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# **Business intelligence**

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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. BI technologies provide historical, current, and predictive views of business operations. Common functions of business intelligence technologies are reporting, online analytical processing, analytics, data mining, business performance management, benchmarking, text mining, and predictive analytics. Business intelligence aims to support better business decision-making. Thus a BI system can be called a decision support system (DSS). Though the term business intelligence is sometimes used as a synonym for competitive intelligence, because they both support decision making, BI uses technologies, processes, and applications to analyze mostly internal, structured data and business processes while competitive intelligence gathers, analyzes and disseminates information with a topical focus on company competitors. Business intelligence understood broadly can include the subset of competitive intelligence.

**Keywords:** business intelligence, data, support system

In a 1958 article, IBM researcher Hans Peter Luhn used the term business intelligence. He defined intelligence as: "the ability to apprehend the interrelationships of presented facts in such a way as to guide action towards a desired goal."

Business intelligence as it is understood today is said to have evolved from the decision support systems which began in the 1960s and developed throughout the mid-80s. DSS originated in the computer-aided models created to assist with decision making and planning. From DSS, data warehouses, Executive Information Systems, OLAP and business intelligence came into focus beginning in the late 80s.

In 1989 Howard Dresner (later a Gartner Group analyst) proposed "business intelligence" as an umbrella term to describe "concepts and methods to improve business decision making by using fact-based support systems." It was not until the late 1990s that this usage was widespread.

## **Business intelligence and data warehousing**

Often BI applications use data gathered from a data warehouse or a data mart. However, not all data warehouses are used for business intelligence, nor do all business intelligence applications require a data warehouse.

In order to distinguish between concepts of business intelligence and data warehouses, Forrester Research often defines business intelligence in one of two ways:

Typically, Forrester uses the following broad definition: "Business Intelligence is a set of methodologies, processes, architectures, and technologies that transform raw data into meaningful and useful information used to enable more effective strategic, tactical, and operational insights and decision-making." When using this definition, business intelligence also includes technologies such as data integration, data quality, data warehousing, master data management, text and content analytics, and many others that the market sometimes lumps into the Information Management segment. Therefore, Forrester refers to data preparation and data usage as two separate, but closely linked segments of the business intelligence architectural stack.

Forrester defines the latter, narrower business intelligence market as "referring to just the top layers of the BI architectural stack such as reporting, analytics and dashboards."

### **Business intelligence and business analytics**

Thomas Davenport has argued that business intelligence should be divided into querying, reporting, OLAP, an "alerts" tool, and business analytics. In this definition, business analytics is the subset of BI based on statistics, prediction, and optimization.

#### **Applications in an enterprise**

Business Intelligence can be applied to the following business purposes (MARCKM), in order to drive business value.

1. Measurement – program that creates a hierarchy of Performance metrics (see also Metrics Reference Model) and Benchmarking that informs business leaders about progress towards business goals (AKA Business process management).
2. Analytics – program that builds quantitative processes for a business to arrive at optimal decisions and to perform Business Knowledge Discovery. Frequently involves: data mining, statistical analysis, Predictive analytics, Predictive modeling, Business process modeling
3. Reporting/Enterprise Reporting – program that builds infrastructure for Strategic Reporting to serve the Strategic management of a business, NOT Operational Reporting. Frequently involves: Data visualization, Executive information system, OLAP
4. Collaboration/Collaboration platform – program that gets different areas (both inside and outside the business) to work together through Data sharing and Electronic Data Interchange.
5. Knowledge Management – program to make the company data driven through strategies and practices to identify, create, represent, distribute, and

enable adoption of insights and experiences that are true business knowledge. Knowledge Management leads to Learning Management and Regulatory compliance/Compliance

## **Business Intelligence – Requirements Gathering**

According to Kimball business users and their requirements impact nearly every decision made throughout the design and implementation of a DW/BI system. The business requirements sit at the center of the business core, and are related to all aspects of the daily business processes. They are therefore extremely critical to successful data warehousing. Business requirements analysis occurs at two distinct levels:

- Macro level: understand the business's needs and priorities relative to a program perspective
- Micro level: understand the users' needs and desires in the context of a single, relatively narrowly defined project.

### Approach

There are two basic interactive techniques for gathering requirements:

1. Conduct interviews.

You need to talk to the users about their jobs, their objectives, and their challenges. This is either done with individuals or small groups

1. Facilitated sessions

Can be used to encourage creative brainstorming

Methods to avoid: Non-interactive alternatives such as sending out surveys and questionnaires is not an effective requirements gathering technique!

### Preparation

Identify the interview team

- Lead interviewer – directing the questioning
- Scribe – take copious notes during the interview

A tape recorder may be used to supplement the scribe, since it is useful as a backup

- Observers – optional part of the team. A good possibility for other team members to gain knowledge about interviewing techniques. It is advisable that there is no more than two observers present.

## Research the organization

Reports, review of business operations, part of the annual report to gain insight regarding organizational structure. If applicable, a copy of the resulting documentation from the latest internal business/ IT strategy and planning meeting.

## Select the interviewees

Select a cross section of representatives. Study the organization to get a good idea of all the stakeholders in the project. These include:

- Business interviewees (to understand the key business processes)
- IT and Compliance/Security Interviewees (to assess preliminary feasibility of the underlying operational source systems to support the requirements emerging from the business side of the house).

## Develop the interview questionnaires

Multiple questionnaires should be developed because the questioning will vary by job function and level.

- The questionnaires for the data audit sessions will differ from business requirements questionnaires
- Be structured. This will help the interview flow and help organize your thoughts before the interview.

## Schedule and sequence the interviews

Scheduling and rescheduling takes time, so make sure you prepare these a good time in advance! Sequence your interviews by beginning with the business driver, followed by the business sponsor. This is to understand the playing field from their perspective. The optimal sequence would be:

- Business driver
- Business sponsor
- An interviewee from the middle of the organizational hierarchy
- Bottom of the organizational hierarchy

The bottom is a disastrous place to begin because you have no idea where you are headed. The top is great for overall vision, but you need the business background, confidence, and credibility to converse at those levels. Also if you are not adequately prepared with in-depth business familiarity, the safest route is to begin in the middle of the organization.

## Prepare the interviewees

Make sure the interviewees are appropriately briefed and prepared to participate. As a minimum, a letter should be emailed to all interview participants to inform them about the process and the importance of their participation and contribution. The letter should explain that the goal is to understand their job responsibilities and business objectives, which then translate into the information and analyses required to get their job done. In addition they should be asked to bring copies of frequently used reports or spreadsheet analyses.

The letter should be signed by a high ranking sponsor, someone well-respected by the interviewees.

It is advisable not to attach a list of the fifty questions you might ask in hopes that the interviewees will come prepared with answers. The odds are that they won't take the time to prepare responses, and even get intimidated by the volume of your questions. Issues with requirements gathering and interviews The process of conducting an interview may seem exhaustive at first, but the ground rule is to be well prepared in all steps. Techniques for questioning may be a good idea to investigate before conducting the interview. Ask open-ended questions such as why, how, what-if, and what-then questions. Make sure you ask unbiased questions. Wrongfully asked questions can lead to wrong answers and in worst case; wrong requirements are gathered. The whole process is valuable in time and resources, and the wrong data can slow down the development of the whole BI installation. Be sure that everyone in the interviewee team is aware of their role to support that everything goes as planned. The next part is to synthesize around the business processes

## Prioritization of business intelligence projects

It is often difficult to provide a positive business case for Business Intelligence (BI) initiatives and often the projects will need to be prioritized through strategic initiatives. Here are some hints to increase the benefits for a BI project.

- As described by Kimball you must determine the tangible benefits such as eliminated cost of producing legacy reports.
- Enforce access to data for the entire organization. In this way even a small benefit, such as a few minutes saved, will make a difference when it is multiplied by the number of employees in the entire organization.
- As described by Ross, Weil & Roberson for Enterprise Architecture, consider letting the BI project be driven by other business initiatives with excellent business cases. To support this approach, the organization must have Enterprise Architects, which will be able to detect suitable business projects.

## Success factors of implementation

Before implementing a BI solution, it is worth taking different factors into consideration before proceeding. According to Kimball et al. These are the three critical areas that you need to assess within your organization before getting ready to do a BI project:

1. The level of commitment and sponsorship of the project from senior management
2. The level of business need for creating a BI implementation
3. The amount and quality of business data available.

## **Business Sponsorship**

The commitment and sponsorship of senior management is according to Kimball et al. The most important criteria for assessment. This is because that having strong management backing can be able to shortcomings elsewhere in the project. But as Kimball et al state: “even the most elegantly designed DW/BI system cannot overcome a lack of business [management] sponsorship”. It is very important that the management personnel that participate in the project have a vision and an idea of the benefits and drawbacks of implementing a BI system. The best business sponsor should have organizational clout and should be well connected within the organization. It is ideal that the business sponsor is demanding but also able to be realistic and supportive if the implementation runs into delays or drawbacks. The management sponsor also needs to be able to assume accountability and to take responsibility for failures and setbacks on the project. It is imperative that there is support from multiple members of management so the project will not fail if one person leaves the steering group. However, having many managers that work together on the project can also mean that there are several different interests that attempt to pull the project in different directions. For instance if different departments want to put more emphasis on their usage of the implementation. This issue can be countered by an early and specific analysis of the different business areas that will benefit the most from the implementation. All stakeholders in project should participate in this analysis in order for them to feel ownership of the project and to find common ground between them. Another management problem that should be encountered before start of implementation is if the Business sponsor is overly aggressive. If the management individual gets carried away by the possibilities of using BI and starts wanting the DW or BI implementation to include several different sets of data that were not included in the original planning phase. However, since extra implementations of extra data will most likely add many months to the original plan. It is probably a good idea to make sure that the person from management is aware of his actions.

Implementation should be driven by clear business needs.

Because of the close relationship with senior management, another critical thing that needs to be assessed before the project is implemented is whether or not there

actually is a business need and whether there is a clear business benefit by doing the implementation. The needs and benefits of the implementation are sometimes driven by competition and the need to gain an advantage in the market. Another reason for a business-driven approach to implementation of BI is the acquisition of other organizations that enlarge the original organization it can sometimes be beneficial to implement DW or BI in order to create more oversight.

The amount and quality of the available data.

This ought to be the most important factor, since without good data – it does not really matter how good your management sponsorship or your business-driven motivation is. If you do not have the data, or the data does not have sufficient quality any BI implementation will fail. Before implementation it is a very good idea to do data profiling, this analysis will be able to describe the “content, consistency and structure [...]” of the data. This should be done as early as possible in the process and if the analysis shows that your data is lacking; it is a good idea to put the project on the shelf temporarily while the IT department figures out how to do proper data collection.

Other scholars have added more factors to the list than these three. In his thesis “Critical Success Factors of BI Implementation” Naveen Vodapalli does research on different factors that can impact the final BI product. He lists 7 crucial success factors for the implementation of a BI project, they are as follows:

1. Business-driven methodology and project management
2. Clear vision and planning
3. Committed management support & sponsorship
4. Data management and quality
5. Mapping solutions to user requirements
6. Performance considerations of the BI system
7. Robust and expandable framework

The user aspect of Business Intelligence

Some considerations must be made in order to successfully integrate the usage of business intelligence systems in a company. Ultimately the BI system must be accepted and utilized by the users in order for it to add value to the organization. If the system is poor, the users may become frustrated and spend a considerable amount of time figuring out how to use the system or may not be able to really use the system. If the system does not add value to the users' mission, they will simply not use it.

In order to increase the user acceptance of a BI system, it may be advisable to consult the business users at an early stage of the DW/BI lifecycle such as for example at the requirements gathering phase. This can provide an insight into the business process and what the users need from the BI system. There are several

methods for gathering this information such as e.g. questionnaires and interview sessions.

When gathering the requirements from the business users, the local IT department should also be consulted in order to determine to which degree it is possible to fulfill the business's needs based on the available data.

Taking on a user-centered approach throughout the design and development stage may further increase the chance of rapid user adoption of the BI system.

Besides focusing on the user experience offered by the BI applications, it may also possible to motivate the users to utilize the system by adding an element of competition. Kimball suggests implementing a function on the Business Intelligence portal website where reports on system usage can be found. By doing so, managers can see how well their departments are doing and compare themselves to others and this may spur them to encourage their staff to utilize the BI system even more.

In a 2007 article, H. J. Watson gives an example of how the competitive element can act as an incentive. Watson describes how a large call centre has implemented performance dashboards for all the call agents and that monthly incentive bonuses have been tied up to the performance metrics. Furthermore the agents can see how their own performance compares to the other team members. The implementation of this type of performance measurement and competition significantly improved the performance of the agents.

Other elements which may increase the success of BI can be by involving senior management in order to make BI a part of the organizational culture and also by providing the users with the necessary tools, training and support. By offering user training, more people may actually use the BI application.

Providing user support is necessary in order to maintain the BI system and assist users who run into problems. User support can be incorporated in many ways, for example by creating a website. The website should contain great content and tools for finding the necessary information. Furthermore, helpdesk support can be used. The helpdesk can be manned by e.g. power users or the DW/BI project team.

## Marketplace

There are a number of business intelligence vendors, often categorized into the remaining independent "pure-play" vendors and the consolidated "megavendors" which have entered the market through a recent trend of acquisitions in the BI industry.

Some companies adopting BI software decide to pick and choose from different product offerings (best-of-breed) rather than purchase one comprehensive integrated solution (full-service).

Independent BI market surveys and analyses include:

- Gartner's "Magic Quadrant for Business Intelligence"
- Business Application Research Center (BARC)'s "The BI Survey" and "The BI Verdict" (formerly "The OLAP Report")
- Forrester Research study

Industry specific

Specific considerations for business intelligence systems have to be taken in some sectors such as governmental banking regulations. The information collected by banking institutions and analyzed with BI software must be protected from some groups or individuals, while being fully available to other groups or individuals. Therefore BI solutions must be sensitive to those needs and be flexible enough to adapt to new regulations and changes to existing laws.

BI and Semi-structured (or unstructured) data

Businesses creates a huge amount of valuable information in the form of e.g. e-mails, memos, notes from call-centers, news, user groups, chats, reports, web-pages, presentations, image-files, video-files, marketing material and news etc.. However, organizations often only use these documents once. According to Merrill Lynch, more than 85 percent of all business information exists as the before-mentioned information types. These information types is called either semi-structured or unstructured data. The management of semi-structured data is recognized as a major unsolved problem in the information technology industry . According to projections from Gartner (2003), white collar workers will spend anywhere from 30 to 40 percent of their time searching, finding and assessing unstructured data. BI uses both structured and unstructured data, but where the latter is easy to search, the former contains a large quantity of the information needed for analysis and decision making . Because of the difficulty of searching, finding and assessing unstructured/semitructured data properly, organizations don't draw on these vast reservoirs of information, which could influence a particular decision, task or project. This ultimately leads to uninformed decision making .

Therefore, when designing a Business Intelligence/DW-solution, the specific problems associated with semi-structured/unstructured data, must be accommodated for, as well as those for the structured data .

Unstructured data vs. Semi-structured data

Unstructured/Semi-structured data has different meanings, depending on the context it is viewed in. In the context of relational database systems, it refers to data that can't be stored in columns and rows. It must be stored in a BLOB (binary large object), a catch-all data type available in most relational database management systems. But many of these data types, like e-mails, word processing text files, ppt's, image-files, and video-files, conform to a standard that offers the possibility of meta

data. Meta data can include information such as author and time of creation, and this can be stored in a relational database. Therefore it may be more accurate to talk about this as semi-structured documents or data, but no specific consensus seems to be agreed upon.

### The problems with semi-structured/unstructured data and BI

There are several problems/challenges when trying to develop BI with semi-structured data, and according to (Inmon & Nesavich, 2008) some of those are:

1. Physically accessing unstructured textual data – unstructured data is stored in a huge variety of formats.
2. Terminology – Among researchers and analysts, there is a need to develop a standardized terminology.
3. Volume of data – As stated earlier, up to 85% of all data exists as semi-structured data. Couple that with the need for word-to-word and semantic analysis..
4. Searchability of unstructured textual data – A simple search on some data, e.g. apple, results in links where there is a reference to that precise search term. (Inmon & Nesavich, 2008) gives an example: “a search is made on the term felony. In a simple search, the term felony is used, and everywhere there is a reference to felony, a hit to an unstructured document is made. But a simple search is crude. It does not find references to crime, arson, murder, embezzlement, vehicular homicide, and such, even though these crimes are types of felonies.”

### The use of Metadata

To solve the problem with the searchability and assessment of the data, it is necessary to know something about the content. This can be done by adding context through the use of metadata. A lot of system already captures some metadata, e.g. filename, author, size etc. But much more useful could be metadata about the actual content – e.g. summaries, topics, people or companies mentioned. Two technologies designed for generating metadata about content is automatic categorization and information extraction.

### Conclusion

A 2009 Gartner paper predicted these developments in the business intelligence market:

- Because of lack of information, processes, and tools, through 2012, more than 35 percent of the top 5,000 global companies will regularly fail to make insightful decisions about significant changes in their business and markets.
- By 2012, business units will control at least 40 percent of the total budget for business intelligence.

- By 2010, 20 percent of organizations will have an industry-specific analytic application delivered via software as a service (SaaS) as a standard component of their business intelligence portfolio.
- In 2009, collaborative decision making emerged as a new product category that combines social software with business intelligence platform capabilities.
- By 2012, one-third of analytic applications applied to business processes will be delivered through coarse-grained application mashups.

A 2009 Information Management special report predicted the top BI trends: "green computing, social networking, data visualization, mobile, predictive analytics, composite applications, cloud computing and multitouch."

According to a study by the Aberdeen Group, there has been increasing interest in Software-as-a-Service (SaaS) business intelligence over the past years, with twice as many organizations using this deployment approach as one year ago – 15% in 2009 compared to 7% in 2008.<sup>[citation needed]</sup>

An article by InfoWorld's Chris Kanaracus points out similar growth data from research firm IDC, which predicts the SaaS BI market will grow 22 percent each year through 2013 thanks to increased product sophistication, strained IT budgets, and other factors.

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