to subordinate individual ego to the goals of the team. The team tracks the data points on potential players with a "Draft Decision Support System" that is updated daily with new reports from scouts. Analytics staff then double-check the scouts' rankings by comparing west coast ratings with similar east coast ratings.

In addition to this, the Patriots are really careful in their choices taking also into account wages in order to stay below the stringent salary cap in the National Football League. In fact, the Patriots have won three out of four Super Bowls in the recent history with a relatively low-cost payroll, the 19th highest in the league in the 2004-5 season.

Off the field, the team uses detailed analytics to assess and improve the "total fan experience." At every home game, for example, 20 to 25 people have specific assignments to make quantitative measurements of the stadium food, parking, personnel, bathroom cleanliness, and other factors. External vendors of services are monitored for contract renewal and have incentives to improve their performance.

Sabermetrics Sabermetrics is the specialized analysis of baseball through objective, empirical evidence, specifically baseball statistics that measure in-game activity. The term is derived from the acronym SABR, which stands for the Society for American Baseball Research. It was coined by Bill James, who is one of its pioneers and is often considered its most prominent advocate and public face.

The book “Moneyball” by Michael Lewis, that is about to become a film starring Brad Pitt, describes how the general manager of a baseball team, Billy Beane of the Oakland A’s, pioneered a new approach and decided to apply a modernized, analytical, sabermetric approach to assembling a competitive baseball team, despite disadvantaged revenue situation. Given the success both of the team and the book, soon many other teams in the Major League Baseball, like the Boston Red Sox and New York Yankees have adopted the analytical approach.

Sabermetrics melts with analytics because it’s the field of scientifically analyzing the data and the statistics of the players in order to produce valid scientific knowledge, both general and specific.

Sabermetricians frequently question traditional measures of baseball skill. For instance, they doubt that batting average is as useful as conventional wisdom says it is because team batting average provides a relatively poor fit for team runs scored. Sabermetric reasoning would say that runs win ballgames, and that a good measure of a player’s worth is his/her ability to help their team score more runs than the opposing team. From this example we can learn that the accumulation of key cause and effect relationships to form a composite relationship is greater than any one single relationship. Moreover, this shows that sometimes it is worthwhile to challenge traditional measures for these may not always reflect current business models, competitive landscapes, and economic environments.

Harrah’s Caesars Entertainment Corporation (formerly Harrah’s Entertainment from 1995 to 2010) is a private gaming corporation that owns and operates over 50 casinos, hotels, and seven golf courses under several brands.

The company is heavily involved in analytical processes, firmly sponsored by its CEO Gary Loveman, a true analytics enthusiast. The analytical model that has been shaped provides a virtuous circle that made the company the world’s largest gaming corporation.

It all starts with a special attention to the internal services’ quality (human resources policies and procedures are always managed with the help of forecasting, staffing and scheduling tools); thanks to this quality there is a

diffused employee satisfaction that is obviously reflected in an increase of employee retention and productivity. This amazing workforce brings also external service value that causes unprecedented highs in customer satisfaction: all these satisfied customers can later become testimonials, sharing their experiences and prompting others to experience the same. In this way the company can earn customers' loyalty, allowing profitable management from their lifetime value, retention, referral, and repeated business. There is a non-stop flow of cash, a revenue and profit growth and the market share is always increasing.

That is really what makes analytics a sustainable differentiating strategy for this company. It is because it is not about a single insight: it is about a set of processes they have, a way of using data and incorporating it into their decision making, that really helps them transform their business. It makes them much more able to maneuver changing business conditions; it makes them much more likely to anticipate changes in customers and markets, and, most importantly, it allows them to come up with different scenarios and understand how they ought to react to changing market conditions.

This strategy is intended to gain the maximum profit from its customers, not from building more and more casinos as others do. They are able to select customers with the greatest profit potential and to refine pricing and promotions for targeted segments. The company uses a loyalty program called "Total Rewards" that collects all kinds of data, from personal preferences to gaming history; for example it allows to offer the same room to a returning customer if he particularly liked it the previous time or even to display a message offering to take a break and enjoy a free meal to a customer that is losing too much at a gaming machine. By refining this closed-loop of insights and efforts, they established a scalable, extensible, and differentiated loyalty and service framework continuously improve customer interactions and business outcomes.

As mentioned before, staff and employees receive special treatment too: the company uses analytics to take care of its staff, knowing that happier and healthier employees create better-satisfied guests. For example, Harrah's used metrics to evaluate the effects of its health and wellness programs on employee engagement. Preventive-care visits to its on-site clinics have increased, lowering urgent-care costs by millions of dollars over the past 12 months. And because Harrah's understands the relationship between employee engagement and top-line revenue, it can evaluate the program according to revenue contribution as well.

4 Chapter 4

4.1 Business Analytics in Italy

Business analytics is a topic that Italy still does not know very well, partly because it can be still mixed up with business intelligence, partly because even business intelligence is just starting to be considered a valuable tool and asset.

It happens that only huge companies realize the importance of these techniques and make plans to embed them in everyday processes and strategies; all the other players in the economy just do not know them or are not ready to embrace them. A great percentage of not only small but also medium scale companies can still be labeled as “analytically impaired” as they have limited or non existent insight into customers, markets, competitors, no analytical processes, missing or poor quality data and unintegrated systems.

The most common scenario is the one with a company possessing a discrete or even huge amount of data and that does not know what to do with it, apart from accumulating it. When it realizes that it can draw value from it, the company starts to organize and assure some quality to its data, consequently implementing some business intelligence tools. Given that this process requires some time, the moment in which analytics will start to matter and be a common practice is well in the future.

To give an idea, let’s consider for a moment the SMAU (Salone Macchine e Attrezzature per l’Ufficio), the annually held and most important Italian expo dedicated to the Information & Communications Technology (ICT). During the last edition, held in Milan from the 19th to the 21st of October 2011, there were several seminars and workshop about topics like enterprise resource planning systems, business intelligence and CRM applications, mobile and wireless, enterprise 2.0, web B2C applications and online marketing, security and IT architecture, cloud computing and Software as a Service, retail & GDO. As can be seen, business analytics was not even mentioned and the 10 workshops about business intelligence were about project management, de-materializing paper documents, SAP BusinessObjects presentations, mobile and digital marketing and only one talked about the possibility of forecasting for a proactive look into the future: there’s no mistake in terms between BI and BA, only an environment still not ready for it.

In order to have a better understanding of what is going on in Veneto about topics like business analytics and business intelligence, I decided to

interview Sergio Rizzato, responsible for the BI by Unicomm s. r. l., holding based in Dueville (VI), leader in the so called GDO area (Grande Distribuzione Organizzata) managing supermarkets like Svelto A&O, Super A&O, Famila, Famila Superstore, Emisfero, C+C cash and carry, Hurrà in seven Italian regions (Veneto, Friuli Venezia Giulia, Emilia Romagna, Marches, Tuscany, Umbria and Latium).

Even if just one interview is not enough to generalize, the information provided can help to throw light on the analytical situation in Italy, starting to what happens in one of its most productive regions, Veneto.

4.2 Interview with Sergio Rizzato, Unicomm s.r.l.

Sergio Rizzato arrived at Unicomm at the end of 2008, after being responsible for the BI by another company, to meet the company's needs among which were managing the budget for the information system, creating a system for the project management and addressing the BI issue, to provide those analytical answers that transactional systems could not assure because of the huge amount of data to be processed (reporting in environment AS/400 and processing with Office automation tools, most of all Excel).

There were departmental databases and lots of separated silos of information about, for example, logistics or accountancy to store data, from which, however, was not possible to extract valuable information. The expansion of the company, now owning about 400 dealers, and the current economical situation imposed to better balance costs and pricing and to cut all kinds of waste due to bad practices in storage, logistics or purchases: the answers can be found by better analyzing the data already in possession.

Were two years enough to internalize those processes or are they still in evolution?

The first year has been spent to map the “as is”, the situation in which the information system of the company was, to collect all the input coming from the directors of the various departments (purchases, sellings, accountability, logistics etc) and to build the basic infrastructure, composed by databases, and business intelligence softwares.

This year instead we produced some models to analyze the data and started to provide high-level reports that extended the power of the previous reports, adding analyses like the average price or the operative margin of every article to simple lists of products or sold articles.

Now we have both a centralized and unique portal to access all the reports and a management control system that certifies every information

before it is released, assuring the quality of the data (“one version of the truth”) and eliminating the fragmentation of the sources of information. The latter process was enabled thanks to the collaboration of the various departments’ chiefs that shared their know-how relative to their particular field and take responsibility for every anomaly in the reports, providing the right answers to correct them.

What kind of projects are underway or are planned in BI? Is the development in-house or with off-the-shelves solutions?

There are several projects running in parallel, with the aim of providing valuable information to every sector: analysis of the customer loyalty and fidelity, analysis of purchases and sellings, analysis of the supply chain, control of the assortment in specific stores, assessment of the profitability of the promotions. In the development process we employ external forces due to the lack of expert employees neither in BI instruments nor in data extraction tools. Among the fifteen people forming the information system staff, four actively follow the life of the dealers (about one hundred each), four take care of technology matters, one follows specific accountancy, two expressly take care of respectively purchases and sellings and the rest works on the projects, side by side with external on demand collaborators.

The company still lacks the veritable figure of the analyst, intending with this word a person able to analyze a problem, defining a data model and strategy to solve it. In the short-medium term we plan to train up a figure responsible for these matters, even if we recognize that a figure like this could be critical in the sense that, given the level of specialization that it will acquire over time on non-trivial applications, it could be difficult to keep or to prevent from leaving.

Has the new platform encountered resistance or was it met with enthusiasm?

The new platform has been welcomed, especially because it is web based so it can be accessed directly from every dealer, connected with us in wide area network. There is no need to install the client anymore, no need to use only one pc that has to be constantly updated. In addition to this, being web based allows to exploit the computational power of the server, deploying in this way a quick, flexible and agile environment to every user.

The difference between business intelligence and business analytics is that the first quantitatively analyzes what happened in the past while the second turns its attention to why those results have been obtained, projecting the analysis into the future with

business optimization, simulation and forecasting to understand what may happen. Does your company use tools of the latter type?

In my opinion, business analytics represents the evolution of the business intelligence. Our company still needs to assess and finalize its projects about the business intelligence environment, so the use of analytics does not yet constitute a systematic approach but instead has been limited to some areas like forecasting the curve of turnover, of sales proceeds, of purchases with the suppliers. Moreover it's used in projecting the profitability of the contracts and to simulate budgets. What is still missing is a constant use of this tool, which is not embedded in everyday processes so the initial simulations are not updated or revised. Taking into account that it has only been a year since all the processes in the business area have been readjusted and formalized, we believe that this kind of tools will be proper of the "new generations" in our company, that are already growing with a more careful attention to numbers and facts rather than experience. We like to think we are sowing some seeds that will result in a plentiful harvest in the next future.

Have you recognized some areas of competitive advantage?

Absolutely. First of all, a change in the marketing direction has moved the focus on areas like customer loyalty. We are coordinating many process to know more about the fidelity of our customers, thanks to a careful management of the promotions and their traceability: we will be able to know who participates to which promo and how effective they really are.

Another project concerns the assortments, with the aim to know more in detail which products to place in which particular dealer, analyzing trends in different geographical areas to assess which are the products that "work" in an area and do not in another one. We are positive that cross-checking assortments, sales data and fidelity will yield a lot of interesting results.

In the short-term we will also be able to manage the costs of logistics and stocking. Up until now, stocking has only been seen as something in the middle between purchasing and selling, when instead an optimization of turnarounds and transportation could convey a decrease in waste and a consequent increase in revenue.

A decision-making approach based only on facts and results (perhaps even in contrast with the commonly held belief) and not on personal instinct or intuition is called "Data Driven decision-making." How are decisions made in your company? Is there a

process of analysis of present \ past \ future facts and results or the instinct \ managerial insight component is still predominant?

Our company is still a “family-run” business, so it can happen that the owner decides which product goes on the shelf and which does not. However the aim of all the processes previously described is to present to the owner more and more analysis based on concrete and certified facts.

New generations of employees are beginning to use dashboards concerning purchases or sellings with the respective margins to help them shape decisions; until now those dashboards have been daily updated but we are already working on a real time solution. These analysis are not anymore based on data in Excel spreadsheets coming from every single department but take account of a more enterprisewide perspective like, for example, when managing costs along the whole supply chain.

The fact that this new methodology did not come directly from “above”, from directors and managerial cadres, has persuaded us in the information system department to start deploying little and targeted new projects (two, three, four months tops) in order to quickly deliver and show results to the upper levels. As soon as responsables in many areas saw the results and the potentialities they could start to exploit, they started to ask for more and, on these bases, we started to plan projects for 2012. The fundamental part was to *show* the results once obtained and once the project has been deployed, because asking inexperienced (on this particular new features) people for what they wanted could result in a waste of time due to too general answers.

Is the company familiar with tools from big vendors like SAP, SAS, IBM? Have you ever considered purchasing off-the-shelves tools? Does the analytical model suggested by these vendors inspire you?

As for the products, before starting our projects of business intelligence, we performed a selection, considering SAS, Microstrategy, IBM Cognos, SAP and also open source products, based on many parameters like functionalities, presence of a portal, ease of implementation. From our point of view the top application was BusinessObjects from SAP, a tool that we already used to manage the accountancy part, and that we updated to the last version.

As for the models instead we took as a starting point the experience that the consulting company who is implementing our management information system already has when working with companies in the GDO world. These

models were then presented to our business managers, rectified and adapted, preferring this way of acting rather than purchasing a final model.

Do you actually exploit or plan to do it in the future new technologies and trends such as cloud computing or Software-as-a-service?

The topic of cloud computing has already been discussed with the owners, due to the increasing amount of data that goes well beyond some terabytes, so there is an attention to this area of interest. However, due to previous investments in this matter, for the next two or three years we plan on keeping our data on our premises.

When it comes to Software-as-a-service instead, for our last software solutions (not related to business intelligence) we are taking this possibility into consideration, evaluating if it's best to bring software solution from outside or to outsource the service. Human resources management is one of the areas involved in this decision.

Obstacles to these new solutions are not from a budget perspective, rather than from a cultural one: the idea of bringing our data outside the company is still looked down on. Another matter to consider is the maturity of these new solutions, because we believe there are still some "gray areas" when it comes to security or service level agreements.

It is generally understood and agreed upon however that the future even of our company is moving towards that direction and that in the years to come we will loosen our grip on those services in order to focus on our core business that is selling products.

Taking into account your experience and what you know about other companies in general, what do you think about the regional, national level when it comes to business intelligence or analytics? Are these consolidated or completely new topics?

In my opinion and also hearing what responsible of information systems in other companies of the GDO area say, companies experienced a big growth in the last years and frequently the underlying information systems could not keep up the pace and be aligned with the demands.

Not even the business intelligence is a consolidated topic because it is a common scenario that the BI covers just some areas and there is still plenty of room for improvement and diffusion. Many companies are still organizing their macro-data, and the next steps will be to refine, certify and analyze them in detail. Our sector is just now beginning to realize that, given the

huge volumes involved in the GDO industry, an improvement even of 1% means a lot more money gained or saved.

Regarding cloud computing, many other companies are still observing what happens without acting; there is curiosity about the topic but i do not know companies that already started moving sensible amounts of data, just some experiments for example with Google Apps. I believe that in a few years from now, when the first case-history about a GDO company embracing these technologies will come out, other companies will start to move in the same direction. Usually this kind of changes happen when a real competitive advantage is granted, no one changes for the sake of the change itself.

Here in our company we are focused on consolidating the business intelligence part and analytics and cloud remain something of the future, at least for a couple of years. Until 2014-2015 we have to amortize the investments made on these areas and then we will see also how industrial giants like Microsoft or Google will act upon them; for example, when the contract for Microsoft Office will expire we will consider what kind of new functionalities the new version will offer, among which there could be some new analytical tools.

Up until now GDO companies focused on opening new dealers and on expanding their network; now that the economical framework has changed they start to move the attention to recovering some expenses and to assess if what is already in possession is the right solution or not.

Conclusions

Considering what Mr. Rizzato told me about his and other companies in this interview, the suggestions made in the introduction to this chapter do not appear without foundation: Italy is generally still not ready to embrace business analytics to its fullest potential. In many cases not even business intelligence tools represent a consolidated asset. This means that whoever decides to get more involved and invest on these techniques will gain unprecedented competitive advantage and will be able to create some distance between itself and its competitors.

Judging from the information received during the interview and taking as a reference Davenport's maturity of analytical capabilities with its five stages, starting from the "analytically impaired" at the bottom stage 1 to the "analytical competitors" at the top stage 5, I can say that Unicomm s. r. l. can be labeled as a stage 3 company, that is a company with "analytical aspirations". It is starting to coordinate and establish enterprise performance metrics and a centralized unique platform. Some analysis are

conducted in multiple areas of business and even if the interactions are somewhat limited, the aim is to align them and build an enterprise-level plan. The fact that little projects have been deployed to demonstrate the power on new kinds of analyses is starting to build and spread a more fact based culture and is starting to attract the attention of the higher levels. There is a proliferation of business intelligence tools and an attention to high-quality data that comes closer even to stage 4 capabilities on the matter. However, the fact that there are just pockets of isolated “analysts” and that proper business analytics insights are still missing represents the reason why I would not characterize them on stage 4, but rather on an advanced stage 3.

5 Mental map

This mental map can help to better visualize contents and relationships present in this thesis.

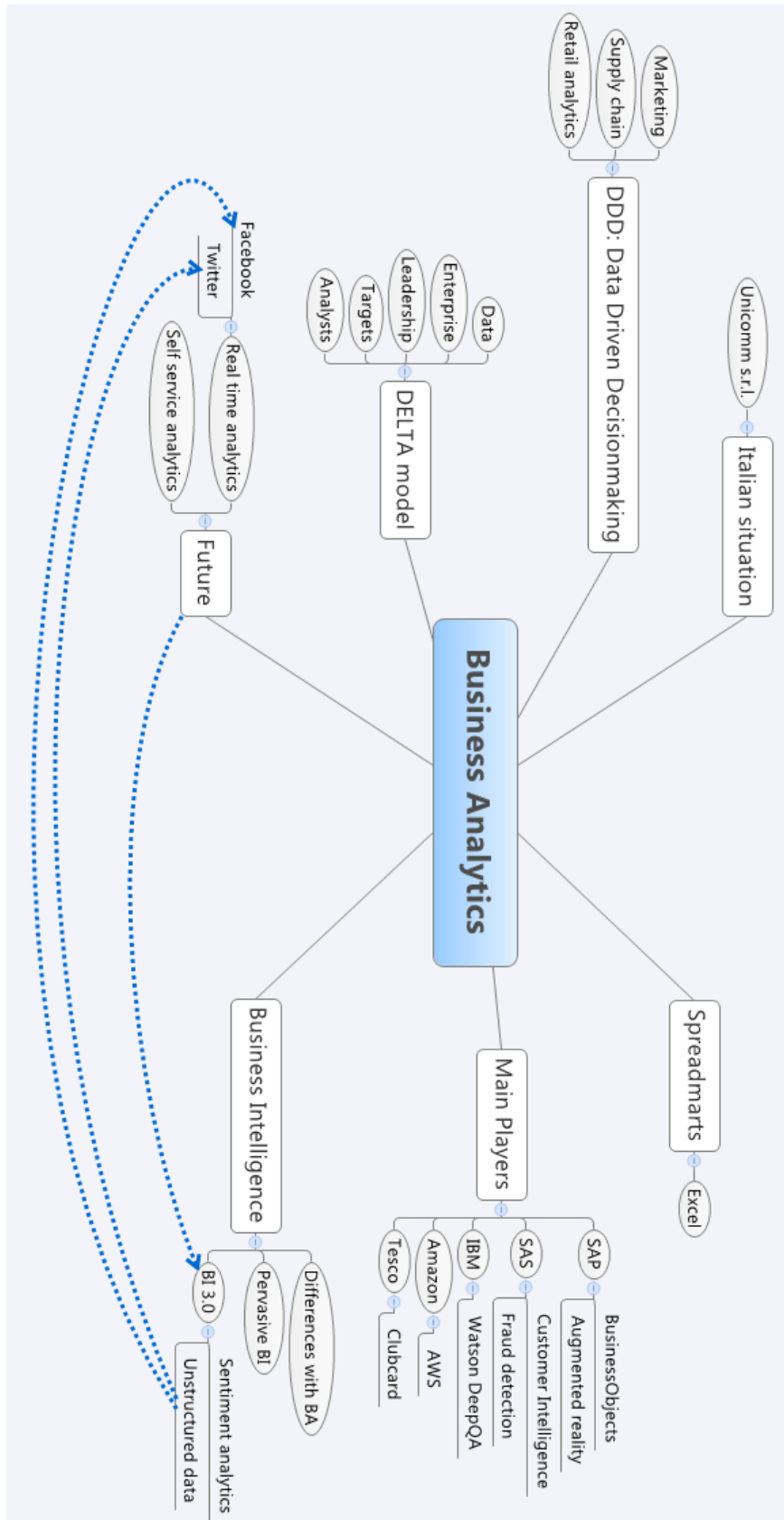


Figure 8: Mental map

6 Conclusions

This thesis wanted to put the spotlights on Business Analytics, a topic that has caught the attention of an ever growing number of companies worldwide but that seems to be less known here in Italy, building a panoramic and analyzing its features.

First of all, I defined what Business Analytics is, presented the main players of the field, depicted the state of the art and focused on the relationship between analytics and business intelligence, as the two terms tend to be confused with each other.

In the second part I tried to build a sort of manual with a lot of advices that a company eager to become more analytical could follow, underlying the fundamental areas that should be affected by this transformation and the cultural changes that need to be done, providing some examples on how it could be applied in traditional sectors and on which are the emerging trends on the matter.

The third part is meant to present some very successful companies that have become so thanks to analytics or that are starting to profitably tap from this source. I chose those particular companies because each of them has some peculiar aspects that are worthwhile of attention; I also tried to prove that analytics can be applied not only in companies belonging to the information and communication technology world but even in totally different ones, hence the cases of Tesco and of sport and entertainment franchises.

Lastly I wanted some evidence of the Italian perspective on these matters so I interviewed Sergio Rizzato, responsible for the business intelligence in a big company based in Veneto, Unicomm s. r. l., that manages about 400 supermarkets around Italy. Even if just one interview is not enough to draw a comprehensive picture of the Italian environment, those insights and inputs can help to understand the situation that I believe to be common for many other Italian companies.

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