The First Decade of Business Intelligence
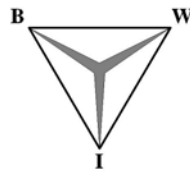
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BMI Paper

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Preface

One of the compulsory assignments in the curriculum of Business Mathematics and Information Science (BMI) is to do a literature study and write a paper on that subject. Because BMI is an education program that lies at the intersection of Economics, Mathematics and Information sciences, I needed to research a subject that also contains these 3 elements.

From all the different areas that exist within the BMI field, my strongest interest went out to Business Intelligence. From there I approached Prof. Dr. A. E. Eiben from the Faculty of Exact Sciences, who has thought several Business Intelligence courses, and asked him for some ideas and topics that I could write about. One of the topics was to look at the evolution of Business Intelligence over the pas 10 years or so. This topic presented an opportunity for me to learn more about Business Intelligence in general.

In recent years the analytics has become one of the buzzwords in world of Business Intelligence. Analytical courses are a major part of the BMI curriculum, and I gained a lot of theoretical knowledge about different statistical and quantitative methods. In Business Intelligence these skills are put into practice.

I would like to thank Professor Eiben, who took the time to brainstorm on topics for me to write about.

Executive Summary

Business Intelligence is a field that has been gaining much momentum in the past decade. There have, however, been some challenges that have plagued the Business Intelligence community, which is why many companies can not fully benefit from the fruits that it has to offer. These challenges get much of attention from the Business Intelligence 'academics' and attempts to provide solutions to these challenges are made. In this paper the mayor challenges are discussed.

With the growth of Business Intelligence, there are many new trends that are appearing. These trends are a pure sign that Business Intelligence field is one that is being taken very seriously by the software developers.   So, we see that the software Giants such as IBM, Oracle and SAP are buying smaller BI vendors in order to stay competitive in the software business.

With Business Intelligence, a new form of competition is emerging. Analytics   - quantitative or statistical models- is applied to different types of business problems, such as supply chains and customer management. Several types of these techniques and their benefits are discussed.

1. Business Intelligence

In this section a brief overview of Businesses Intelligence (BI) is given without going into too much detail, because former BMI students have written on this topic before. BI is an umbrella term with several components hanging under it, which will briefly be discussed.

1.1. What is BI?

For many years technology has enabled companies to gather lots of data, which can be captured by websites, ATM machines, ERP (enterprise resource planning) systems, POS (point of sales) systems and many other systems. If this data is transformed, combined, and structured correctly, lots of valuable business information can be extracted that can be used to make decision. The processes of collecting, managing, and reporting of decision oriented data as well as the analytical techniques and computing approaches that are performed on the data fall under the umbrella term, BI. Davenport defines the BI architecture as 'an umbrella term for an enterprise-wide set of systems, applications, and governance processes that enable sophisticated analytics, by allowing data, content, and analyses to flow to those who need it when they need it'.(Davenport & J. G. Harris, 2007, p. 155)
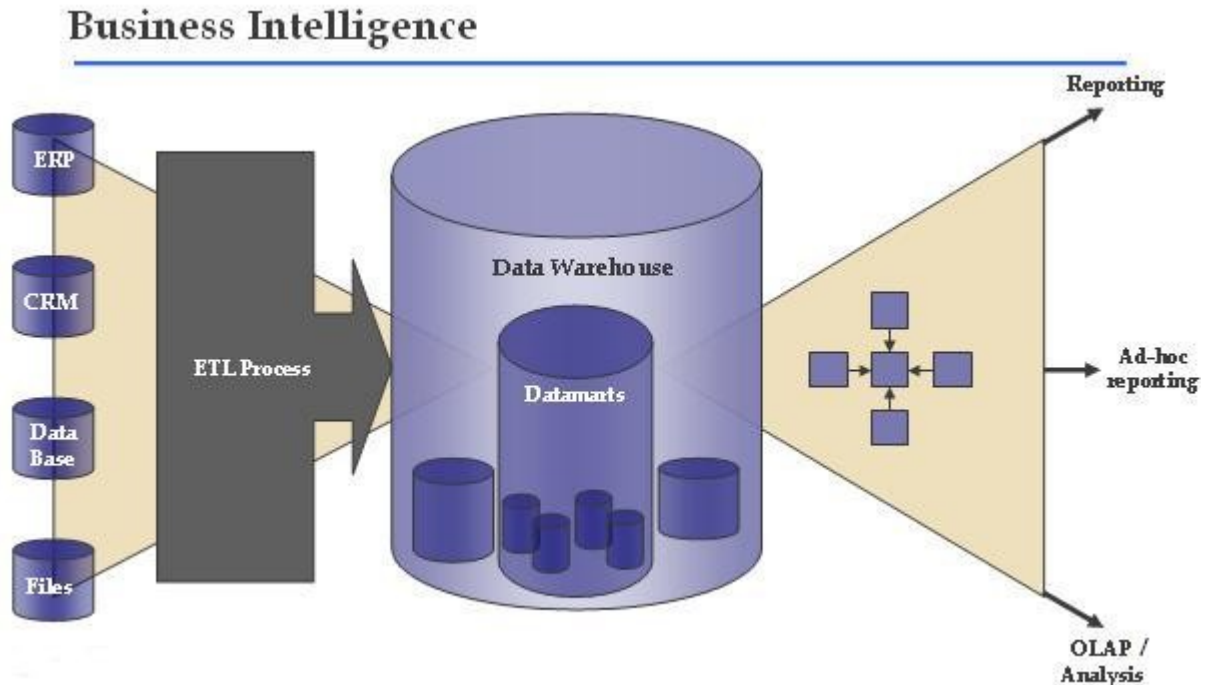
Figure 1: Diagram of the BI process("Data warehouse concepts," n.d.)

Figure 1 gives a picture of the steps that need to be taken in order to achieve proper business intelligence. These steps are:

1. Extracting the data from the necessary sources such as ERP, CRM, POS, ATM and different file systems

2. Transforming the data, which includes cleansing, validating so that the data is uniform and comparable

3. Loading the data into a repository such as a data mart[I] or data warehouse[II].

4. Reporting and analysis. Reporting is the technique of shaping and presenting the data into a form that can be used to make decisions and its distribution. In analysis different analytical techniques are used to extract information from the data.

[I] Data marts are databases with integrated data from different sources and usually support a single business function

[II] Data warehouses are databases with integrated data from different sources and can support multiple business functions

The first 3 steps in the BI process are called the ETL or Data Integration process, after which the data is ready for reporting, distribution, and analysis. To accomplish this, a BI environment must consists of; tooling for the extracting, transforming and loading (ETL) data from multiple source system into a data mart or a data warehouse; a data warehouse for storing historical and current business data, with an OLAP server that provides analytical services; applications that are used to generate and distribute reports; tools with different analytical functionalities such as different statistical methods, data mining or artificial intelligence. In this paper BI tools tat contain all these capabilities are referred to as comprehensive or fully integrated BI tools. Some tools do not have all of the capabilities, and are usually combined with other tools to complete the whole BI process.

1.2. Why BI?

Factors such as globalization, rapid growth of technologies make it very hard for companies to survive purely on the offering of products and services. Besides attempting to offer unique products and services, organizations nowadays, need to optimize their business processes in order to be profitable in the long run. In order to do this, managers need detailed information about what is going on with their business, in terms of their products, customers, and services. Further, organizations can also get a competitive edge when they have information that the competitors do not have yet. This type of information is often embedded in the data captured in the transactional systems, and can be extracted by using BI.

If an organization wants to have detailed information of what is going on in their business, it needs to use BI, which enables managers to get answers to questions such as, "who are the most profitable customers and where do they live?", "which customers are more likely to purchase a particular product?", "What products should be discontinued?" Great cost cutting, savings or profit increasing decisions can be made when managers make decisions based on these types of facts.

1.3. BI acceptance

BI has gained much popularity in around 1995, and the field has been growing ever since. To find out how the acceptance of BI has been over the years, I collected the yearly revenues from the sale of BI tools(Vesset, 2009), calculated the percentage growth and plotted these as

you can see in graph 1. Here I am making the assumption that the acceptance of BI is proportional to the growth in revenue of BI tools sales. I am purposely only using the revenue gained by tools and not the extra revenue gained by services, because my assumption is that cost for services can be lingering costs out of necessity, whereas tooling costs are usually by choice. By that I mean to say that I only want to include the revenues that are due to a company's choice to invest in BI. When including services, I would also be including maintenance, consulting etc. These costs are often made to run the businesses and not to change them. The choice to invest in the tools implicates an actual change, and therefore the acceptance of BI by institutions.

Yearly Revenue and Growth of BI tools

revenue in millions
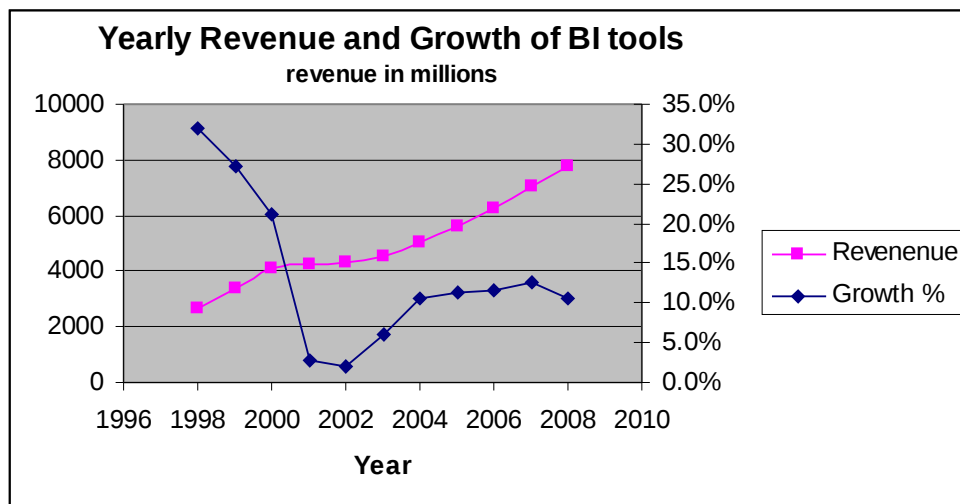
Graph 1

The revenue line in the graph is constantly increasing, which means that more and more is being spent in BI. From the growth curve we can conclude that there seems to be a constant growth since 2004. From this graph it is also evident that there was a great BI hype towards the end of the 1990s. There is a steep dive in the growth curve in the first 2 years of the year 2000. My research on why this happen is inconclusive. Maybe related to the internet bubble burst? Another explanation could be that companies were awaiting ROI results in order to be convinced of the benefits of BI.

The one thing that is evident is that BI is a growing field and is predicted to continue to grow. In 2008 experts have predicted that this growth will slow down, due to market consolidations. (Fergusson, 2008) From the decrease in the graph in 2008, we can see that this prediction is

true. This however is not necessarily due to a decrease in acceptance, but more than likely a sign of market maturity.

1.4. BI in the industries

If I look back in history at what type of industries were the pioneers in using BI type systems I en up in 1970. The term BI did not exist in those days but something else called Decision Support Systems (DSS) was. In my literary research I came across the term **data-driven** DSS which are data warehouse systems that allow the manipulation of data by computerized tools tailored to a specific task and setting or by more general tools and operators provide additional functionality. In general, business intelligence systems are data-driven DSS.(Power, 2007)

BI/DSS systems are gaining an increased popularity in various domains, including business, engineering, the military, and medicine. They are especially valuable in situations in which the amount of available information is prohibitive for the intuition of an unaided human decision maker, and in which precision and optimality are of importance.(Druzdzel & Flynn, 2002)

One of the first data-driven DSS was an Analytical Information Management System developed in 1970-1974, at American airlines.(Power, 2007) Thus, the **airline industries** were one of the first to use BI. The data warehousing and OLAP as we know it now became popular in the 1990's. The developments that lead up to this popularity can be traced back to 1985, when the **consumer goods** giant Procter & Gamble made efforts to build a data-driven DSS system that linked sales information and retail scanner data. From there the BI systems across all industries experienced an explosive growth. In 1995, **retail** company Wall Mart already had a data warehouse with 5 terabytes, which grew to 20 terabytes in 1997.

At the end of the 20th century another dimension was added to BI. This was the Web-based DSS. In 1999 vendors introduced Web-based analytical applications. Many DBMS vendors shifted their focus to web based analytical applications.(Power, 2007) Companies such as Amazon.com (**books & electronics store**), Google (**software**) and Netflix (**movie rentals**) started creating data warehouses based upon information gathered through the internet.

All industries that generate data can use business intelligence to improve their business processes. Now BI is being used in almost all industries, retail, transport, pharmaceutical, health care (usually structured data), to law firms (usually unstructured data).

2. BI challenges

BI had - and still has - some challenges to overcome. Some effects of these challenges where that they caused the acceptance to slow down, gave it somewhat of a bad reputation or minimized the value add. Much of the focus of the BI community has been to find ways to overcome these hurdles so that companies can get the most out of it. Some of these solutions lay in the trends which are discussed in the next chapter.

2.1. Spreadsheet challenge

One of the more difficult BI challenges to tackle is the "spread sheet" challenge. Passioned – an independent consultancy and analyst group - states the following on their website: "Whilst spreadsheets provide an excellent mechanism for information delivery they are not and were never intended to be seen as the infrastructure behind Business Intelligence systems. This misuse of an excellent product is probably the single most important reason that Business Intelligence Systems still have a bad reputation, information only has value if it is accurate and timely, generally "information" produced by spreadsheets is neither."("Business Intelligence Tools Survey - Background," n.d.)

We see that lots of companies have reports are built in excel, which has advantages and disadvantages. One of the advantages of excel is that it is easy to work with, but this is also its disadvantage. First of all, reports that are made in spread sheets are easy to manipulate, which may result in audit problems. A second, problem with spreadsheets is that they are very error prone. Research by one academic suggests that between 20 percent and 40 percent of user-created spreadsheets contain errors; the more spreadsheets the more errors. (Davenport & J. G. Harris, 2007, p. 28)
A third issue with spreadsheets is that they can evolve into complex applications that may become very difficult to manage. These applications can include complex formulas that link between cells, sheets and even between spreadsheets documents. A situation like this will most likely create key man exposure. Key man exposure can lead to stress, panic, which again leads to more errors etc.

In order for companies to comply with legal and regulatory reporting requirements the BI architecture should be robust. The Sarbanes Oxley Act (SOX) for example, requires companies that are traded on the US stock market to demonstrate that their decisions are based on trustworthy, meaningful, authorative, and accurate data.

Some of the reasons why people are tempted to use excel for reporting are discussed below:

2.1.1. Inclusion of foreign data

Some data that is needed for analyses is not in the data warehouse. This type of data can be in "silos" that contain useful data but can not be accessed by the automated process some for technical reason(s), or this can be data from sources outside the company, such as market trends, survey data, stock exchange data etc.

As most BI tools pull from the data warehouse this extra data needs to be added to the report at a later stage. Because of the flexibility of spreadsheets, many analysts manually gather this type of data and manually enter it into spreadsheets in order to do analysis and make the reports. In most situations these reports are intended to serve as a report on a 'one-time' analysis, but if a manager says 'I like this report! I want to see it monthly' this turns into a periodic report. When such a report becomes periodic, there is a huge chance that this process is not changed and the integration of the "foreign" data is not included in the automated process.

2.1.2. Implementation speed

When circumstances such as a changing business climate call for a change in a certain report, the IT department is often needed to implement these changes. IT departments often work with budgets, programming resource availability and priorities which users perceive as expensive, time consuming and cumbersome. Instead of turning to the IT departments, these users turn to their own excel expertise.

2.1.3. Decentralization

In many companies the BI process is decentralized. Having a process decentralized has its positives, but it also has negatives. One of these negatives is 'wild grow', which can exist if the

data integration and some querying steps of BI are done by a data delivery department and the remainder of the BI process is left over to the individual business departments who create there own reports or analytical tools. In most cases, due to the lack of technical skills these individuals use spreadsheets as the tool to produce the final products because spreadsheets give the user a lot of flexibility and are very easy to create logic in, even for a non-technical person. With multiple individuals or departments managing their own spreadsheets multiple versions of the truth are created. It is very difficult for a company to have one focus if there is not one consistent and reliable source of information.

This situation can give BI a bad reputation and the value add is drastically reduced. Much of today focus in the BI community is to think of processes and tools that can solve this spreadsheet challenge.

2.2. BI implementation

More than half of BI projects are either never completed or fail to deliver the features and benefits that are optimistically agreed on at their outset.(Atre, 2003)

2.2.1. Skilled team members

Most non-BI IT implementation projects - such as an OS roll out, a new email client or a transactional system - involve a system with well defined variables and scopes. BI systems, however, usually do not serve one certain area of a business, as opposed to other online transaction processing systems such as ATM's or payment systems. BI systems extract, transform, deliver and analyze information from almost every area of a company. Therefore, finding people with the right combination of skills to successfully complete is a difficult task. Since, most BI projects have aggressive time lines an inexperienced and unskilled team is a huge risk for the successfulness of a BI project. Due to the difficulty of finding the right combination of necessary skills, some organizations unknowingly settle for less.

2.2.2. Business involvement

Many BI implementation projects tend to focus on the technique of the applications and are not business-oriented enough due to the fact that these projects are usually run by IT project managers. The BI systems will be used by businesspeople so it is important that these people

are involved in the implementation from start to finish of BI project. This type of project should also have a project manager from the business side so that the expected business benefits can be achieved. Such a project manager can then involve the stakeholders of such a project in order to steer the project in the right direction.

2.2.3. *Data quality*

Many source systems tend to contain data that is inaccurate or inconsistent. A TDWI study shows that poor data quality costs U.S. businesses an estimated $600 billion a year. (Eckerson, 2002) The issue data quality is a huge one on which many books have been written, and much discussion exists.

There are many reasons for 'dirty data'. One of which, is that front office workers do not always understand the importance of entering the right information in the systems. The systems do not always enforce the user to enter all information in all the fields or the user enters bogus information just to get to the next screen of the application. The user often does not understand that this may cause problems when this data is used for analyses in the back offices. Another cause of data inconsistency is the use of several systems to collect the same information. For example, if a company maintains customer contact information in the technical support system and in the customer service system. This is a situation that often leads to multiple versions of the truth.
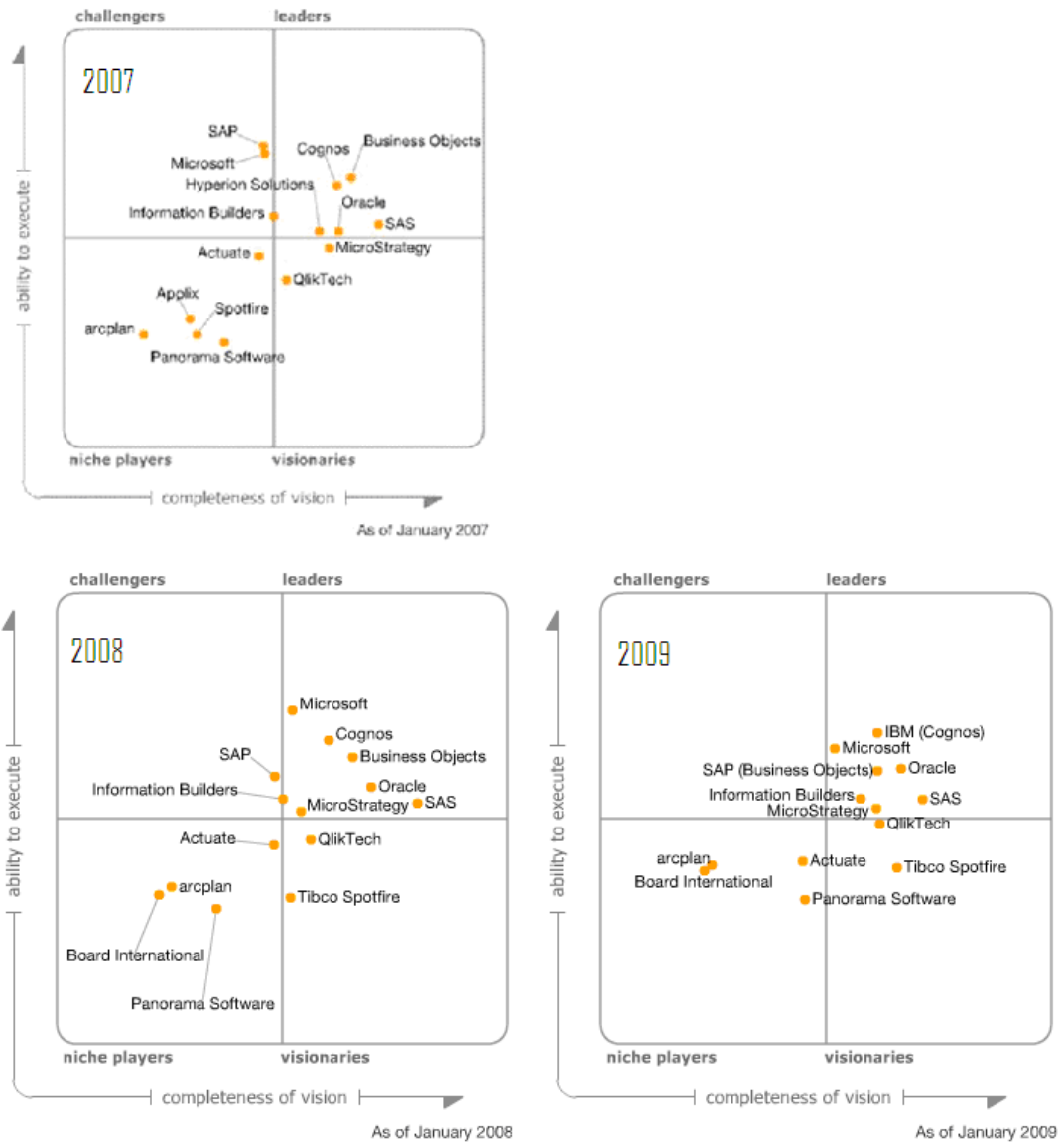
3. The trends

BI is a growing field, but several trends show that this is also maturing which leads some BI specialist believe that this is a sign that the growth rate of Business intelligence will decrease. "The days of strong double-digit growth in the business intelligence (BI) market are over as the industry enters a state of flux following vendor consolidation, increasing maturity and price erosion, said Gartner." ("Gartner Says Strong Growth in Business Intelligence Will Decline as Market Flux Continues," 2008)

3.1. Vendor consolidation

One of the interesting events that have occurred since 2007, are mergers and acquisitions of big players in the BI field. In most cases smaller BI innovators were bought by larger technology players, some of these acquisitions caused a shift in the BI landscape. In 2006 Cognos acquired Applix followed by Celequest in 2007. In 2008 Cognos itself was taken over by IBM. Hyperion software was bought by the database giant Oracle in 2007, and Business Objects was acquired by SAP in 2008.

There are several reasons why these consolidations have been taking place, of which the most obvious ones are, the synergy and competitive benefits. For example: Cognos did not have a MOLAP (multidimensional online analytical processing) environment. Acquiring Applix-whose main product was TM1- enabled them to fill this gap. In order to fill in the dashboard gap Cognos also bought Celequest. Being a mayor technology vendor IBM that certainly does not want to stay behind in the evolution of BI snapped up Cognos, thereby strengthening its position as a key BI player.

If we look at the Gartner Magic quadrants for the years 2007, 2008 and 2009 (figure 2) we can see this clearly.(Richardson, 2009) IBM does not even appear in the Quadrant until 2009 which can be interpreted as a consequence of the acquisition of Cognos. The same can also be observed for Oracle and SAP, which -within the MC- both gain growth in, ability to execute and, completeness of vision in the year following their acquisition.

Figure 2: Magic quadrants for 2007, 2008 and 2009

This consolidation trend also has some benefits. One of these is that the tool selection issue becomes less of a problem. There are many different vendors each having their own strengths and weaknesses. For example, one tool has the capability of producing nice reports, but lacked the capabilities for "slicing and dicing" (OLAP) or visa versa. This consolidation of vendors leads to the integration of BI tools each with a different focus, as we see with Cognos, TM1 and Celequest. As the packages become more integrated, the process of choosing an appropriate BI software tool becomes less difficult because the necessary features are now combined into one package.

Also, IT departments of many large companies have a preferred suppliers list. That means that they prefer to provide support for software from companies that are on that list, which usually does not contain the smaller BI companies. Organizations (especially large ones), that are searching for BI tooling are therefore hesitant to their purchase software, because the IT departments may not provide quick support. The larger software companies such as IBM, Oracle or SAP tend to be on these lists so companies tend to invest in these tools quicker.

It will be interesting to see how IBM's competitors such as HP (Hewlett Packard) will respond to IBM's move in BI. Kristina Robinson, vice president and general manager, Business Intelligence solutions, HP said: "HP is 100 percent focused on helping businesses address the most important challenges in enterprise data management to help them realize the full value of their business intelligence investments"(McCabe, 2009). Still, HP has not been able to get into the BI spotlight yet, and is also absent from the Magic Quadrant. Boris Evelson, an analyst at Forrester Research expects HP to buy some smaller BI vendors- Microstrategy, Actuate- in order to compete(Evelson, 2007).

3.2.   Operational BI

The current market competition forces companies to react quicker to changing business conditions and customer requirements. As a result, there is a need for BI systems to help drive and optimize business operations on a daily basis, and, in some cases, even for "on the spot" decision making. This type of BI is called operational business intelligence.

In a traditional BI system environment, the time between events occurring in transactional systems and action being taken based on BI system output is relatively long(days, weeks or months). In operational BI the idea is to extract useful information out of the data that is gathered at certain event almost as soon as they occur. This tactic has been used much in the hotel and airline industry before, in the form of dynamic pricing where the price of a hotel room or an airline ticket is adjusted in real time as a response to market conditions such as demand, inventory lever, competitor behavior, and customer history. Now, however, companies in the retail, gaming, manufacturing and other industries have started to apply operational BI on data so that their response to market behavior can be near immediate. Credit card and telephone companies are also very active in implementing different operational BI systems in order to prevent fraud and improving supply chain efficiency.

One example of a company using operational BI is Harrah's Entertainment Inc.[III] which is looking to raise the stakes by using its IT systems to let it identify, track, communicate with, and reward its customers while they're playing in its casinos.
Harrah's plans to add real-time capabilities to the system to get rewards in customers' hands more quickly. That means a regular customer on a losing streak might get a message on a slot machine's card-reader display that says" looks like you are having a bad moment. Here is a $20 credit you can spend in the restaurant". The objective, Harrah's CIO Tim Stanley says, is to stop good customers from leaving the premises for a competing casino.
Harrah's goal of developing tighter relationships with its customers isn't new, but its real-time approach is. "If you're not able to make a real-time decision about who the best prospects are and how to best match your resources with those prospects, then all is just about lost," says analyst Denis Pombriant, principal at Beagle Research Group (Kontzer, 2004).

There is a big technological challenge in operational business intelligence. In the BI process data needs to be extracted from multiple sources, which then need to be integrated and loaded into a data warehouse before analytics can be done. Most existing BI environments provide weak support for the kind of real-time query federation between data warehouse and

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III Harrah's Entertainment, Inc. is the world's largest provider of branded casino entertainment through operating subsidiaries.

another operational data sources necessary for operational-analytical hybrids to support business processes.

One alternative is to be very selective about the data elements to include and use real-time agents to gather the data as it flows through a message queue or read the applications' logs for changed data. This is BI's version of event-stream processing. By providing such capabilities (and others) as part of its core technology, Celequest[IV] has found a way for BI to participate in an SOA cooperatively. The event orientation helps move analytical information out to users, processes or applications in real-time--either as a standalone set of dashboards or as services employed by composite applications.

Neil Raden[v] states: "Operational BI or, more accurately, operational analytics, must be as lightweight and configurable as services. Grabbing a piece of historical data from a data warehouse, aligning it with current information from an operational process, perhaps dynamically generating a forecast based on trend analysis or even a stochastic process like Monte Carlo Simulation to produce a range of outcomes--all these activities must happen transparently and in near-real time. Although it's true that many operational-analytical hybrids can operate in a more relaxed timeframe, the demand for analytical services will drive the development of fast, thin applets" (Raden, 2006).

As we see in the case of Harrah's casinos, the real time events were mostly event driven and not based on analyses of huge amounts of data. Due to the technical challenges this is an area of BI that will probably get lots of attention from the BI community in the years to come.

3.3. Open source

As is the case with most commercial software tools, commercial BI tools are often too expensive and the price becomes a hurdle to the CIO's willingness to invest in them. Commercial BI packages also tend to have many more features than are needed. The open source community is trying to fill this gap.

Open source vendors provide free downloads of their products and manuals on their websites. These freely downloadable versions are usually scaled down version of the full packages in

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[IV] Celequest – BI vendor purchased by Cognos, which is now owned by IBM
[v] Neil Raden is a consultant and analyst and a partner and co-founder of Smart (enough) Systems LLC, a research and advisory firm specializing in analytics, business Intelligence and decision management.

terms of performance and some special features. The vendors then charge fees for the full version, extra support, and services such as updates, patches, future releases and help with code customizations.   However, even after including the fees, the open source option usually has a lower total cost of ownership.

Open source also enables organizations to of test out a variety of software in order to find out what best suits their business needs, instead of listening to a sales person that is trying to sell their product. With a downloadable copy of the software, BI users can try a near complete (in some cases complete) version of the software before deciding to invest in it.

Most commercial software packages are far too large, and have so many features and modules that they are completely over-serving core needs (C. Harris, 2008). Open source is less overwhelming, allowing organizations to tailor a solution specific to their needs. This has its advantages and disadvantages. For example, companies that are looking for a particular solution may view this as an advantage, as apposed to companies that are seeking a comprehensive end to end software tool.

With the arrival of open source the large commercial venders will need to react and keep their product more appealing than the open source alternative. It is likely that they will do this in the form of innovation, services, or even cheaper software licenses.

Some of the popular open source vendors are:

Pentaho:

Pentaho is a BI tool that offers end to end capabilities by integrating several open source projects. It offers Kettle for ETL, Mondrian for OLAP functionalities, Pentaho reporting for the reporting needs, and Pentaho Data Mining – based on Weka - for Data Mining.

Jedox:

Jadox is a company that develops open source-based planning, analysis and reporting systems. The most popular tool developed by Jedox is Palo, which is a SaaS enabled Open-Source BI Suite for Performance Management including Planning, Analysis, Reporting and ETL. The suite includes an in-memory OLAP Server, an Ajax-based online spreadsheet with DynaRanges and a web-based ETL-Tool.("Palo BI Suite," n.d.)

Talend:

Talend is a developer of open-source data integration tools, which states that their solutions are the most widely used and deployed data integration solutions in the world ("Talend - first provider of open source data integration software," n.d.). These solutions enable automation of the ETL process.

Bi surveys show that 40% of companies are handcoding their ETL processes, while due to economic factors IT budgets are under heavier scrutiny as a cost to control. Talend and other open- source BI vendors are addressing this gap in data integration (Madsen, 2009).

3.4. *Master data management*

One of the great difficulties of managing data in a management information environment is the use of the same common reference data[vi] – single version of the truth – such as a list of foreign currency codes or country codes, across different platforms. Very often this type of data is scattered and managed at different places within the organization. This can cause information inconsistencies. Master data management (MDM) is trying to tackle this issue by using different processes, techniques and tools which are also being provided by software vendors such as SAS and IBM.

Although several application and information management domains are trying to own MDM, the discipline is emerging as its own entity next to BI. This is so because MDM should not be limited to a data warehouse processes only, but it needs to be across the whole organization. I am including MDM as a trend because having a single version of the truth is essential to BI, and therefore part of BI.

[vi] Data that describes a physical object and its properties, which is shared across multiple systems

4. The major players

There are many BI vendors appearing on the market these days, and each claims to be the best. All these choices make it difficult for companies to select tool. Several market research (market intelligence) firms try to assist with this, by conducting surveys and studies about the existing tools. Two well known firms are Gartner and Forrester.

4.1. Gartner

Gartner is a leading information technology research and advisory company, which publishes the famous BI Magic Quadrant (MQ). In the MQ, Gartner presents a global view of its opinion of the main software vendors that should be considered by company's seeking to develop BI applications.

In the MQ the BI vendors are ranked based upon 2 criteria. First is ability to execute, which is the ability to make their vision a market reality. The second criterion is completeness of vision, which is the understanding of how market forces can be exploited to create value for customers and opportunity for themselves.

The vendors that are included in the MQ must; generate at least 20 million dollars revenue from BI platform software sales annually; have customers that have deployed the vendor's platform as their enterprise BI solution; deliver at least eight out of 12 capabilities in the BI platform definition (Richardson, 2009). The 12 capabilities in the BI platform definition are: reporting, dashboards, ad hoc query, Microsoft office integration, BI infrastructure, Metadata management, development environment, workflow and collaboration, OLAP, visualization, predictive modeling and data mining, and scorecards.

According to the annalists that compose the MQ, the leaders and visionaries of the BI market are: IBM, Microsoft, Oracle, SAS, Information Builders, SAP, and Microstrategy.

As of January 2009

4.2.   IBM

International Business Machines Corporation (IBM) is a multinational computer technology and IT consulting corporation headquartered in Armonk, New York, United States.

IBM has delivered BI-related applications for some time, but did not appear in the MQ before 2009. Due to the purchase of Cognos in late 2007, IBM now becomes one of the key BI software vendors. IBM is now very committed to BI which is evident in the significant staff increase. Globally, the firm has hired over 800 employees since Februari 2008, representing a 20% growth in the overall "Cognos" workforce since the acquisition.

In july 2009 IBM purchased SPSS which is a leader in the predictive analytics/data mining market. "Buying SPSS, which had 14% of the predictive analytics/data mining market segment, will allow IBM to leap from 13th into second place, behind only SAS Institute Inc, which dominates the segment with a 33% market share. It will also allow IBM to technically integrate its other business intelligence software with similar offerings from SPSS" (Lai, 2009).

With the purchase of SPSS, IBM will be able to integrate predictive analyses with other analytical and operational tools IBM currently provides, which will likely cause IBM to closer to SAS on the visionary axes of the MQ.

4.3. Microsoft

Microsoft Corporation is a United States-based multinational computer technology corporation that develops, manufactures, licenses, and supports a wide range of software products for computing devices.

Even though Microsoft joined the BI market relatively late, it's broadly capable and low priced product resulted in quick growth. In 2008 Microsoft was able to gain a position itself in the leader and visionaries' quadrant of the MC. The main BI products that Microsoft offers are Excel, SQL server and Sharepoint server.

As discussed in the BI Challenges section, Excel is well known as a good and practical do-it-yourself analysis tool, and/or as the front-end to third-party BI applications. The distribution of a spreadsheet, however, can lead to further manipulation of its content by users on their own PCs, which in turn can lead to 'many versions of the truth'. Excel as a client-side application does not scale-up well, and is certainly not designed to work on the server side.

As a solution to the limitations of Excel, Microsoft introduced Excel services as part of Microsoft Office Sharepoint service (MOSS). Excel services provides functionality for securely sharing office Excel spreadsheets as HTML pages so others can access the information within a web browser. Using Excel services the spreadsheets –viewed via the browser- remain interactive; e.g. cell manipulations, drill through, consolidating. The combination of MOSS and Excel gives users the flexibly of Excel with the server-side capabilities offered by Excel services enables companies to build small and basic BI capabilities (Burnett, 2001).

For the end to end BI solution Microsoft offers Microsoft SQL server. This application includes; Microsoft SQL Server Integration Services for data integration; Microsoft SQL Server Analysis Services for complex analyses; Microsoft SQL Server Reporting Services for reporting.

4.4. Oracle

Oracle Corporation specializes in developing and marketing enterprise software products — particularly database management systems. Through organic growth and a number of high-

profile acquisitions, Oracle enlarged its share of the software market. By 2007 Oracle had the third-largest software revenue, after Microsoft and IBM ("Oracle Corporation - Wikipedia, the free encyclopedia," n.d.).

Oracle bundles its BI under the Oracle Business Intelligence foundation which consists of: Oracle BI Enterprise Edition, which is a comprehensive suite of enterprise BI products that delivers a full range of analysis and reporting capabilities. This also includes Hyperion Essbase which is an OLAP server. Hyperion was purchased by Oracle in 2007.

Gartner annalists views Oracle's packaged solution, which consists of more than 70 functional and industry-specific BI applications as a pro. As a con they mention that Oracle lags behind the competition in introducing emerging technologies such as, in memory processing, interactive visualization and search, as part of the BI platform offering.

4.5. SAS

SAS, a US based company has been a major producer of analytical software since 1976. SAS originally stood for Statistical Analysis System, but this has now become the name of the company as a whole. SAS is one of the largest privately-held corporations in the software industry.
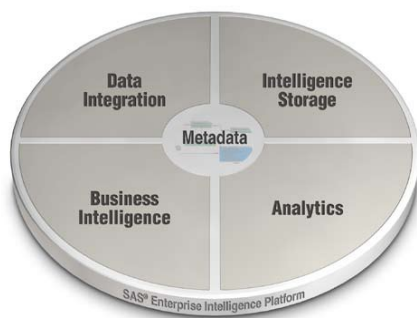
SAS has developed the SAS Enterprise Intelligence Platform, which integrates the individual BI technology components within an organization into a unified system. This platform enables IT to deliver extensive BI capabilities – from reporting and dashboards to complex analytics - to users with different skill levels across the enterprise.

According to Gartner, SAS has a stronger focus on forecasting, predictive modeling and optimization when compared to the other BI vendors in the Magic quadrant. Their survey data

collected shows clearly that SAS is the only BI vendor of any scale whose customers use data mining or predictive modeling extensively.

As a flaw Gartner states that SAS has a reputation for being difficult to use. "While SAS offers Web Report Studio, a business user interface, anything beyond simple ad hoc reporting requires the power user-oriented Enterprise Guide, with many of the data manipulation and advanced analysis tasks requiring SAS programming language knowledge. The need for specialized skills represents a significant barrier to adoption in new SAS accounts" (Richardson, 2009).

4.6. Information Builders

Information Builders is a privately held software company, with its headquarters in New York City. Together with Apple Computer, Oracle Corporation, and the SAS Institute they belong to a select group of medium to large software and hardware companies from the mid-seventies that are still managed by their founders ("Information Builders - Wikipedia, the free encyclopedia," n.d.).

Webfocus is the BI platform that the Information Builders offers, which is a fully integrated enterprise BI platform. Webfocus' excels as a platform for building custom Web-based BI applications, including RIA, often in extranet and public Web applications where its deployments regularly exceed tens of thousands of users executing live interactive queries against multiple databases.

Due in part to Information Builders' mature WebFOCUS product, its focus on internal development as opposed to acquisition, and its continuous quality assurance processes for all

supported platforms, customer references rate Information Builders' product quality among the best in the industry.

For data integration purposes, Information Builders offers I-Way. This is packaged with WebFOCUS and serves as an adapter to the data sources. According to Gartner, the use of I-way makes the WebFOCUS package better suited for data warehouse-less and operational reporting than most other BI platforms (Richardson, 2009).

4.7. SAP

SAP is a globally operating company whit its headquarters in Waldorf, Germany. SAP specializes in business management software, and is the fourth largest independent software company in the world. In 2008 SAP acquired the popular BI vendor Business Objects. This purchase is probably played the biggest role in pushing SAP in the leader's quadrant of the MQ.

Before SAP purchased Business Objects, their main BI offering was the SAP Netweaver BI suite, which is part of the Netweaver technology stack. SAP Netweaver BI solution has a very pervasively employed data warehouse, and contains a large number of pre-defined business content in the form of InfoCubes, Info Objects, authorization roles, and queries. The pre-defined business content can be modified to meet an organization's specific requirements. With the acquisition of Business Objects there is overlap between the BI products that SAP offers. Technology News articles stat that, SAP has made the strategic decision to encourage the current SAP Netweaver BI users to start looking at Business Objects. SAP NetWeaver BI is still available for SAP-only customers, but Business Objects XI, is now SAP's flagship BI platform (Kelly, 2008).

On the SAP website however, SAP states the following: "SAP NetWeaver BI and capabilities from Business Objects bring together market leading query and analysis and reporting tools, planning and simulation capabilities, and data-warehousing functionality".

4.8. Microstrategy

MicroStrategy is a BI, enterprise reporting, and OLAP software vendor with its headquarters in the United States. Microstrategy is one of the few independent BI vendors left as a result of the latest BI vendor consolidation trend. As a response to this trend Microstrategy has been aggressively recruiting talent and pursuing customers from the competitors. In 2009 Microstrategy released Microstrategy 9, which with more than 8000 enhancements and upgrades, is the company's most significant release in nearly a decade.

MicroStrategy's software allows reporting and analysis of data stored in a relational database, multidimensional database, or flat data file. The Gartner report states that the software performs very well when it is running on top of large enterprise data warehouse.

The tool, however, is not a fully comprehensive BI tool. It does not have the ETL capabilities, and only operates in the reporting and analyses and distribution phases of the BI process. For the ETL process a different tool such as Talend can be used. This lack of end-to-end offering is mentioned as one of Microstrategy's minor weaknesses.

5. Analytics

One of the elements under the BI umbrella that has proven to be very beneficial to companies is analytics[VII]. In the past, statistical and quantitative methods for business decision purposes have been used on a small scale, and most decisions made by executives were based on intuition.

Analytical techniques have been used for decades so analytics by itself is not new. What is new here is the integration with BI. In theory, after the ETL process, analytical users now have a whole data warehouse with clean data available to them to be analyzed, where in the past statisticians had to ask the IT department for data that was often unstructured and needed to be 'cleaned'. With analytics now being more integrated into the BI process, analytical staff can provide executives with information quicker and with more confidence.

What is also new is that companies in all kinds of different industries are now starting to use these methods to gain an advantage over their competition. Davenport and Harris call this "competing on analytics". In their book, Davenport and Harris suggest that, the former strategic alternatives are no longer viable or likely to lead to success. These days' new technologies are easily copied, and breakthrough innovation in products or services is rare. The way for an organization to gain a competitive advantage now, is by optimizing their key business processes.

5.1. The 5 stages of analytical competition

With the right elements in place, analytics can support and possibly even shape a company's strategy. Using analytics an executive can extract knowledge from data that enables them to outperform their competitors. There is considerable evidence that decisions based on analytics are more likely to be correct than those based intuition. However due to several factors, some of which are mentioned in the "challenges" chapter some companies have been less successful in competing analytics than others. In "Competing on analytics" Davenport

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[VII] Analytics: the extensive use of data, statistical and quantitative analysis, explanatory and predictive models, and fact-based management to drive decisions and actions

and Harris identify 5 stages of analytical competitors (Davenport & J. G. Harris, 2007, p. 35).
These are:

Stage 1: analytically impaired

Stage 2: localized analytics

Stage 3: analytical aspirations

Stage 4: analytical companies

Stage 5: analytical competitors

Analytically impaired:

These are organizations that have some desire to become analytical competitors, but some factors exist that prevent them from doing so. This can be due to many factors such as; bad transaction data, lack executive support, have too many silo systems, or lack of skilled analysts. From a "competing on analytics" perspective, these companies are flying blind.

Localized analytics:

These organizations do BI in the past, which emphasizes on reporting with some analytical activity around the company. The information that is gained from the analytical work is not used to make decisions, so the company strategy is not affected by it. Davenport suggests that most companies might fall into this group.

Analytical aspirations:

Organizations at this stage understand the values and promise of analytical competition and are in the starting blocks of elevating themselves to a company capable of competing on analytics.

Analytical companies:

These are organizations are at the verge of being full blown analytical competitors, but miss a small element, such as passion of leadership that holds them back.

Analytical competitors:

These companies have identified the key strategies and capabilities to be supported by analytics techniques and are consciously and visibly applying them.

"Their analytical activities are clearly in support of a distinctive capability, they are taking an enterprise wide approach, their executives are passionate and driving, and their analytical initiatives are aimed at substantial results. Some of the firms that fall into this category include Google, Harrah's, Amazon.com, Progressive, Netflix, Wal-Mart, and Yahoo".(Davenport & J. G. Harris, 2007, p. 124)

5.2. Where can organizations benefit from analytics?

There are many different business objectives and issues that can be improved by using analytics. Here some of these objective and techniques used are discussed:

5.2.1. Customer or consumer

Here the focus is on the customer, where different analytical methods are used by the marketing departments to attract new customers, but also to retain the current customers. Some of the different types of analytical techniques and tools that are used when focusing on the customer are:

Chi-square automatic interaction detection (CHAID) - this is a decision tree type technique, which is used to group customer on the basis of multiple alternative variables. This technique is often used by marketing to select groups of customers to target.

Conjoint analysis – This is a statistical method that is used to determine which attributes of a product or services are appealing to a customer. For example, using this technique one can determine which factors (price, size, location, color, etc) are most important to a customer when buying a new car.

Lifetime value analysis – This is an analysis of the predicted future cash flows and costs that are attributed to a customer relationship. This gives an organization a good idea of what a customer is actually worth, and decisions can be made whether a customer (potential customer) is worth retaining (or acquiring).

Multiple regression analysis – This is the most popular statistical method for predicting the value of or changes in a dependent variable in relation to values of one or more independent variables. For example the, the relationship between a dependent variable such as sales of a certain product, and independent variables such as season, time of day, weather, or number of products in stock.

Price optimization – this is a technique (or field) is also called revenue management, in which the focus is to influence purchase behavior by changing the price and at the same time maximizing the revenue. Here the price elasticity or the response of the buyer to increase of the product price is key. Using, this technique the appropriate price increase or decrease can be measured when the demand of a product or service goes up or down. Most retailers experience a 5 to 10 percent increase in gross margin as a result of using price optimization systems.(Davenport & J. G. Harris, 2007, p. 92)

Location analysis – The main aim here is to optimize the location of stores, distribution centers, manufacturing plants and so on. A retail company could also use location analysis to determine on what shelf and how high on the shelves the products need to be in order to optimize revenue.

5.2.2. Supply chain processes
Here the focus in on the supplier- facing processes. Many large firms have logistical tools in place that are used to reduce inventory. This is also an area that is currently getting much attention from the academic world under the term "operations research". Different types of applications include the following:

Inventory and queuing– Models are created to simulate and optimize supply chains. The techniques can range from finding intersections of demand and supply curves to linear programming with constraints.

Routing – these tackle the problem of finding the best path a delivery vehicle should travel to a set of locations. A popular type of problem within that deals with this is the 'traveling salesman problem'.

Crew scheduling – here the schedules for resources of an organization are created. Many different factors such as labor laws, availability, maximum hours and skill sets, need to be taken into account when scheduling resources, which can make it quite complex.

5.2.3. Internal processes

The internal processes of a business also are also mayor areas where analytics are used. Such internal processes include finance, manufacturing, operations, human resources, quality analyses R&D (research and development). Some of the applications used in these processes are:

Activity based costing - this is the discipline of allocating the costs of an activity within an organization to different aspects of a business such as customers, processes, or distribution channels. One example of where this could be used is in calculating the 'real' profitability of product or services, by also taking the different cost aspects into account at the activity level. Management gets a good view of were and how too much money is spend, so that activities, materials, resources, and product-offering components can be optimized.

Combinatorial optimization – with this technique there are multiple options (resources, products etc.) which can be combined in order to find the optimal solution. This has a widespread use for many practical problems in telecommunications, manufacturing, transportation and retail.

Analytics, however, is not limited to the activities named above. In the Athletics world for example, analytics is used to recruit professional athletes. In team sports analytics is used to find the optimal combination of talents. The analytical applications are limitless, and can be applied in any satiation when a model can be shaped out of data.

5.3.   The Analytical professionals

All the above quantitative methods and techniques are in some form covered in the curriculum of BMI. Davenport did a survey out of which he concludes that, most of the analytical competitors had a group of smart and hardworking analytical professionals within the ranks of executives. These professionals specialize in the design and implementation of experiments and tests, to define and refine analytical algorithms, and perform data mining and statistical analysis on key data.

In a cover story in Businessweek, Stephen baker writes the following:

"The world is moving into a new age of numbers. Partnerships between mathematicians and computer scientists are bulling into whole new domains of business and imposing the efficiencies of math. This has happened before. In past decades, the marriage of higher math and computer modeling transformed science and engineering. Quants turned finance upside down a generation ago. And data miners plucked useful nuggets from vast consumer and business databases. But just look at where the mathematicians are now. They're helping to map out advertising campaigns, they're changing the nature of research in newsrooms and in biology labs, and they're enabling marketers to forge new one-on-one relationships with customers. As this occurs, more of the economy falls into the realm of numbers" (Baker, 2006).

Tom Leighton, an entrepreneur and applied math professor at Massachusetts Institute of Technology, says: "All of my students have standing offers at Yahoo! and Google."(Baker, 2006) Thus, the need for BMI students in the business world is great.

Conclusions

The above discussions indicate that the successful method for making business decisions is shifting from intuition based to analytical based decision making. The more intelligent way of running a business should be based on facts and trends instead of gut feeling. Wheraes in the past, people with an MBA were responsible for spotting the opportunities in the market, now most signs indicate that this role is being taken over by the more mathematically oriented people who are able to explore different opportunities inside and outside the company by exploring data using statistical techniques.

Companies with their management information in order and competing on analytics ten to have control over their business and are excelling, while those that do not fail to maintain their grip in their business. This can lead to excessive expenses, lost opportunities, reduction in revenues and ultimately bankruptcy.

The success stories show that, as the collaboration between IT and the financial department is strengthened, companies get control and are able to maneuver themselves into a better position in the competitive market. In his book "Competing on Analytics", Davenport suggests that a company can not compete on analytics without executive support. The CFO of the company must view IT departments as assets of a company instead of as liabilities. The practical cases indicate that, without financial executive support, the IT departments are more than likely to fail in the implementation of BI initiatives.

As the business world is becoming aware of the importance of management information and analytics, we see the BI field maturing. This is because BI is an enabler of business control and growth. The evolution and, in some cases, revolution of the BI technology and the awareness of management information appear to be directionally proportional to each other. BI is a growing field and most companies that implement BI correctly benefit from it. Most BI specialists expect that this field will continue to develop in the future as executives become aware of the return on investment that can be gained.

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