1/29/2021

BIT 2210: BUSINESS INTELLIGENCE

READING AND LECTURE NOTES | J.N

Course Purpose

This course introduces analytical information systems that will enable learners understand the theoretical background of business intelligence and practice their knowledge using business intelligence tools in the lab.

Expected Learning Outcomes

Upon successful completion of this course the student are able to:

i. Discuss the origin and drivers of Business Intelligence and evaluate its major features
ii. Discuss the data warehouse architecture, its role and importance of business intelligence
iii. Discuss different applications of data mining, and produce data analysis based on different methods of data mining

Course Outline

WEEK	TOPIC	SUB-TOPICS	REMARKS
1,2&3	The Essentials of Business intelligence	• Definitions, origin and drivers of Business Intelligence • Major Characteristics of Business Intelligence • Structure and components of Business Intelligence • Areas to External and Internal business whose data affect business intelligence • Data warehouse Definitions and Concepts	
4&5	Data Mining/ Marketing Research	• Data mining Concepts, Tools and Techniques and Applications • Steps in research process • Types of Data and Research designs • Processing and Analyzing the Data and writing the report	
6		**CAT ONE**	
7	Business analytics, data Visualization and Forecasting	• Online analytical processing • Reports and Queries • Business analytics • Types of Forecast Error • Qualitative and Quantitative Forecasting	

8	Market Segmentation	• Concepts of market segmentation • Bases for segmentation • Target marketing • Importance of target marketing in Business intelligence	
9		**CAT TWO**	
10&11	Web and Text Mining	• Web and text Mining Concepts • Applications • Tools and techniques	
12 &13	Marketing Mix Variables	• Product Decisions • Distribution Decisions • Price Decisions • Promotion Decisions • Importance of marketing mix Decisions in Business Intelligence	
14		**EXAMINATION**	

Course Text Books

Ramez Elmasri, shamkant B. Navathe (2006). Fundamentals of database system (5th ed.). Addison Wesley.

Thomas M. Connolly, Carolyn E. Begg (2004). Database Systems: A Practical Approach to Design, Implementation and Management (4th ed.) Addison Wesley.

Margret H. Dunham (2003). Data Mining: Introductory and Adnced Topics. Printice Hall

Reference Text books

Patricia W. (2006). Database Management systems. Thompson Course Technology ISBN: 1844804526 2.

Phillip. L., Arthur. B. & Micheal. K. (ISBN: 0-201-70872-8)

Definition of Business Intelligence (BI)

Business intelligence (BI) is a technology-driven process for analyzing data and presenting actionable information to help executives, managers and other corporate end users make informed business decisions.

BI encompasses a wide variety of tools, applications and methodologies that enable organizations to collect data from internal systems and external sources; prepare it for analysis; develop and run queries against that data; and create reports, dashboards and data visualizations to make the analytical results available to corporate decision-makers, as well as operational workers.

Business intelligence (**BI**) comprises the strategies and technologies used by enterprises for the data analysis of business information. BI technologies provide historical, current and predictive views of business operations. Common functions of business intelligence technologies include reporting, online analytical processing, analytics, data mining, process mining, complex event processing, business performance management, benchmarking, text mining, predictive analytics and prescriptive analytics. BI technologies can handle large amounts of structured and sometimes unstructured data to help identify, develop and otherwise create new strategic business opportunities. They aim to allow for the easy interpretation of these big data. Identifying new opportunities and implementing an effective strategy based on insights can provide businesses with a competitive market advantage and long-term stability.

Business intelligence can be used by enterprises to support a wide range of business decisions ranging from operational to strategic. Basic operating decisions include product positioning or pricing. Strategic business decisions involve priorities, goals and directions at the broadest level. In all cases, BI is most effective when it combines data derived from the market in which a company operates (external data) with data from company sources internal to the business such as financial and operations data (internal data). When combined, external and internal data can provide a complete picture which, in effect, creates an "intelligence" that cannot be derived from any singular set of data. Amongst myriad uses, business intelligence tools empower organizations to gain insight into new markets, to assess demand and suitability of products and services for different market segments and to gauge the impact of marketing efforts.

Often BI applications use data gathered from a data warehouse (DW) or from a data mart, and the concepts of BI and DW combine as "BI/DW" or as "BIDW". A data warehouse contains a copy of analytical data that facilitate decision support.

According to Forrester Research, 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." Under this definition, business intelligence encompasses information management (data integration, data quality, data warehousing, master-data management, text- and content-analytics, et al.). Therefore, Forrester refers to *data preparation* and *data usage* as two separate but closely linked segments of the business-intelligence architectural stack.

Some elements of business intelligence are:

- Multidimensional aggregation and allocation
- DE normalization, tagging, and standardization (**DE normalization** is a strategy used on a previously-normalized database to increase performance. In computing, denormalization is the process of trying to improve the read performance of a database, at the expense of losing some write performance, by adding redundant copies of data or by grouping data)
- Real-time reporting with analytical alert
- A method of interfacing with unstructured data sources
- Group consolidation, budgeting and rolling forecasts
- Statistical inference and probabilistic simulation
- Key performance indicators optimization
- Version control and process management
- Open item management

A **performance indicator** or **key performance indicator** (**KPI**) is a type of performance measurement.[1] KPIs evaluate the success of an organization or of a particular activity (such as projects, programs, products and other initiatives) in which it engages.

Often success is simply the repeated, periodic achievement of some levels of operational goal (e.g. zero defects, 10/10 customer satisfaction, etc.), and sometimes success is defined in terms of making progress toward strategic goals. Accordingly, choosing the right KPIs relies upon a good understanding of what is important to the organization. What is deemed important often depends on the department measuring the performance – e.g. the KPIs useful to finance will differ from the KPIs assigned to sales.

Since there is a need to understand well what is important, various techniques to assess the present state of the business, and its key activities, are associated with the selection of performance indicators. These assessments often lead to the identification of potential improvements, so performance indicators are routinely associated with 'performance improvement' initiatives. A very common way to choose KPIs is to apply a management framework such as the balanced scorecard.

Categorization of indicators

Key performance indicators define a set of values against which to measure. These raw sets of values, which can be fed to systems that aggregate the data, are called *indicators*. There are two categories of measurements for KPIs;

- *Quantitative* facts without distortion from personal feelings, prejudices, or interpretations presented with a specific value - objective- preferably numeric measured against a standard.
- *Qualitative* values based on or influenced by personal feelings, tastes, or opinions and presented as any numeric or textual value that represents an interpretation of these elements.

An 'indicator' can only measure what 'has' happened, in the past tense, so the only type of measurement is descriptive or lagging. Any KPI that attempts to measure something in a future state as predictive, diagnostic or prescriptive is no longer an 'indicator' it is a 'prognosticator' - at this point its analytics (possibly based on a KPI).

Points of measurement

Performance focuses on measuring a particular *element* of an *activity*. An activity can have four elements: input, output, control, and mechanism. At a minimum, an activity is required to have at least an input and an output. Something goes into the activity as an *input*; the activity transforms the input by making a change to its *state*; and the activity produces an *output*. An activity can also have enabling *mechanisms* that are typically separated into *human* and *system* mechanisms. It can also be constrained in some way by a *control*. Lastly, its actions can have a temporal construct of *time*.

- *Input* indicates the inputs required of an activity to produce an output.
- *Output* captures the outcome or results of an activity or group of activities.
- *Activity* indicates the transformation produced by an activity (i.e., some form of work).
- *Mechanism* is something that enables an activity to work (a performer), either human or system.
- *Control* is an object that controls the activity's production through compliance.
- *Time* indicates a temporal element of the activity.

Identifying indicators of organization

Performance indicators differ from business drivers and aims (or goals). A school might consider the failure rate of its students as a key performance indicator which might help the school understand its position in the educational community, whereas a business might consider the percentage of income from returning customers as a potential KPI.

The key stages in identifying KPIs are:

- Having a pre-defined business process (BP).
- Having requirements for the BPs.
- Having a quantitative/qualitative measurement of the results and comparison with set goals.
- Investigating variances and tweaking processes or resources to achieve short-term goals.

Key performance indicators (KPIs) are ways to periodically assess the performances of organizations, business units, and their division, departments and employees. Accordingly, KPIs are most commonly defined in a way that is understandable, meaningful, and measurable. They are rarely defined in such a way such that their fulfillment would be hampered by factors seen as non-controllable by the organizations or individuals responsible. Such KPIs are usually ignored by organizations

KPIs should follow the **SMART** criteria. This means the measure has a **S**pecific purpose for the business, it is **M**easurable to really get a value of the KPI, the defined norms have to be **A**chievable, the improvement of a KPI has to be **R**elevant to the success of the organization, and finally it must be **T**ime phased, which means the value or outcomes are shown for a predefined and relevant period.

In order to be evaluated, KPIs are linked to target values, so that the value of the measure can be assessed as meeting expectations or not.

Examples
Key performance indicators are the non-financial measures of a company's performance - they do not have a monetary value but they do contribute to the company's profitability.

Accounts
Some examples are:

1. Percentage of overdue invoices
2. Percentage of purchase orders raised in advance
3. Number of retrospectively raised purchase orders
4. Finance report error rate (measures the quality of report)
5. Average cycle time of workflow
6. Number of duplicate payments

Marketing and sales
1. New customer acquisition
2. Demographic analysis of individuals (potential customers) applying to become customers, and the levels of approval, rejections, and pending numbers
3. Status of existing customers
4. Customer attrition
5. Turnover (i.e., revenue) generated by segments of the customer population
6. Outstanding balances held by segments of customers and terms of payment
7. Collection of bad debts within customer relationships
8. Profitability of customers by demographic segments and segmentation of customers by profitability

Many of these customer KPIs are developed and managed with customer relationship management software.

Faster availability of data is a competitive issue for most organizations. For example, businesses which have higher operational/credit risk (involving for example credit cards or wealth management) may want weekly or even daily availability of KPI analysis, facilitated by appropriate IT systems and tools.

Manufacturing

Overall equipment effectiveness is a set of broadly accepted non-financial metrics which reflect manufacturing success.

- **OEE** = availability x performance x quality
- **Availability** = run time / total time, by definition this is the percentage of the actual amount of production time the machine is running to the production time the machine is available.
- **Performance** = total count / target counter, by definition this is the percentage of total parts produced on the machine to the production rate of machine.
- **Quality** = good count / total count, by definition, this is the percentage of good parts out of the total parts produced on the machine.
- **Cycle time ratio** (CTR) = standard cycle time / real cycle time
- Utilization
- Rejection rate

Professional Services
Most professional services firms (for example: management consultancies, systems integration firms, or digital marketing agencies) use three key performance indicators to track the health of their businesses. They typically use professional services automation (PSA) software to keep track of and manage these metrics.

- **Utilization rate** = the percentage of time employees spend generating revenue
- **Project profitability** = the difference between revenue generated by a project and the cost of delivering the work
- **Project success rate** = the percentage of projects delivered on time and under budget

System operations

- Availability / uptime
- Mean time between failure
- Mean time to repair
- Unplanned availability
- Average time to repair

Project execution

- Earned value

- Estimate to complete
- Manpower spent / month
- Money spent / month
- Planned spend / month
- Planned manpower / month
- Average time to delivery
- Tasks / staff
- Project overhead / ROI
- Planned delivery date vs actual delivery date

Supply chain management

Businesses can utilize KPIs to establish and monitor progress toward a variety of goals, including lean manufacturing objectives, minority business enterprise and diversity spending, environmental "green" initiatives, cost avoidance programs and low-cost country sourcing targets.

Any business, regardless of size, can better manage supplier performance with the help of KPIs robust capabilities, which include:

- Automated entry and approval functions
- On-demand, real-time scorecard measures
- Rework on procured inventory
- Single data repository to eliminate inefficiencies and maintain consistency
- Advanced workflow approval process to ensure consistent procedures
- Flexible data-input modes and real-time graphical performance displays
- Customized cost savings documentation
- Simplified setup procedures to eliminate dependence upon IT resources

Main SCM KPIs will detail the following processes:

- Sales forecasts
- Inventory
- Procurement and suppliers
- Warehousing
- Transportation
- Reverse logistics

Suppliers can implement KPIs to gain an advantage over the competition. Suppliers have instant access to a user-friendly portal for submitting standardized cost savings templates. Suppliers and their customers exchange vital supply chain performance data while gaining visibility to the exact status of cost improvement projects and cost savings documentation.

Government

The provincial government of Ontario, Canada has been using KPIs since 1998 to measure the performance of higher education institutions in the province. All post secondary schools collect and report performance data in five areas – graduate satisfaction, student satisfaction, employer satisfaction, employment rate, and graduation rate.[5]

Further performance indicators

- Duration of a stockout situation
- Customer order waiting time

Human Resource Management

- Employee turnover
- Employee performance indicators
- Cross functional team analysis

Problems

In practice, overseeing key performance indicators can prove expensive or difficult for organizations. Some indicators such as staff morale may be impossible to quantify. As such, dubious KPIs can be adopted that can be used as a rough guide rather than a precise benchmark.

Key performance indicators can also lead to perverse incentives and unintended consequences as a result of employees working to the specific measurements at the expense of the actual quality or value of their work.

Sometimes the collecting of statistics can become a substitute for a better understanding of the problems so the use of dubious KPIs can result in progress in aims and measured effectiveness becoming different. For example, US soldiers during the Vietnam War were shown to be effective in kill ratios and high body counts, but this was misleading when used to measure aims as it did not show the lack of progress towards the US goal of increasing South Vietnamese government control of its territory. Another example would be to measure the productivity of a software development team in terms of lines of source code written. This approach can easily result in large amounts of dubious code being added, thereby inflating the line count but adding little of value in terms of systemic improvement. A similar problem arises when a footballer kicks a ball uselessly in a match in order to build up his statistics.

History

The earliest known use of the term *business intelligence* is in Richard Millar Devens' *Cyclopædia of Commercial and Business Anecdotes* (1865). Devens used the term to describe how the banker Sir Henry Furnese gained profit by receiving and acting upon information about his environment, prior to his competitors:

Throughout Holland, Flanders, France, and Germany, he maintained a complete and perfect train of business intelligence. The news of the many battles fought was thus received first by him, and the fall of Namur added to his profits, owing to his early receipt of the news.

The ability to collect and react accordingly based on the information retrieved, Devens says, is central to business intelligence.

When Hans Peter Luhn, a researcher at IBM, used the term *business intelligence* in an article published in 1958, he employed the *Webster's Dictionary* definition of intelligence: "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 (DSS) that began in the 1960s and developed throughout the mid-1980s. DSS originated in the computer-aided models created to assist with decision making and planning.

In 1989, Howard Dresner (later a Gartner 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.

Critics[*who?*] see BI merely as an evolution of business reporting together with the advent of increasingly powerful and easy-to-use data analysis tools. In this respect it has also been criticized[*by whom?*] as a marketing buzzword in the context of the "big data" surge.

Business intelligence vs. data analytics

Sporadic use of the term *business intelligence* dates back to at least the 1860s, but consultant Howard Dresner is credited with first proposing it in 1989 as an umbrella phrase for applying data analysis techniques to support business decision-making processes. What came to be known as BI tools evolved from earlier, often mainframe-based analytical systems, such as decision support systems and executive information systems.

Business intelligence vs. advanced analytics

	BUSINESS INTELLIGENCE	ADVANCED ANALYTICS
Answers the questions:	▪ What happened? ▪ When? ▪ Who? ▪ How many?	▪ Why did it happen? ▪ Will it happen again? ▪ What will happen if we change x? ▪ What else does the data tell us that we never thought to ask?
Includes:	▪ Reporting (KPIs, metrics) ▪ Automated monitoring and alerting (thresholds) ▪ Dashboards ▪ Scorecards ▪ OLAP (cubes, slice and dice, drilling) ▪ Ad hoc query ▪ Operational and real-time BI	▪ Statistical or quantitative analysis ▪ Data mining ▪ Predictive modeling ▪ Multivariate testing ▪ Big data analytics ▪ Text analytics

Comparison of BI and advanced analytics

Business intelligence is sometimes used interchangeably with business analytics; in other cases, business analytics is used either more narrowly to refer to advanced data analytics or more broadly to include both BI and advanced analytics.

Compared with competitive intelligence

Though the term business intelligence is sometimes 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. If understood broadly, business intelligence can include the subset of competitive intelligence.

Competitive intelligence (**CI**) is the action of defining, gathering, analyzing, and distributing intelligence about products, customers, competitors, and any aspect of the environment needed to support executives and managers in strategic decision making for an organization.

CI means understanding and learning what is happening in the world outside the business to increase one's competitivity. It means learning as much as possible, as soon as possible, about one's external environment including one's industry in general and relevant competitors.

Key points:

1. Competitive intelligence is a legal business practice, as opposed to industrial espionage (undercover activities or spying), which is illegal.
2. The focus is on the external business environment.
3. There is a process involved in gathering information, converting it into intelligence and then using it in decision making. Some CI professionals erroneously emphasise that if the intelligence gathered is not usable or actionable, it is not intelligence.

Another definition of CI regards it as the organizational function responsible for the early identification of risks and opportunities in the market before they become *obvious* ("early signal analysis"). This definition focuses attention on the difference between dissemination of widely available factual information (such as market statistics, financial reports, newspaper clippings) performed by functions such as libraries and information centers, and competitive intelligence which is a *perspective* on developments and events aimed at yielding a competitive edge.

The term CI is often viewed as synonymous with competitor analysis, but competitive intelligence is more than analyzing competitors; it embraces the entire environment and stakeholders: customers, competitors, distributors, technologies, and macroeconomic data.

Compared with business analytics

Business intelligence and business analytics are sometimes used interchangeably, but there are alternate definitions.[14] Thomas Davenport, professor of information technology and management at Babson College argues that business intelligence should be divided into querying, reporting, Online analytical processing (OLAP), an "alerts" tool, and business analytics. In this definition, business analytics is the subset of BI focusing on statistics, prediction, and optimization, rather than the reporting functionality.

Data discovery

Data discovery is a buzzword in BI for creating and using interactive reports and exploring data from multiple sources. The market research firm Gartner promoted it in 2012.

Data discovery is a user-driven process of searching for patterns or specific items in a data set. Data discovery applications use visual tools such as geographical maps, pivot tables, and heat maps to make the process of finding patterns or specific items rapid and intuitive. Statistical and data mining techniques can be employed to accomplish these goals.

Data discovery is a type of business intelligence in that they both provide the end-user with an application that visualizes data using dashboards, static and parameterized reports, and pivot tables. Visualization of data in traditional BI incorporated standard charting, key performance indicators, and limited graphical representation and interactivity. BI is undergoing transformation in capabilities it offers, with a focus on end-user data analysis and discovery, access to larger volumes of data and an ability to create high fidelity presentations of information.

Data warehousing

To distinguish between the concepts of business intelligence and data warehouses, Forrester Research defines business intelligence in one of two ways:

1. Using a 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. Under 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.

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

Amount and quality of available data

Without proper data, or with too little quality data, any BI implementation fails; it does not matter how good the management sponsorship or business-driven motivation is. Before implementation it is a good idea to do data profiling. This analysis identifies 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 data is lacking, put the project on hold temporarily while the IT department figures out how to properly collect data.

When planning for business data and business intelligence requirements, it is always advisable to consider specific scenarios that apply to a particular organization, and then select the business intelligence features best suited for the scenario.

Often, scenarios revolve around distinct business processes, each built on one or more data sources. These sources are used by features that present that data as information to knowledge workers, who subsequently act on that information. The business needs of the organization for each business process adopted correspond to the essential steps of business intelligence. These essential steps of business intelligence include but are not limited to:

1. Go through business data sources in order to collect needed data
2. Convert business data to information and present appropriately
3. Query and analyze data
4. Act on the collected data

Data Mining and Marketing Research

Data mining is a popular technological innovation that converts piles of data into useful knowledge that can help the data owners/users make informed choices and take smart actions for their own benefit. In specific terms, data mining looks for hidden patterns amongst enormous sets of data that can help to understand, predict, and guide future behavior. A more technical explanation: Data Mining is the set of methodologies used in analyzing data from various dimensions and perspectives, finding previously unknown hidden patterns, classifying and grouping the data and summarizing the identified relationships.

The elements of data mining include extraction, transformation, and loading of data onto the data warehouse system, managing data in a multidimensional database system, providing access to

business analysts and IT experts, analyzing the data by tools, and presenting the data in a useful format, such as a graph or table. This is achieved by identifying relationship using classes, clusters, associations, and sequential patterns by the use of statistical analysis, machine leaning and neural networks.

The Importance of Data Mining

Data can generate revenue. It is a valuable financial asset of an enterprise. Businesses can use data mining for knowledge discovery and exploration of available data. This can help them predict future trends, understand customer's preferences and purchase habits, and conduct a constructive market analysis. They can then build models based on historical data patterns and garner more from targeted market campaigns as well as strategize more profitable selling approaches. Data mining helps enterprises to make informed business decisions, enhances business intelligence, thereby improving the company's revenue and reducing cost overheads. Data mining is also useful in finding data anomaly patterns that are essential in fraud detection and areas of weak or incorrect data collation/ modification. Getting the help of experienced data entry service providers in the early stages of data management can make the subsequent data mining easier.
Data Mining Techniques

The art of data mining has been constantly evolving. There are a number of innovative and intuitive techniques that have emerged that fine-tune data mining concepts in a bid to give companies more comprehensive insight into their own data with useful future trends. Many techniques are employed by the data mining experts, some of which are listed below:

1. *Seeking Out Incomplete Data:*

   Data mining relies on the actual data present, hence if data is incomplete, the results would be completely off-mark. Hence, it is imperative to have the intelligence to sniff out incomplete data if possible. Techniques such as Self-Organizing-Maps (SOM's), help to map missing data based by visualizing the model of multi-dimensional complex data. Multi-task learning for missing inputs, in which one existing and valid data set along with its procedures is compared with another compatible but incomplete data set is one way to seek out such data. Multi-dimensional preceptors using intelligent algorithms to build imputation techniques can address incomplete attributes of data.

2. *Dynamic Data Dashboards:*

This is a scoreboard, on a manager or supervisor's computer, fed with real-time from data as it flows in and out of various databases within the company's environment. Data mining techniques are applied to give live insight and monitoring of data to the stakeholders.

3. *Database Analysis:*

   Databases hold key data in a structured format, so algorithms built using their own language (such as SQL macros) to find hidden patterns within organized data is most useful. These algorithms are sometimes inbuilt into the data flows, e.g. tightly coupled with user-defined functions, and the findings presented in a ready-to-refer-to report with meaningful analysis.

   A good technique is to have the snapshot dump of data from a large database in a cache file at any time and then analyze it further. Similarly, data mining algorithms must be able to pull out data from multiple, heterogeneous databases and predict changing trends.

4. *Text Analysis:*

   This concept is very helpful to automatically find patterns within the text embedded in hordes of text files, word-processed files, PDFs, and presentation files. The text-processing algorithms can for instance, find out repeated extracts of data, which is quite useful in the publishing business or universities for tracing plagiarism.

5. *Efficient Handling of Complex and Relational Data:*

   A data warehouse or large data stors must be supported with interactive and query-based data mining for all sorts of data mining functions such as classification, clustering, association, prediction. OLAP (Online Analytical Processing) is one such useful methodology. Other concepts that facilitate interactive data mining are analyzing graphs, aggregate querying, image classification, meta-rule guided mining, swap randomization, and multidimensional statistical analysis.

6. *Relevance and Scalability of Chosen Data Mining Algorithms:*

   While selecting or choosing data mining algorithms, it is imperative that enterprises keep in mind the business relevance of the predictions and the scalability to reduce costs in future. Multiple algorithms should be able to be executed in parallel for time efficiency, independently and without interfering with the transnational business applications, especially time-critical ones. There should be support to include SVMs on larger scale.

7. *Popular Tools for Data Mining:*

   There are many ready made tools available for data mining in the market today. Some of these have common functionalities packaged within, with provisions to add-on functionality by supporting building of business-specific analysis and intelligence.

   Listed below are some of the popular multi-purpose data mining tools that are leading the trends:

8. *Rapid Miner (erstwhile YALE):*

This is very popular since it is a ready made, open source, no-coding required software, which gives advanced analytic s. Written in Java, it incorporates multifaceted data mining functions such as data preprocessing, visualization, predictive analysis, and can be easily integrated with WEKA and R-tool to directly give models from scripts written in the former two.

9. *WEKA:*

   This is a JAVA based customization tool, which is free to use. It includes visualization and predictive analysis and modeling techniques, clustering, association, regression and classification.

10. *R-Programming Tool:*

    This is written in C and FORTRAN, and allows the data miners to write scripts just like a programming language/platform. Hence, it is used to make statistical and analytical software for data mining. It supports graphical analysis, both linear and nonlinear modeling, classification, clustering and time-based data analysis.

11. *Python based Orange and NTLK:*

    Python is very popular due to ease of use and its powerful features. Orange is an open source tool that is written in Python with useful data analytic s, text analysis, and machine-learning features embedded in a visual programming interface. NTLK, also composed in Python, is a powerful language processing data mining tool, which consists of data mining, machine learning, and data scraping features that can easily be built up for customized needs.

12. *Knime:*

    Primarily used for data preprocessing – i.e. data extraction, transformation and loading, Knime is a powerful tool with GUI that shows the network of data nodes. Popular amongst financial data analysts, it has modular data pipe lining, leveraging machine learning, and data mining concepts liberally for building business intelligence reports.

Data mining tools and techniques are now more important than ever for all businesses, big or small, if they would like to leverage their existing data stores to make business decisions that will give them a competitive edge. Such actions based on data evidence and advanced analytics have better chances of increasing sales and facilitating growth. Adopting well-established techniques and tools and availing the help of data mining experts shall assist companies to utilize relevant and powerful data mining concepts to their fullest potential.

Data Mining is primarily used today by companies with a strong consumer focus — retail, financial, communication, and…

Data Mining is primarily used today by companies with a strong consumer focus — retail, financial, communication, and marketing organizations, to “drill down” into their transactional data and determine pricing, customer preferences and product positioning, impact on sales, customer satisfaction and corporate profits. With data mining, a retailer can use point-of-sale records of customer purchases to develop products and promotions to appeal to specific customer segments.

Here is the list of 14 other important areas where Data Mining is widely used:

Future Healthcare

Data mining holds great potential to improve health systems. It uses data and analytics to identify best practices that improve care and reduce costs. Researchers use data mining approaches like multi-dimensional databases, machine learning, soft computing, data visualization and statistics. Mining can be used to predict the volume of patients in every category. Processes are developed that make sure that the patients receive appropriate care at the right place and at the right time. Data mining can also help healthcare insurers to detect fraud and abuse.

Market Basket Analysis

Market basket analysis is a modelling technique based upon a theory that if you buy a certain group of items you are more likely to buy another group of items. This technique may allow the retailer to understand the purchase behaviour of a buyer. This information may help the retailer to know the buyer's needs and change the store's layout accordingly. Using differential analysis comparison of results between different stores, between customers in different demographic groups can be done.

Education

There is a new emerging field, called Educational Data Mining, concerns with developing methods that discover knowledge from data originating from educational Environments. The goals of EDM are identified as predicting students' future learning behaviour, studying the effects of educational support, and advancing scientific knowledge about learning. Data mining can be used by an institution to take accurate decisions and also to predict the results of the student. With the results the institution can focus on what to teach and how to teach. Learning pattern of the students can be captured and used to develop techniques to teach them.

Manufacturing Engineering

Knowledge is the best asset a manufacturing enterprise would possess. Data mining tools can be very useful to discover patterns in complex manufacturing process. Data mining can be used in system-level designing to extract the relationships between product architecture, product portfolio, and customer needs data. It can also be used to predict the product development span time, cost, and dependencies among other tasks.

CRM

Customer Relationship Management is all about acquiring and retaining customers, also improving customers' loyalty and implementing customer focused strategies. To maintain a proper relationship with a customer a business need to collect data and analyse the information. This is where data mining plays its part. With data mining technologies the collected data can be used for analysis. Instead of being confused where to focus to retain customer, the seekers for the solution get filtered results.

Fraud Detection

Billions of dollars have been lost to the action of frauds. Traditional methods of fraud detection are time consuming and complex. Data mining aids in providing meaningful patterns and turning data into information. Any information that is valid and useful is knowledge. A perfect fraud detection system should protect information of all the users. A supervised method includes collection of sample records. These records are classified fraudulent or non-fraudulent. A model is built using this data and the algorithm is made to identify whether the record is fraudulent or not.

Intrusion Detection

Any action that will compromise the integrity and confidentiality of a resource is an intrusion. The defensive measures to avoid an intrusion includes user authentication, avoid programming errors, and information protection. Data mining can help improve intrusion detection by adding a level of focus to anomaly detection. It helps an analyst to distinguish an activity from common everyday network activity. Data mining also helps extract data which is more relevant to the problem.

Lie Detection

Apprehending a criminal is easy whereas bringing out the truth from him is difficult. Law enforcement can use mining techniques to investigate crimes, monitor communication of suspected terrorists. This filed includes text mining also. This process seeks to find meaningful patterns in data which is usually unstructured text. The data sample collected from previous investigations are compared and a model for lie detection is created. With this model processes can be created according to the necessity.

Customer Segmentation

Traditional market research may help us to segment customers but data mining goes in deep and increases market effectiveness. Data mining aids in aligning the customers into a distinct segment and can tailor the needs according to the customers. Market is always about retaining the customers. Data mining allows to find a segment of customers based on vulnerability and the business could offer them with special offers and enhance satisfaction.

Financial Banking

With computerised banking everywhere huge amount of data is supposed to be generated with new transactions. Data mining can contribute to solving business problems in banking and finance by finding patterns, causalities, and correlations in business information and market prices that are not immediately apparent to managers because the volume data is too large or is generated too quickly to screen by experts. The managers may find these information for better segmenting,targeting, acquiring, retaining and maintaining a profitable customer.

Corporate Surveillance

Corporate surveillance is the monitoring of a person or group's behaviour by a corporation. The data collected is most often used for marketing purposes or sold to other corporations, but is also regularly shared with government agencies. It can be used by the business to tailor their products desirable by their customers. The data can be used for direct marketing purposes, such as the targeted advertisements on Google and Yahoo, where ads are targeted to the user of the search engine by analyzing their search history and emails.

Research Analysis

History shows that we have witnessed revolutionary changes in research. Data mining is helpful in data cleaning, data pre-processing and integration of databases. The researchers can find any similar data from the database that might bring any change in the research. Identification of any co-occurring sequences and the correlation between any activities can be known. Data visualisation and visual data mining provide us with a clear view of the data.

Criminal Investigation

Criminology is a process that aims to identify crime characteristics. Actually crime analysis includes exploring and detecting crimes and their relationships with criminals. The high volume of crime datasets and also the complexity of relationships between these kinds of data have made criminology an appropriate field for applying data mining techniques. Text based crime reports can be converted into word processing files. These information can be used to perform crime matching process.

Bio Informatics

Data Mining approaches seem ideally suited for Bioinformatics, since it is data-rich. Mining biological data helps to extract useful knowledge from massive datasets gathered in biology, and in other related life sciences areas such as medicine and neuroscience. Applications of data mining to bioinformatics include gene finding, protein function inference, disease diagnosis, disease prognosis, disease treatment optimization, protein and gene interaction network reconstruction, data cleansing, and protein sub-cellular location prediction.

Steps in Research process

According to Phillip Kotler," Marketing research is systematic problem analysis, model building and fact-finding for the purpose of improved decision-king and control in the marketing of goods and services."

Marketing research is fast growing in its importance due to increasing competition, fast moving technological developments and changing consumer needs expectations and attitudes.The importance of MR is universally accepted. Its status in business management is identical to the position of brain in a human body.

decision-making process

The decision-making process, in a business context, is a set of steps taken by managers in an enterprise to determine the planned path for business initiatives and to set specific actions in motion. Ideally, business decisions are based on an analysis of objective facts, aided by the use of business intelligence (BI) and analytics tools.

BI Self-Service Tool Comparison

In any business situation there are multiple directions in which to take a strategy or an initiative. The variety of alternatives to weigh -- and the volume of decisions that must be made on an ongoing basis, especially in large organizations -- makes the implementation of an effective decision-making process a crucial element of managing successful business operations.

There are many different decision-making methodologies, but most share at least five steps in common:

1. Identify a business problem.
2. Seek information about different possible decisions and their likely effect.
3. Evaluate the alternatives and choose one of them.
4. Implement the decision in business operations.

5. Monitor the situation, gather data about the decision's impact and make changes if necessary.

OR

Marketing Research Process

- Identification and definition of the marketing problem and objectives
- Developing the research plan
- Data Collection
- Data Processing and Analysis
- Formulating conclusion, preparing and presenting the report
    - Preparing Research Report , Presenting research report and Follow-up steps

Data-driven decision making

Traditionally, decisions were made by business managers or corporate executives using their intuitive understanding of the situation at hand. However, intuitive decision-making has several drawbacks. For example, a gut-feel approach makes it hard to justify decisions after the fact and bases enterprise decision-making on the experience and accumulated knowledge of individuals, who can be vulnerable to cognitive biases that lead them to make bad decisions. That's why businesses today typically take more systematic and data-driven approaches to the decision-making process. This allows managers and executives to use techniques such as cost-benefit analysis and predictive modeling to justify their decisions. It also enables lines of business to build process automation protocols that can be applied to new situations as they arise, obviating the need for each one to be handled as a unique decision-making event.

If designed properly, a systematic decision-making model reduces the possibility that the biases and blind spots of individuals will result in sub-optimal decisions. On the other hand, data isn't infallible, which makes observing the business impact of decisions a crucial step in case things go in the wrong direction. The potential for humans to choose the wrong data also highlights the need for monitoring the analytics and decision-making stages, as opposed to blindly going where the data is pointing.

Challenges in the decision-making process

Balancing data-driven and gut-feel approaches to decision-making is a difficult proposition. Managers and executives may be skeptical about relying on data that goes against their intuition in making decisions, or feel that their experience and knowledge is being discounted or ignored completely. As a result, they may push back against the findings of BI and analytics tools during the decision-making process.

Getting everyone on board with business decisions can also be a challenge, particularly if the decision-making process isn't transparent and decisions aren't explained well to affected parties in an organization. That calls for the development of a plan for communicating about decisions internally, plus a change management strategy to deal with the effects of decisions on business operations.

A research can use either qualitative or quantitative techniques when collecting data necessary for business intelligence.

Qualitative methods include contact methods such as questionnaires, surveys (interviews), focus groups, observations, sampling

Quantitative methods include experiments,

Quality Aspect

The **quality aspect** in business intelligence should cover all the process from the source data to the final reporting. At each step, the **quality gates** are different:

1. Source Data:
    - Data Standardization: make data comparable (same unit, same pattern...)
    - Master Data Management: unique referential
2. Operational Data Store (ODS):
    - Data Cleansing: detect & correct inaccurate data
    - Data Profiling: check inappropriate value, null/empty
3. Data warehouse:
    - Completeness: check that all expected data are loaded
    - Referential integrity: unique and existing referential over all sources
    - Consistency between sources: check consolidated data vs sources
4. Reporting:
    - Uniqueness of indicators: only one share dictionary of indicators
    -
    - Formula accuracy: local reporting formula should be avoided or checked

User aspect

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 usability of 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 be productive. If the system does not add value to the users´ mission, they simply don't use it.

To increase user acceptance of a BI system, it can be advisable to consult business users at an early stage of the DW/BI lifecycle, 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 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 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 possibly 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 implemented performance dashboards for all call agents, with monthly incentive bonuses tied to performance metrics. Also, agents could compare their performance to other team members. The implementation of this type of performance measurement and competition significantly improved agent performance.

BI chances of success can be improved by involving senior management to help make BI a part of the organizational culture, and by providing the users with necessary tools, training, and support. Training encourages more people to use the BI application.[1]

Providing user support is necessary to maintain the BI system and resolve user problems.[28] 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 help desk can be manned by power users or the DW/BI project team.[27]

BI Portals

A **Business Intelligence portal** (BI portal) is the primary access interface for Data Warehouse (DW) and Business Intelligence (BI) applications. The BI portal is the user's first impression of the DW/BI system. It is typically a browser application, from which the user has access to all the individual services of the DW/BI system, reports and other analytical functionality. The BI portal must be implemented in such a way that it is easy for the users of the DW/BI application to call on the functionality of the application.[30]

The BI portal's main functionality is to provide a navigation system of the DW/BI application. This means that the portal has to be implemented in a way that the user has access to all the functions of the DW/BI application.

The most common way to design the portal is to custom fit it to the business processes of the organization for which the DW/BI application is designed, in that way the portal can best fit the needs and requirements of its users.[31]

The BI portal needs to be easy to use and understand, and if possible have a look and feel similar to other applications or web content of the organization the DW/BI application is designed for (consistency).

The following is a list of desirable features for web portals in general and BI portals in particular:

Usable

User should easily find what they need in the BI tool.

Content Rich

The portal is not just a report printing tool, it should contain more functionality such as advice, help, support information and documentation.

Clean

The portal should be designed so it is easily understandable and not over-complex as to confuse the users

Current

The portal should be updated regularly.

Interactive

The portal should be implemented in a way that makes it easy for the user to use its functionality and encourage them to use the portal. Scalability and customization give the user the means to fit the portal to each user.

Value Oriented

It is important that the user has the feeling that the DW/BI application is a valuable resource that is worth working on.

Marketplace

There are a number of business intelligence vendors, often categorized into the remaining independent "pure-play" vendors and consolidated "megavendors" that have entered the market through a recent trend[32] of acquisitions in the BI industry.[33] The business intelligence market is gradually growing. In 2012 business intelligence services brought in $13.1 billion in revenue.[34]

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).[35]

Industry-specific

Specific considerations for business intelligence systems have to be taken in some sectors such as governmental banking regulations or healthcare.[36] 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 law.[*citation needed*]

BUSINESS INTELLIGENCE LANDSCAPE

Components of the BI landscape

The Business Intelligence landscape reflects the complex system which data goes through in order to get processed into information. One of the first steps of starting a BI program, is to understand all components of this landscape. The particularities of this system tend to differ based on the industry and organization, but at a macro level, all BI landscapes have the same format. It's usually composed of five pillars and five foundation blocks[16]:

The five pillars:

1. Data source(s)
2. Data integration
3. Data management
4. Reports
5. Information dissemination

The five foundation blocks:

1. Information security
2. Data quality
3. Metadata management
4. Data governance
5. People & culture

Data

Business operations can generate a very large amount of information in the form of e-mails, memos, notes from call-centers, news, user groups, chats, reports, web-pages, presentations, image-files, video-files, and marketing material. According to Merrill Lynch, more than 85% of all business information exists in these forms; a company might only use such a document a single time.[17] Because of the way it is produced and stored, this information is either unstructured or semi-structured.

The management of semi-structured data is an unsolved problem in the information technology industry.[18] According to projections from Gartner (2003), white collar workers spend 30–40% of their time searching, finding, and assessing unstructured data. BI uses both structured and unstructured data. The former is easy to search, and the latter contains a large quantity of the information needed for analysis and decision making.[18][19] Because of the difficulty of properly searching, finding and assessing unstructured or semi-structured data, organizations may not draw upon these vast reservoirs of information, which could influence a particular decision, task or project. This can ultimately lead to poorly informed decision making.[17]

Therefore, when designing a business intelligence/DW-solution, the specific problems associated with semi-structured and unstructured data must be accommodated for as well as those for the structured data.[19]

Unstructured data vs. semi-structured data

Unstructured and semi-structured data have different meanings depending on their context. In the context of relational database systems, unstructured data cannot be stored in predictably ordered columns and rows. One type of unstructured data is typically stored in a BLOB (binary large object), a catch-all data type available in most relational database management systems. Unstructured data may also refer to irregularly or randomly repeated (nonrepetitive) column patterns that vary from row to row within each file or document.[20]

Many of these data types, however, like e-mails, word processing text files, PPTs, image-files, and video-files conform to a standard that offers the possibility of metadata. Metadata 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,[18] but no specific consensus seems to have been reached.

Unstructured data can also simply be the knowledge that business users have about future business trends. Business forecasting naturally aligns with the BI system because business users think of their business in aggregate terms. Capturing the business knowledge that may only exist in the minds of business users provides some of the most important data points for a complete BI solution.

Limitations of semi-structured and unstructured data

There are several challenges to developing BI with semi-structured data. According to Inmon & Nesavich,[21] some of those are:

- Physically accessing unstructured textual data – unstructured data is stored in a huge variety of formats.
- Terminology – Among researchers and analysts, there is a need to develop a standardized terminology.
- 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.
- 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)[21] 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."

Metadata

To solve problems with searchability and assessment of data, it is necessary to know something about the content. This can be done by adding context through the use of metadata.[17] Many systems already capture some metadata (e.g. filename, author, size, etc.), but more useful would be metadata about the actual content – e.g. summaries, topics, people or companies mentioned. Two technologies designed for generating metadata about content are automatic categorization and information extraction.

Metadata is "data [information] that provides information about other data".[1] Many distinct types of metadata exist, among these **descriptive metadata**, **structural metadata**, **administrative metadata**[2], **reference metadata** and **statistical metadata**[3]

- Descriptive metadata describes a resource for purposes such as discovery and identification. It can include elements such as title, abstract, author, and keywords.
- Structural metadata is metadata about containers of data and indicates how compound objects are put together, for example, how pages are ordered to form chapters. It describes the types, versions, relationships and other characteristics of digital materials.[4]
- Administrative metadata provides information to help manage a resource, such as when and how it was created, file type and other technical information, and who can access it.[5]
- Reference metadata describes the contents and quality of statistical data
- Statistical metadata may also describe processes that collect, process, or produce statistical data; such metadata are also called process data

Applications

Business intelligence can be applied to the following business purposes:[22]

- Performance metrics and benchmarking inform business leaders of progress towards business goals (business process management).
- Analytics quantify processes for a business to arrive at optimal decisions, and to perform business knowledge discovery. Analytics may variously involve data mining, process mining, statistical analysis, predictive analytics, predictive modeling, business process modeling, data lineage, complex event processing and prescriptive analytics.
- Business reporting can use BI data to inform strategy. Business reporting may involve data visualization, executive information system, and/or OLAP
- BI can facilitate collaboration both inside and outside the business by enabling data sharing and electronic data interchange
- Knowledge management is concerned with the creation, distribution, use, and management of business intelligence, and of business knowledge in general. Knowledge management leads to learning management and regulatory compliance.

Why is business intelligence important?

The potential benefits of business intelligence tools include accelerating and improving decision-making, optimizing internal business processes, increasing operational efficiency, driving new revenues and gaining competitive advantage over business rivals. BI systems can also help companies identify market trends and spot business problems that need to be addressed.

BI data can include historical information stored in a data warehouse, as well as new data gathered from source systems as it is generated, enabling BI tools to support both strategic and tactical decision-making processes.

Initially, BI tools were primarily used by data analysts and other IT professionals who ran analyses and produced reports with query results for business users. Increasingly, however, business executives and workers are using BI platforms themselves, thanks partly to the development of self-service BI and data discovery tools and dashboards.

Types of BI tools

Business intelligence combines a broad set of data analysis applications, including ad hoc analytics and querying, enterprise reporting, online analytical processing (OLAP), mobile BI, real-time BI, operational BI, cloud and software-as-a-service BI, open source BI, collaborative BI, and location intelligence.

BI technology also includes data visualization software for designing charts and other infographics, as well as tools for building BI dashboards and performance scorecards that display visualized data on business metrics and key performance indicators in an easy-to-grasp way.

Data visualization tools have become the standard of modern BI in recent years. A couple leading vendors defined the technology early on, but more traditional BI vendors have followed in their path. Now, virtually every major BI tool incorporates features of visual data discovery.

BI programs may also incorporate forms of advanced analytics, such as data mining, predictive analytics, text mining, statistical analysis and big data analytics. In many cases, though, advanced analytics projects are conducted and managed by separate teams of data scientists, statisticians, predictive modelers and other skilled analytics professionals, while BI teams oversee more straightforward querying and analysis of business data.

Business intelligence data is typically stored in a data warehouse or in smaller data marts that hold subsets of a company's information. In addition, Hadoop systems are increasingly being used within BI architectures as repositories or landing pads for BI and analytics data -- especially for unstructured data, log files, sensor data and other types of big data.

Before it's used in BI applications, raw data from different source systems must be integrated, consolidated and cleansed using data integration and data quality tools to ensure that users are analyzing accurate and consistent information.

BI trends

In addition to BI managers, business intelligence teams generally include a mix of BI architects, BI developers, business analysts and data management professionals. Business users are also often included to represent the business side and make sure its needs are met in the BI development process.

To help with that, a growing number of organizations are replacing traditional waterfall development with Agile BI and data warehousing approaches that use Agile software development techniques to break up BI projects into small chunks and deliver new functionality to business analysts on an incremental and iterative basis. Doing so can enable companies to put BI features into use more quickly and to refine or modify development plans as business needs change or as new requirements emerge and take priority over earlier ones.

BI for big data

BI platforms are increasingly being used as front-end interfaces for big data systems. Modern BI software typically offers flexible back ends, enabling them to connect to a range of data sources.

This, along with simple user interfaces, makes the tools a good fit for big data architectures. Users can connect to a range of data sources, including Hadoop systems, NoSQL databases, cloud platforms and more conventional data warehouses, and can develop a unified view of their diverse data.

Business Intelligence Trends

Currently organizations are starting to see that data and content should not be considered separate aspects of information management, but instead should be managed in an integrated enterprise approach. Enterprise information management brings Business Intelligence and Enterprise Content Management together. Currently organizations are moving towards Operational Business Intelligence which is currently under served and uncontested by vendors. Traditionally, Business Intelligence vendors are targeting only top the pyramid but now there is a paradigm shift moving toward taking Business Intelligence to the bottom of the pyramid with a focus of self-service business intelligence.

Self-Service Business Intelligence (SSBI)

Self-service business intelligence (SSBI) involves the business systems and data analytics that give business end-users access to an organization’s information without direct IT involvement. Self-service Business intelligence gives end-users the ability to do more with their data without necessarily having technical skills. These solutions are usually created to be flexible and easy-to-use so that end-users can analyze data, make decisions, plan and forecast on their own. Companies such as PARIS Technologies have taken an approach to making Business Intelligence an easily integrated tool for other end-user tools such as Microsoft Excel, Access, Web browsers and other vendors.