

Business Intelligence: Concepts, Components, Techniques and Benefits

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Abstract: Business intelligence (BI) refers to computer-based techniques used in spotting, digging-out, and analyzing business data, such as sales revenue by products and/or departments, or by associated costs and incomes. For companies maintaining direct contact with large numbers of customers, however, a growing number channel-oriented application (e.g. e-commerce support, call center support) create a new data management challenge: that is effective way of integrating enterprise applications in real time. To learn from the past and forecast the future, many companies are adopting Business Intelligence (BI) tools and systems. Companies have understood the importance of enforcing achievements of the goals defined by their business strategies through business intelligence concepts. It describes the insights on the role and requirement of real time BI by examining the business needs. The paper explores the concepts of BI, its components, emergence of BI, benefits of BI, factors influencing BI, technology requirements, designing and implementing business intelligence, and various BI techniques.

Keywords: business intelligence, data, support system.

I. Introduction

Business intelligence (BI) has two basic different meanings related to the use of the term intelligence. The primary, less frequently, is the human intelligence capacity applied in business affairs/activities. Intelligence of Business is a new field of the investigation of the application of human cognitive faculties and artificial intelligence technologies to the management and decision support in different business problems. The second relates to the intelligence as information valued for its currency and relevance. It is expert information, knowledge and technologies efficient in the management of organizational and individual business. Therefore, in this sense, business intelligence is a broad category of applications and technologies for gathering, providing access to, and analyzing data for the purpose of helping enterprise users make better business decisions. The term implies having a comprehensive knowledge of all of the factors that affect the business. It is imperative that firms have an in depth knowledge about factors such as the customers, competitors, business partners, economic environment, and internal operations to make effective and good quality business decisions. Business intelligence enables firms to make these kinds of decisions.

A specialized field of business intelligence known as competitive intelligence focuses solely on the external competitive environment. Information is gathered on the actions of competitors and decisions are made based on this information. Little if any attention is paid to gathering internal information.

In modern businesses, increasing standards, automation, and technologies have led to vast amounts of data becoming available. Data warehouse technologies have set up repositories to store this data. Improved Extract, transform, load (ETL) and even recently Enterprise Application Integration tools have increased the speedy collecting of data. OLAP reporting technologies have allowed faster generation of new reports which analyze the data. Business intelligence has now become the art of sifting through large amounts of data, extracting pertinent information, and turning that information into knowledge upon which actions can be taken.

The paper explores the concepts of BI, its components, emergence of BI, benefits of BI, factors influencing BI, technology requirements, designing and implementing business intelligence, cultural imperatives, and various BI techniques. The paper would be useful for budding researchers in the field of BI to understand the basic concepts.

II. Business Intelligence

Stackowiak et al. (2007) define Business intelligence as the process of taking large amounts of data, analyzing that data, and presenting a high-level set of reports that condense the essence of that data into the basis of business actions, enabling management to make fundamental daily business decisions. (Cui et al, 2007) view BI as way and method of improving business performance by providing powerful assists for executive decision maker to enable them to have actionable information at hand. BI tools are seen as technology that enables the efficiency of business operation by providing an increased value to the enterprise information and hence the way this information is utilized. Zeng et al. (2006) define BI as "The process of collection, treatment

and diffusion of information that has an objective, the reduction of uncertainty in the making of all strategic decisions.” Experts describe Business intelligence as a “business management term used to describe applications and technologies which are used to gather, provide access to analyze data and information about an enterprise, in order to help them make better informed business decisions.” (Tvrđiková, 2007) describes the basic characteristic for BI tool is that it is ability to collect data from heterogeneous source, to possess advance analytical methods, and the ability to support multi users demands. Zeng et al. (2006) categorized BI technology based on the method of information delivery; reporting, statistical analysis, ad-hoc analysis and predicative analysis. The concept of Business Intelligence (BI) is brought up by Gartner Group since 1996. It is defined as the application of a set of methodologies and technologies, such as J2EE, DOTNET, Web Services, XML, data warehouse, OLAP, Data Mining, representation technologies, etc, to improve enterprise operation effectiveness, support management/decision to achieve competitive advantages. Business Intelligence by today is never a new technology instead of an integrated solution for companies, within which the business requirement is definitely the key factor that drives technology innovation. How to identify and creatively address key business issues is therefore always the major challenge of a BI application to achieve real business impact. (Golfarelli et.al, 2004) defined BI that includes effective data warehouse and also a reactive component capable of monitoring the timecritical operational processes to allow tactical and operational decision-makers to tune their actions according to the company strategy. (Gangadharan and Swamy, 2004) define BI as the result of in-depth analysis of detailed business data, including database and application technologies, as well as analysis practices. (Gangadharan and Swamy, 2004) widen the definition of BI as technically much broader tools, that includes potentially encompassing knowledge management, enterprise resource planning, decision support systems and data mining. BI includes several software for Extraction, Transformation and Loading (ETL), data warehousing, database query and reporting, (Berson et.al, 2002; Curt Hall, 1999) multidimensional/on-line analytical processing (OLAP) data analysis, data mining and visualization.

III. Components Of Bi

OLAP (On-line analytical processing): It refers to the way in which business users can slice and dice their way through data using sophisticated tools that allow for the navigation of dimensions such as time or hierarchies. Online Analytical Processing or OLAP provides multidimensional, summarized views of business data and is used for reporting, analysis, modeling and planning for optimizing the business. OLAP techniques and tools can be used to work with data warehouses or data marts designed for sophisticated enterprise intelligence systems. These systems process queries required to discover trends and analyze critical factors. Reporting software generates aggregated views of data to keep the management informed about the state of their business. Other BI tools are used to store and analyze data, such as data mining and data warehouses; decision support systems and forecasting; document warehouses and document management; knowledge management; mapping, information visualization and dash boarding; management information systems, geographic information systems; Trend Analysis; Software as a Service (SaaS). **Advanced Analytics:** it is referred to as data mining, forecasting or predictive analytics, this takes advantage of statistical analysis techniques to predict or provide certainty measures on facts. **Corporate Performance Management (Portals, Scorecards, and Dashboards):** this general category usually provides a container for several pieces to plug into so that the aggregate tells a story. For example, a balanced scorecard that displays port lets for financial metrics combined with say organizational learning and growth metrics. **Real time BI:** It allows for the real time distribution of metrics through email, messaging systems and/or interactive displays. **Data Warehouse and data marts:** The data warehouse is the significant component of business intelligence. It is subject oriented, integrated. The data warehouse supports the physical propagation of data by handling the numerous enterprise records for integration, cleansing, aggregation and query tasks. It can also contain the operational data which can be defined as an updateable set of integrated data used for enterprise wide tactical decision-making of a particular subject area. It contains live data, not snapshots, and retains minimal history. Data sources can be operational databases, historical data, external data for example, from market research companies or from the Internet), or information from the already existing data warehouse environment. The data sources can be relational databases or any other data structure that supports the line of business applications. They also can reside on many different platforms and can contain structured information, such as tables or spreadsheets, or unstructured information, such as plaintext files or pictures and other multimedia information. A data mart as described by (Inmon, 1999) is a collection of subject areas organized for decision support based on the needs of a given department. Finance has their data mart, marketing has theirs, and sales have theirs and so on. And the data mart for marketing only faintly resembles anyone else's data mart. Perhaps most importantly, (Inmon, 1999) the individual departments own the hardware, software, data and programs that constitute the data mart. Each department has its own interpretation of what a data mart should look like and each department's data mart is peculiar to and specific to its own needs. Similar to data warehouses, data marts contain operational data that helps business experts to

strategize based on analyses of past trends and experiences. The key difference is that the creation of a data mart is predicated on a specific, predefined need for a certain grouping and configuration of select data. There can be multiple data marts inside an enterprise. A data mart can support a particular business function, business process or business unit.

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V. Issues In Bi

Experts View: Experts view BI in different ways. Data warehousing experts view BI as supplementary systems and is very new to them. These experts treat BI as technology platform for decision support application. The author is of opinion that to data mining experts BI is set of advanced decision support systems with data mining techniques and applications of algorithms. To statisticians BI is viewed as a forecasting and multidimensional analysis based tool.

VI. Approaches In Data Warehousing

The main key to successful BI system is consolidating data from the many different enterprise operational systems into an enterprise data warehouse. Very few organizations have a full-fledged enterprise data warehouse. This is due to the vast scope of effort towards consolidating the entire enterprise data. (Berson et.al, 2002) emphasizes that in view of emerging highly dynamic business environment, only the most competitive enterprises will achieve sustained market success. The organizations will distinguish themselves by the capability to leverage information about their market place, customers, and operations to capitalize on the business opportunities.

Analysis of right information:

Several surveys including Gartner, Forrester and International Data Centre report that most of the firms throughout the globe are interested in investing in BI. It is to be noted that despite major investments in enterprise resource planning (ERP) and customer relationship management (CRM) over the last decade businesses are struggling to achieve competitive advantage. It is due to the information captured by these systems. Any corporate would look forward for one goal called 'right access to information quickly'. Hence, the firms need to support the analysis and application of information in order to make operational decisions. Say for marking seasonal merchandise or providing certain recommendations to customers, firms need right access to information quickly. Implementing smarter business processes is where business intelligence influences and influences the bottom line and returns value to any firm.

VII. Future Of Business Intelligence

In this rapidly changing world consumers are now demanding quicker more efficient service from businesses. To stay competitive companies must meet or exceed the expectations of consumers. Companies will have to rely more heavily on their business intelligence systems to stay ahead of trends and future events. Business intelligence users are beginning to demand Real time Business Intelligence] or near real time analysis relating to their business, particularly in frontline operations. They will come to expect up to date and fresh information in the same fashion as they monitor stock quotes online. Monthly and even weekly analysis will not suffice. In the not too distant future companies will become dependent on real time business information in much the same fashion as people come to expect to get information on the internet in just one or two clicks. Also in the near future business information will become more democratized where end users from throughout the organization will be able to view information on their particular segment to see how it's performing.

So, in the future, the capability requirements of business intelligence will increase in the same way that consumer expectations increase. It is therefore imperative that companies increase at the same pace or even faster to stay competitive.

VIII. Reasons For Business Intelligence

Business Intelligence enables organizations to make well informed business decisions and thus can be the source of competitive advantages. This is especially true when firms are able to extrapolate information from indicators in the external environment and make accurate forecasts about future trends or economic conditions. Once business intelligence is gathered effectively and used proactively then the firms can make decisions that benefit the firms.

The ultimate objective of business intelligence is to improve the timeliness and quality of information. Timely and good quality information is like having a crystal ball that can give an indication of what's the best course to take. Business intelligence reveals:

- The position of the firm as in comparison to its competitors.
- Changes in customer behavior and spending patterns
- The capabilities of the firm
- Market conditions, future trends, demographic and economic information
- The social, regulatory, and political environment

Businesses realize that in this very competitive, fast paced and ever-changing business environment, a key competitive quantity is how quickly they respond and adapt to change. Business intelligence enables them to use information gathered to quickly and constantly respond to changes.

The Fig.1 presents an understanding of BI. A BI system in other words is a combination of data warehousing and decision support systems. The figure also reveals how data from disparate sources can be extracted and stored to be retrieved for analysis. The basic BI functions and reports are shown in fig 1.

The primary activities include gathering, preparing and analyzing data. The data itself must be of high quality. The various sources of data is collected, transformed, cleansed, loaded and stored in a warehouse. The relevant data is for a specific business area that is extracted from the data warehouse. A BI organization fully exploits data at every phase of the BI architecture as it progresses through various levels of informational metamorphosis. The raw data is born in operational environments, where transactional data pours in from every source and every corner of the enterprise. Therefore, that is the business intelligent organization vision: A natural flow of data, from genesis to action. In addition, at each step in the flow, the data is fully exploited to ensure the increase of information value for the enterprise. The challenge for BI, of course, is to build any organization's vision

BI provides many benefits to companies utilizing it. It can eliminate a lot of the guesswork within an organization, enhance communication among departments while coordinating activities, and enable companies to respond quickly to changes in financial conditions, customer preferences, and supply chain operations. BI improves the overall performance of the company using it.

Information is often regarded as the second most important resource a company has (a company's most valuable assets are its people). So when a company can make decisions based on timely and accurate information, the company can improve its performance. BI also expedites decision-making, as acting quickly and correctly on information before competing businesses do can often result in competitively superior performance. It can also improve customer experience, allowing for the timely and appropriate response to customer problems and priorities.

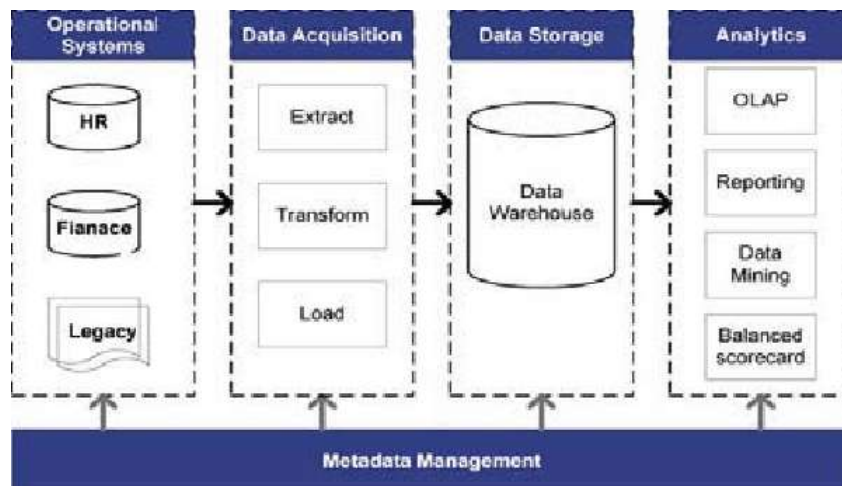


Figure 1. Business Intelligence System

IX. Benefits Of Bi

The firms have recognized the importance of business intelligence for the masses has arrived. Some of them are listed below. • With BI superior tools, now employees can also easily convert their business knowledge via the analytical intelligence to solve many business issues, like increase response rates from direct mail, telephone, e-mail, and Internet delivered marketing campaigns.

With BI, firms can identify their most profitable customers and the underlying reasons for those customers' loyalty, as well as identify future customers with comparable if not greater potential.

- Analyze click-stream data to improve ecommerce strategies.
- Quickly detect warranty-reported problems to minimize the impact of product design deficiencies.
- Discover money-laundering criminal activities.
- Analyze potential growth customer profitability and reduce risk exposure through more accurate financial credit scoring of their customers.

Customers are the most critical aspect to a company's success. Without them a company cannot exist. So it is very important that firms have information on their preferences. Firms must quickly adapt to their changing demands. Business Intelligence enables firms to gather information on the trends in the marketplace and come up with innovative products or services in anticipation of customer's changing demands.

Competitors can be a huge hurdle on firm's way to success. Their objectives are the same as firms' and that is to maximize profits and customer satisfaction. In order to be successful firms must stay one step ahead of the competitors. In business we don't want to play the catch up game because we would have lost.

X. Business Intelligence Technology

Business intelligence provides organizational data in such a way that the organizational knowledge filters can easily associate with this data and turn it into information for the organization. Persons involved in business intelligence processes may use application software and other technologies to gather, store, analyze, and provide access to data, and present that data in a simple, useful manner. The software aids in Business performance management, and aims to help people make "better" business decisions by making accurate, current, and relevant information available to them when they need it. Some businesses use data warehouses because they are a logical collection of information gathered from various operational databases for the purpose of creating business intelligence.

In order for BI system to work effectively there must be some technical constraints in place. BI technical requirements have to address the following issues:

- Security and specified user access to the warehouse
- Data volume (capacity) • How long data will be stored (data retention)
- Benchmark and performance targets

People working in business intelligence have developed tools that ease the work, especially when the intelligence task involves gathering and analyzing large quantities of unstructured data. Each vendor typically defines Business Intelligence their own way, and markets tools to do BI the way that they see it. Business intelligence includes tools in various categories, including the following:

- AQL - Associative Query Logic
- Score carding
- Business Performance Management and Performance Measurement
- Business Planning

XI. Conclusion

Powerful transaction-oriented information systems are now commonplace in every major industry, effectively leveling the playing field for corporations around the world. To remain competitive, however, now requires analytically oriented systems that can revolutionize a company's ability to rediscover and utilize information they already own. The business intelligence (BI) has evolved over the past decade to rely increasingly on real time data. The BI systems auto-initiate actions to systems based on rules and context to support several business processes. These analytical systems derive insight from the wealth of data available, delivering information that's conclusive, fact based, and actionable. Enterprises today demand quick results. It is becoming essential nowadays that not only is the business analysis done, but also actions in response to analysis of results can be performed and instantaneously changes parameters of business processes. The paper explored the concepts of BI, its components, benefits of BI, technology requirements, designing and implementing business intelligence, and various BI techniques.

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