BUSINESS INTELLIGENCE TOOLS FOR DATA ANALYSIS AND DECISION MAKING

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Abstract
Every business is dynamic in nature and is affected by various external and internal factors. These factors include external market conditions, competitors, internal restructuring and re-alignment, operational optimization and paradigm shifts in the business itself. New regulations and restrictions, in combination with the above factors, contribute to the constant evolutionary nature of compelling, business-critical information; the kind of information that an organization needs to sustain and thrive.
Business intelligence ("BI") is broad term that encapsulates the process of gathering information pertaining to a business and the market it functions in. This information when collated and analyzed in the right manner, can provide vital insights into the business and can be a tool to improve efficiency, reduce costs, reduce time lags and bring many positive changes. A business intelligence application helps to achieve precisely that.
Successful organizations maximize the use of their data assets through business intelligence technology. The first data warehousing and decision support tools introduced companies to the power and benefits of accessing and analyzing their corporate data. Business users at every level found new, more sophisticated ways to analyze and report on the information mined from their vast data warehouses.
Choosing a Business Intelligence offering is an important decision for an enterprise, one that will have a significant impact throughout the enterprise. The choice of a BI offering will affect people up and down the chain of command (senior management, analysts, and line managers) and across functional areas (sales, finance, and operations). It will affect business users, application developers, and IT professionals.
BI applications include the activities of decision support systems (DSS), query and reporting, online analytical processing (OLAP), statistical analysis, forecasting, and data mining. Another way of phrasing this is that BI applications take data that is generated by the operations of an enterprise and translate that data into relevant and useful information for consumption by people throughout the enterprise.

Keywords: *Business intelligence, application, decision making, knowledge, data mining, data warehouse*

Introduction

The final decades of the 20th century and the beginning of the 21st have been marked by a staggering proliferation of information and communication technologies throughout the industrialized world. Not only do globalization trends bring a turbulent and most often unequal competitive environment, they also propagate waves of "managerial imperatives" – such as total quality; reengineering and integrated systems – that exert tremendous pressure on organizations wanting not only to survive but to succeed. In addition to performance and effectiveness, global organizations are asked to display ethical, social and environmental responsibility. This entire context makes the task of managing information a formidable challenge.

At present, information management is seen as one of the biggest challenges characterizing today's corporate context. A combination of constant technological innovation and increasing competitiveness makes the management of information a difficult task, one which requires decision-making processes that are built on reliable and timely information, gathered from internal and external sources. Although the volume of information available is increasing, this does not automatically mean that people are able to derive value from it. In the IT field, after years of significant investments to create technological platforms that support all business processes

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(processes that are "reengineered" and "integrated") and that strengthen the efficiency of the operational structure (after undergoing "quality" programs), organizations are supposed to have reached a point where the implementation of IT solutions for strategic decision-making processes becomes possible and necessary. This context explains the emergence of the area generally known as "business intelligence" (BI), seen as an answer to current needs in terms of information for strategic decision-making through intensive use of information technology (IT).

Definition of Business intelligence

The literature review of BI reveals few studies. Most of the articles are conceptual. What's more, throughout the literature, meets the traditional "separation" between technical and managerial aspects, outlining two broad patterns[1]. The technological approach, which prevails in most studies, presents BI as a *set of tools* that support the storage and analysis of information. This encompasses a broad category of applications and technologies for gathering, storing, analyzing, and providing access to data to help enterprise users make better business decisions. Those BI tools include decision support systems, query and reporting, online analytical processing (OLAP), statistical analysis, forecasting and data mining. The focus is not on the process itself, but on the technologies that allow the recording, recovery, manipulation and analysis of information. Sophisticated use of warehoused data occurs when advanced *data mining* techniques are applied to change data into information. Data mining is the utilization of mathematical and statistical applications that process and analyze data. Mathematics refers to equations or algorithms that process data to discover patterns and relationships among variables. Statistics generally shed light on the robustness and validity of the relationships that exist in the data mining model. Leading methods of data mining include regression, segmentation classification, neural networks, clustering and affinity analysis. The synergy created between data warehousing and data mining allows knowledge seekers to leverage their massive data assets, thus improving the quality and effectiveness of their decisions. The growing requirements for data mining and real time analysis of information will be a driving force in the development of new data warehouse architectures and methods and, conversely, the development of new data mining methods and applications.

In short, BI is a wide set of tools and applications for gathering, consolidation, analysis and dissemination aiming at to improve the power to decision process. The components of business intelligence that focus in collect and consolidation can involve data management software's to access data variables, extract, transform and load tools that also enhance data access and storage in a data warehouse or data mart. In the steps of analysis and distribution, each time more different products are launched and integrated with objective to take care of the different use of the information. These products can include the creation of reports, the fine-tuned dashboards containing customized performance indicators visually rich presentations using gauges, maps, charts, and other graphical elements to show multiple results together, the generation of OLAP cubes and the data mining software's to discover information hidden within valuable data assets, using advanced mathematical and statistical techniques, can uncover veins of surprising, golden insights in a mountain of factual data. Figure 1 presents a proposal of BI architecture, distributing the different technologies and applications argued in function of its main contribution in each one of the steps in the BI process.

The managerial approach sees BI as a *process* in which data from inside and outside the company are integrated in order to generate information relevant to the decision-making process. The role of BI here is related to the whole informational environment and by which operational data gathered from transactional systems and external sources can be analyzed to reveal the "strategic" business dimensions. From this perspective emerge concepts such as the "intelligent company": one that uses BI to make faster and smarter decisions than its competitors. Put simply, "intelligence" entails the reduction of a huge volume of data into knowledge through a process of filtering,

[1] Altosoft corporation, Bringing business intelligence to business operations, March 2009.

analyzing and reporting information. The explanation of how companies acquire "intelligence" would lie in the data-information-intelligence transformation. Traditional wisdom emerges here: data is raw and mirrors the operations and daily transactions of a company; information is the data that has passed through filtering and aggregation processes and acquired a certain level of contextual meaning; intelligence elevates the information to the highest level, as the result of a complete understanding of actions, contexts and choices.

Both approaches – technical and managerial – rely on an objective and positive view that "strategic decisions based on accurate and usable information lead to an intelligent company". All the subjectivism inherent in social interactions is evacuated and cultural and political issues are not evoked. Whether the reviewed studies are managerial or technological, they share a common idea:

- the core of BI (process or tool) is information *gathering, analysis and use*, and
- the goal is to support the strategic *decision-making process*.

The Characteristics of a Business Intelligence Solution

Single point of access to information

With BI systems, organizations can unlock information held within their databases by giving authorized users a single point of access to data—a BI portal—in both intranet or extranet environments. Wherever the data resides, whether it is stored in operational systems, data warehouses, data marts and/or packaged applications, users can prepare reports and drill deep down into the information to understand what drives their business, without technical knowledge of the underlying data structures. The most successful BI applications allow users to do this with an easy-to-understand, non-technical, graphical user interface.

Using BI in all departments of an organization

There are many different uses for BI systems. BI systems can be used at every step in the value chain.

Timely answers to business questions

The key to unlocking information is to give users the tools to quickly and easily find answers to their questions. Some users will be satisfied with standard reports that are updated on a regular basis, like current inventory reports, sales per channel, or customer status reports. However, the answers these reports yield, can lead to new questions. Some users will want dynamic access to information. The information that a user finds in a report will trigger more questions, and these questions will not be answered in a prepackaged report.

Making the most of the internet by creating an extranet

You can open up BI system access to users outside the organization through extranet applications with clearly defined security limits. For example, customers may want to consult their ordering history to analyze their buying patterns and identify cost-saving opportunities. Or suppliers may be interested in gathering sales data.

Selection of BI Tools

Selection of a BI tool may turn out to be a difficult task. At present companies offer a wide range of products beginning from simple reporting technologies up to sophisticated BI platforms. While choosing a BI tool, it is necessary – like in the case of purchasing other IS – to take the following criteria into consideration: functionality, complexity of solutions, and compatibility. It is also necessary to remember that organization's informational needs will evolve. Therefore, BI tools should be up-to-date enough to meet enterprise's expectations in a few years to come.

At this stage, good market knowledge of BI is required. Today BI products may be found in different segments of the IT market. Providers of MRP II and ERP systems more and more frequently equip their products with BI modules (e.g. SAP, Oracle or Microsoft), thus wishing to make their products more dynamic and analytical. OLAP techniques and data mining have also been

implemented in database systems (Oracle, Microsoft or IBM)[2]. Planning and budgeting belong to another segment of the IT market that uses BI techniques. Additionally, it has to be mentioned that there is a group of providers that offer BI solutions in a highly specialized area and usually on a very high level of customer need satisfaction. Such products often include best practices for a particular sector along with some future solutions. One cannot forget about open source solutions that are more and more frequently available on the market.

In the BI sector – similarly as in case of other IT sectors – it is possible to observe some processes of consolidating providers - purchasing products or expanding products by means of functionalities that are offered by the best providers in a given category. Hence, it is necessary to consider whether a given enterprise ought to purchase products and technologies from one provider or if such an enterprise should follow a principle of selecting the best products in a given category (e.g. the best tools for OLAP, ETL, etc.) sold by different providers. In the former case, enterprises are guaranteed integration of particular products and a similar interface. However, it has to be taken into account that not all solutions are going to be of the highest possible quality. Package purchase of products frequently involves discounts, which is quite important for enterprises. On the other hand, purchasing products from several providers may lead to delegating responsibility for particular module performance to other providers. It is also more difficult to obtain larger discounts while purchasing technologies that come from different providers. There is also some other possibility – purchase of a ready to use solution instead of a particular technology. In this situation, it is necessary to learn more about capacities of a given application and then consider whether such an application meets enterprise's needs and whether there are some elements that the application in question should be subsequently provided with. Providing an enterprise with BI products of an open source type is another possibility. Examples of complimentary or open source products may be provided by Sygate Analyst (a tool used for data visualization), Agata Reports (a reporting tool), Oracle Application Express (environment for building web applications), and cockpit for the management in open source ERP Compiere, Business Intelligence Reporting Tool for Eclipse or Mondrian OLAP Server. Some providers of BI products use free databases. For instance, Business Objects uses a complimentary database called MySQL. Figure 1[3] represents the largest BI vendors of the world IT market.

[2] www.intelligententerprise.com.
[3] www.informationweek.com.

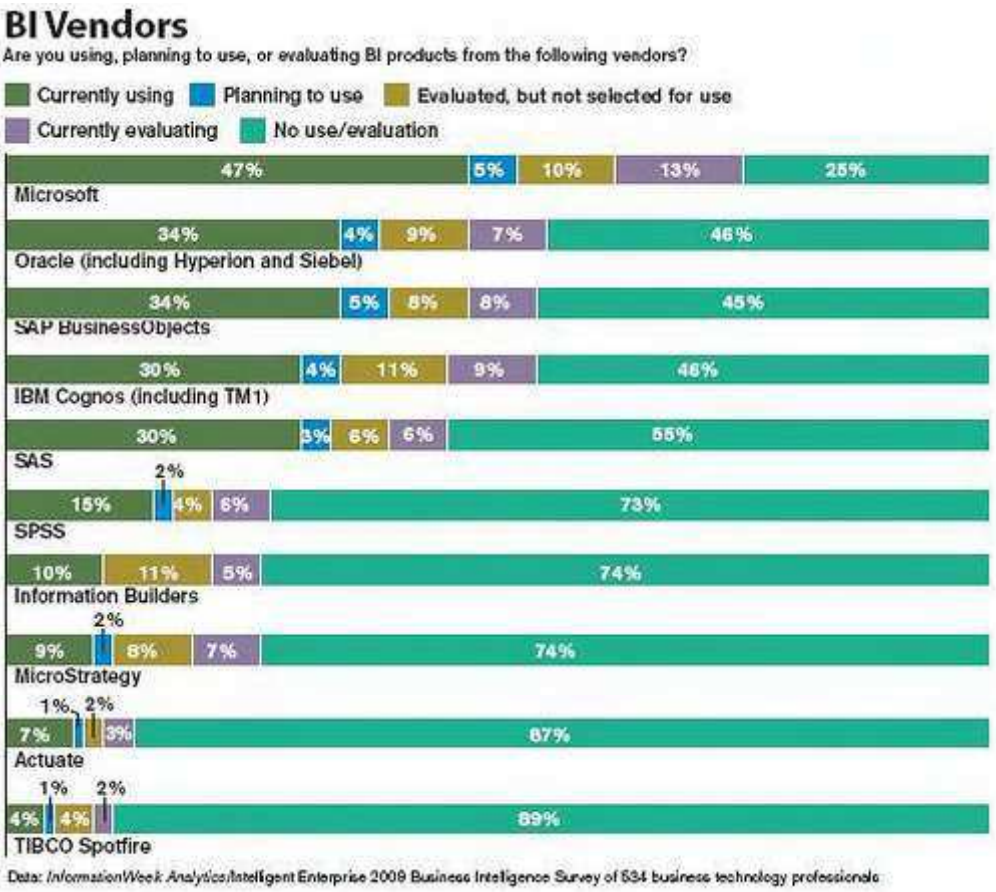

Figure 1. BI vendors
Source, www.intelligententerprise.com

The typical BI 'stack' or architecture can be represented as having a series of layers. The base is usually shown as source data systems from where data is extracted, translated and loaded by extract, transform and load (ETL) software into a data warehouse. Above this is an application layer (or BI layer) and on top of this the presentation or delivery layer which can include executive dashboards, scorecards and other tools that make it easier for managers to find and understand the information and proactively use it in decision making.

As BI has evolved, the greatest challenge has been how to integrate data on different systems accumulated from different vendors over many years. Traditionally, data flows from source systems to data warehouses then to data marts and cubes to be used in BI applications. Source data can now also come from customer facing applications, suppliers and sources of external information. The data warehouse has the potential to become the information hub that distributes data to and from many data sources and applications. Software houses used to specialize in different layers of this BI stack and businesses applied a 'best of breed' approach to assembling their own stacks. For example, a SAP ERP system might feed data to an Oracle data warehouse and the finance function might use an application from Hyperion for consolidation and reports and another from SAS for more advanced analytics. These solutions were developed by independent software houses to meet different businesses' needs.

This integration challenge is being addressed[4].

❖ Service-oriented architecture is promoted as a flexible solution which eliminates the need to develop point-to-point connections between resources. It provides access to data in legacy systems through 'services' which link together and are combined to provide a business intelligence solution.

❖ The major ERP, ETL, data warehouse and customer relationship management (CRM) vendors now offer what are claimed to be integrated BI applications, for example SAP BW, Informatica PowerCenter, Oracle Applications and Siebel Analytics. And BI vendors began to add ETL tools, such as Business Objects Data Integrator and Cognos DecisionStream.

❖ The major vendors, SAP, Oracle, IBM and Microsoft, who already had some BI solutions, have expanded into performance management by acquisition. There has been a feeding frenzy and the big players are still digesting their prey. If they succeed in doing so, they are expected to offer better integrated BI solutions.

❖ Meanwhile, data integration tools, such as those offered by Informatica, already allow data from diverse sources to be integrated into the database layer. This enhances the performance and scalability of BI applications accessing this data.

The Benefits of Business Intelligence

Because of the wide applicability of BI in enterprise and extranet deployments, the business benefits are numerous. These benefits can be grouped into three main categories: lowering costs, increasing revenue, and improving customer satisfaction[5].

Lowering Costs

Improve operational efficiency

❖ By giving internal or external customers access to real-time data over the web, customers can track their own accounts and answer their own questions. As a result, customer satisfaction is improved while reducing support costs. A significant, added benefit to real time data access is that data becomes much cleaner. By reviewing the data themselves, customers can spot errors, and help improve the quality of the information in the data warehouse.

Eliminate report backlog and delays

❖ Business intelligence allows business users to design their own queries and reports, allowing organizations to redeploy the programmers who formerly performed this task. This can generate significant cost savings in human resources, since sought-after staff can be reallocated to projects that add more value to the organization.

Negotiate better contracts with suppliers and customers

❖ A solid grasp of facts and figures is invaluable when it comes to negotiating contracts with suppliers and customers. For instance, by analyzing supplier performance on-time delivery trends, percentage of rejects, and price changes will be in an excellent position to discuss all aspects of the contract as well as possibly negotiate volume discounts. And identifying a customer's spending patterns could qualify him or her for a particular packaged deal.

Find root causes and take action

❖ If one division is doing better or worse than others, identify the root cause and either implement a best practice or fix the problem. With BI, can be found root causes both to problems and to best practices by simply asking "Why?" The process is initiated by analyzing a global report, say of sales per quarter. Every answer is followed by a new question, and users can drill deep down into a report to get to fundamental causes. Once they have a clear understanding of root causes, they can take highly effective action.

[4] CIMA, Improving decision making in organizations, September 2008.

[5] Mark Ritacco and Astrid Carver, The business value of business intelligence, Business object, 2008.

Identify wasted resources and reduce inventory costs

❖ BI can be apply activity-based costing methods to identify hidden costs or missed opportunities. From these findings, resources can be allocated to highly profitable products, customers, and projects, thereby increasing the bottom line. Also, having a clearer understanding of success of promotions can help to effectively monitor inventory levels.

Increasing Revenue

Sell information to customers, partners and suppliers

❖ Leading organizations are using BI to differentiate their product and service offerings from competitors through value added, web-based services. In the past, many departments generated zero revenue, but now with BI extranets, they create a recurring revenue stream by selling information to customers, partners, and suppliers.

Improve strategies with better marketing analysis

❖ With easy access to ordering, accounting, production, shipping, customer service, and even external databases, marketers can find answers to the most detailed of questions such as, "What was the success rate of my direct mail campaign?" or "What was the incremental revenue generated from the new TV ads we just ran?" . With this information, the marketer can precisely tailor product launches and promotion campaigns to the targeted audience. Using BI, companies can micro segment their markets and gain an edge over the competition.

Empower sales force

❖ Better results from sales force can be achieved by analyzing its selling patterns: compare results to targets, to figures from previous years, to other sales staff results, and suggest improvements. Encourage the sales force to focus on high profitability customers and products. The sales force can also use BI to analyze data on brands, clients, and distributors.

Improving Customer Satisfaction

Give users the means to make better decision

❖ With access to information, users can make better decisions faster, without having to escalate standard problems up the management hierarchy. This guarantees pragmatic and effective solutions since the people directly involved in the operations make decisions. In addition, users have the increased satisfaction of controlling their own process.

Provide quick answers to user questions

❖ One of the primary benefits of BI is that you can dramatically reduce the time it takes for internal and external users to get answers to their questions. With fewer delays and faster response time, users are empowered to act quickly, based on the information they receive.

Challenge assumptions with factual information

❖ Almost all businesses rely on assumptions and rule of thumb. However, it is worthwhile to challenge these hunches through detailed analysis of operational data, because assumptions and rule of thumb are frequently incorrect.

Conclusions

The term Business Intelligence may turn out to be a fad. However, the underlying concepts, using information technology to deliver actionable information for decision makers, are essential for managing today's global businesses. BI uses both structured and semi-structured data. The former is much easier to search but the latter contains the information needed for analysis and decision making.

For structured data, many BI tools exist for acquisition, integration, cleanup, search, analysis, and delivery. Further work is needed, however, to integrate these tools and to provide actionable information. BI tools for semi-structured data, on the other hand, are not yet mature.

The development of analytical tools to integrate structured and semi-structured data can benefit from attention by researchers. The BI market is growing, and the proportion of semi-structured data used in daily decisions is growing. Exploring the underlying issues and the development of information technology that provide intelligence to business therefore is a fertile area for research.

Business intelligence could inform better decision making in business. Everyone in management needs to be alert to this opportunity and the threat that early adapters may achieve a competitive advantage. But BI is only a technology enabler. Management accountants have important roles to play if BI is to be of value. The necessary changes will have to be implemented properly. People will have to use it to produce information and that information still has to be applied in decision making and, for those decisions to be effective, they will have to be managed through to impact.

The nature of the management information and analysis required by business has expanded. The range of data to be considered now includes non-financial and external information. The emphasis has shifted from reporting through monitoring to providing information and analysis as appropriate to users' roles. These users may be strategic managers, knowledge workers, people in operational and customer facing roles or external stakeholders and regulators Business intelligence is evolving to meet these information needs. It now encompasses the reporting and analysis tools used for performance management by accountants. Advances in data management and better integration of systems will enable BI to provide better management information to inform decision making.

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