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In the present day era of globalization and cut throat competition, where speed is the buzzword, it is very important for an organization to take right decision at the right time. Business Intelligence (BI) allows us to use data strategically in responses to challenges and drive profitable business actions. Decisions purely based on the gut feeling cannot assure success; but with BI's fact-based decision-making framework, confident decisions can be made for assured business success. BI refers to a set of tools and techniques that enable a company to transform its business data into timely and accurate information for the decisional process, to be made available to the right persons in the most suitable form. The paper explores the concept of business intelligence, its architecture and applications.

Keywords: Business Intelligence Technology, Globalization, Fact Based decisions.

Introduction

The choices we make in our life have life changing and everlasting consequences. Trivial decisions can have big effects on our present and also on the future. So, its always said that the key to success is to make good choices! Every day a number of decisions must be made that determine the direction and efficiency of the organizations and the individuals. Organizations make decisions regarding production, marketing and personnel; decisions are made regarding costs, sales and margins. So, in order to compete in the present day environment of globalization and cut throat competition, where organizations have limited resources, the importance of effective decision making increases many fold. The overall impact of effective decision is not based only on the caliber of the decision maker, but it also depends on the person/team responsible for the implementation. There are numerous examples in the history where brilliant strategic plans went in to doldrums because of poor decisions made by those who are responsible for the implementation. So, effective decision making is an essential throughout the organization.

Business Intelligence is the delivery of accurate, useful information to the appropriate decision maker within the required time frame to support the effective decision making. Business intelligence equips enterprises to gain business advantage from data. *It is all about getting right information, to right decision makers at the right time in right format.* Once an organization is powered with BI, it can anticipate enhanced turnaround time on data collection, come up with fresh ideas for novel business

initiatives, foresee accurate picture of customer needs and demands, and perform more targeted marketing campaigns. Business Intelligence is not simply facts and figures on a printed report or computer, Bulk of data showing detailed sales figures or production numbers may be accurate, reliable, but they are not BI, unless and until they are put in a format that can easily be put in a form that can be understood by the decision maker easily and are not available to the right person at the right time. As effective decision making is an essential for all levels of the organization, so is the business intelligence should be available throughout the organization. It makes an organization agile thereby giving it a competitive edge in today's evolving market condition. Business intelligence is a concept or approach and is much more than a technology. It leads to fact based decision making and provides a single version of truth.

Review of Literature

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."***

Data Warehouse Institute defines business analytics as - The processes, technologies and tools needed to turn data into information and information into knowledge and knowledge into plans that drive profitable business action. BI encompasses data warehousing, business analytics and knowledge management."

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."***

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."***

Zeng et al. (2006) categorized BI technology based on the method of information delivery; reporting, statistical analysis, ad-hoc analysis and predicative analysis. Business intelligence is a process of taking large amounts of data, analyzing that data, and presenting a high-level set of reports that condense the

essence of that data into the basis of business actions, enabling management to make fundamental daily business decisions (Stackowiak et al. (2007).

Golfarelli et.al, 2004 defined BI that includes effective data warehouse and also a reactive component capable of monitoring the time-critical operational processes to allow tactical and operational decision-makers to tune their actions according to the company strategy.

Gangadharan and Swamy, 2004 define BI as the result of in-depth analysis of detailed business data, including database and application technologies, as well as analysis practices. They widen the definition of BI as technically much broader tools, that includes potentially encompassing knowledge management, enterprise resource planning, decision support systems and data mining.

Business Intelligence (BI) is the new technology for understanding the past & predicting the future. It is a collection of a broad category of technologies that allows for:

- gathering, storing, accessing & analyzing data to help business users to make better decisions.
- analyzing business performance through data-driven insight and
- a broad category of applications, which include the activities of: decision support systems, query and reporting, online analytical processing (OLAP), statistical analysis, forecasting, and data mining.

Business Intelligence (BI) is “about how to capture, access, understand, analyze and turn one of the most valuable assets of an enterprise - *raw data* - into *actionable information* in order to improve business performance”.

The business intelligence systems are based on multidimensional data modeling and rely on the concepts and technologies of data warehouse and mining and hence use OLAP technology as the base, whereas the traditional systems are transaction based and are dependent on OLTP technologies. The given below are some of the major differences between these two systems:

Transaction Systems	BI Systems
These systems automate the processes.	These systems support the decision makers.
These systems have been designed to improve efficiency.	These systems have been designed to improve effectiveness.
These systems are optimized for transactions.	These systems are optimized for queries.

These systems are designed for a particular system.	These systems adapt themselves with the system under consideration.
These systems work on the events, which have occurred in the past or are occurring at present.	These systems try to anticipate the future outcomes of the events occurring at present or have occurred in the past.
These systems store current data which is continuously updated and detailed.	These systems store historical data which is updated periodically and is summarized and derived.

Table I: Difference between Transaction Systems and BI Systems

Business intelligence (BI) is a broad category of application programs and technologies for gathering, storing, analyzing, and providing access to data from various data sources, thus providing enterprise users with reliable and timely information and analysis for improved decision making. To put it simply, BI is an umbrella term that refers to an assortment of software applications for analyzing an organization's raw data for intelligent decision making for business success. BI as a discipline includes a number of related activities, including decision support, data mining, online analytical processing (OLAP), querying and reporting, statistical analysis and forecasting.

BI Architecture

It is a framework for organizing the data, information management and technology components that are used to build business intelligence systems for reporting and data analytics. The underlying BI architecture plays an important role in business intelligence projects because it affects development and implementation decisions. The architecture has been divided in the following five layers:

1. Data Source
2. ETL (Extract-Transform-Load)
3. Data Warehouse
4. End User and
5. Metadata

1. **Data Source Layer:** The applications today require various types of data like structured, unstructured and semi-structured data to make effective and timely decision. This data can be acquired from two types of sources:

Internal Data Source, It refers to data that is captured and maintained by operational systems inside an organization such as Customer Relationship Management and Enterprise Resource Planning systems. It includes the data related to business operations (i.e., customers, products, and sales data). These operational systems are also known as online transaction processing systems as they process large amount of transactions in real time and update data whenever it is needed.

External Data Source refers to those that originate outside an organization. This type of data can be collected from external sources such as business partners, syndicate data suppliers, the Internet, governments, and market research. This data is often related to competitors, market, environment (e.g., customer demographic and economic), and technology.

It is important for organizations to clearly identify their data sources. Knowing where the required data can be obtained is useful in addressing specific business questions and requirements, thereby resulting in significant time savings and greater speed of information delivery.

2. **ETL (Extract-Transform-Load) Layer**

This layer focuses on three main processes: extraction, transformation and loading. Where

Extraction is the process of identifying and collecting relevant data from different sources. But the data collected from internal and external sources are not integrated, incomplete, and may be duplicated. Therefore, the extraction process is needed to select data that are significant in supporting organizational decision making. The extracted data are then sent to a temporary storage area called the data staging area prior to the transformation and cleansing process. After that, the data will go through the transformation and the cleansing process.

Transformation is the process of converting data using a set of business rules (such as aggregation functions) into consistent formats for reporting and analysis. **Data transformation process also includes defining business logic for data mapping and standardizing data definitions in order to ensure consistency across an organization.**

As for data cleansing, it refers to the process of identifying and correcting data errors based on pre-specified rules. If there is an error found on the extracted data, then it is sent back to the data source for correction. Once data have been transformed and cleansed, they are stored in the staging area. This can prevent the need of transforming data again if the loading processes fail or terminate.

Loading is the last phase of the ETL process. The data in staging area are loaded into target repository.

3. Data Warehouse Layer

There are three components in the data warehouse layer- operational data store, data warehouse, and data marts. Data flows from operational data store to data warehouse and subsequently to data mart.

Operational Data Store

An operational data store (ODS) is used to integrate all data from the ETL layer and load them into data warehouses. ODS is a database that stores subject-oriented, detailed, and current data from multiple sources to support tactical decision making. It provides an integrated view of near real-time data such as transactions and prices.

Data Warehouse

Data warehouse is one of the most important components in BI architecture. Inmon (2005) defines data warehouse as “a subject-oriented, integrated, time-variant, and non-volatile collection of data in support of management’s decision making process”. In summary, data warehouse is a central storage that collects and stores data from internal and external sources for strategic decision making, queries, and analysis.

Data Mart

While the data in a data warehouse is mainly used to support various needs across the whole organization, it is not equipped to support the needs and requirements of specific departments.

A data mart is a subset of the data warehouse that is used to support analytical needs of a particular business function or department. Like data warehouses, it contains historical data that can help users to access and analyze different data trends. There can be many data marts inside an organization.

4. Metadata Layer

Metadata refers to data about data. It describes where data are being used and stored, the source of data, what changes have been made to the data, and how one piece of data relates to other information. Metadata repository is used to store technical and business information about data as well as business rules and data definitions. Good management and use of metadata can reduce development time, simplify on-going maintenance, and provide users with information about data source. It is essential to ensure that metadata in repositories are maintained and updated regularly.

Metadata repository is also used to document the information about data contained in the data warehouse layer. It includes description of data structure (schema, dimensions, and hierarchies) and definitions of conformed dimensions and conformed facts. This metadata guide the process of

extracting, transforming, and loading data into target repository. OLAP metadata provides descriptions about structure of cubes, dimensions, hierarchies, levels, and the type of drill paths being taken.

5. End User Layer

The end user layer consists of tools that display information in different formats to different users. These tools can be grouped hierarchically in a pyramid shape (as shown in Figure 1). As one moves from the bottom to the top of the pyramid, the degree of comprehensiveness at which data are being processed and presented increases. This is to tailor to increasing complexity in decision-making as one moves up organizational hierarchy.

OLAP (Online Analytical Processing)

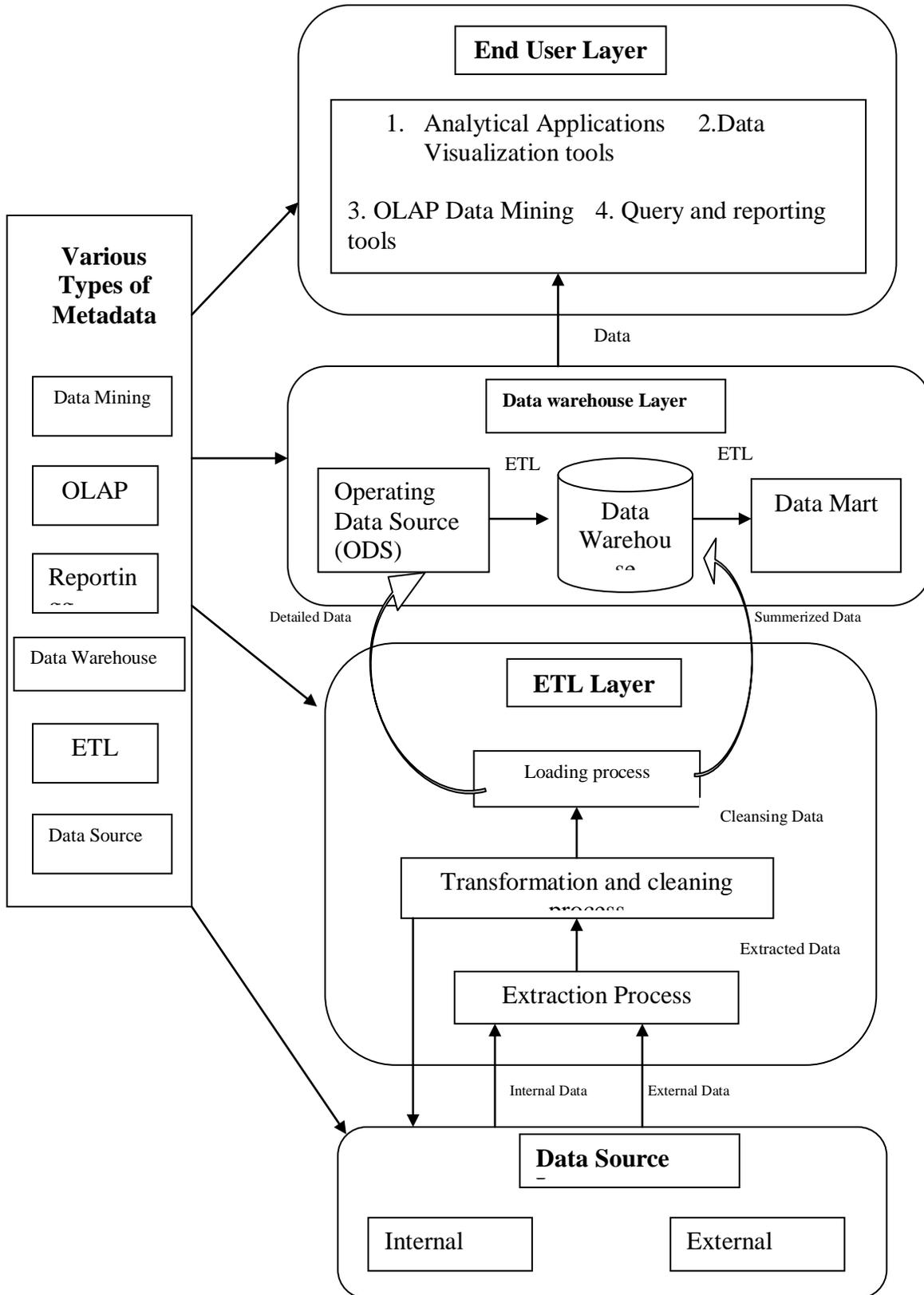
One or more OLAP servers can manage data in the data warehouse layer for reporting, analysis, modelling, and planning to optimize business. OLAP server is a “data manipulation engine that is designed to support multidimensional data structures”. OLAP server can provide multi-dimensional and summarized views of aggregated data.

Data Mining: It is the data mining process can be achieved with the integration of data warehouses and OLAP servers by performing further data analysis in OLAP cubes. Since the amount of data in an organization is growing rapidly, it is necessary to have data mining to make decisions faster. Basically, data mining is a process that automatically identifies useful information such as unusual patterns, trends, and relationships that are hidden within large amount of data. This can be achieved by applying statistical techniques such as classification, time-series analysis or clustering.

Data Visualisation Tools

Data visualisation tools such as dashboard and scorecards can be provided to managers and executives who need an overall view of their business performance. Dashboard is a useful tool that allows users to visualize data using charts, coloured metrics or tables. Users can also view more detailed information about key performance indicators across their organizations. ***Analytical Applications***

Analytical applications provide functionalities such as modeling, forecasting, sales analysis, and what-if scenarios. These applications can be used to support both internal and external business processes. Applications that are equipped with analytical capabilities allow users to gain insights into improving the performance of business operations. By employing analytical applications, decision makers can also identify and understand what factors drive their business value, and thus able to leverage opportunities faster than their competitors.



Applications of Business Intelligence: BI is neither a product nor a system. It is an architecture and a collection of integrated operational as well as decision-support applications and databases that provide the business community easy access to business data. Organizations use Business Intelligence to gain data-driven insights on anything related to business performance. It is used to understand and improve performance and to cut costs and identify new business opportunities, this can include, among many other things

- BI can be used to help analysts and managers determine which adjustments are most likely to respond to changing trends.
- BI systems can help companies develop a more consistent, data-based decision making process for business decisions, which can produce better results than making business decisions by "guesswork."
- BI applications can enhance communication among departments, coordinate activities, and enable companies to respond more quickly to changes (e.g., in financial conditions, customer preferences, supply chain operations, etc.).
- When a BI system is well-designed and properly integrated into a company's processes and decision-making process, it may be able to improve a company's performance.
- Analyzing customer behaviors, buying patterns and sales trends.
- Measuring, tracking and predicting sales and financial performance.
- Budgeting and financial planning and forecasting.
- Tracking the performance of marketing campaigns.
- Optimizing processes and operational performance.
- Improving delivery and supply chain effectiveness.
- Web and e-commerce analytics.
- Customer relationship management.
- Risk analysis.
- Strategic value driver analysis.

Conclusion

The analytical oriented systems that can totally restructure a company's ability to rediscover and utilize information they already own. These analytical systems derive insight from the wealth of data available, delivering information that's conclusive, fact-based, and actionable. The applications of tools and techniques of business intelligence facilitate the organizations to control the business variables and to get the insight into the results and observations which were not noticeable directly. It is rightly said that if you are not able to predict the trends before your competitors then you are dead. Bi tools help the decision makers to get that edge from the competitors by providing the right information to the right person at the right time.

References

Stackowiak, R., Rayman, J. and Greenwald, R. (2007) 'Oracle Data Warehousing and Business Intelligence Solutions', Wiley Publishing, Inc, Indianapolis.

Zeng, L., Xu, L., Shi, Z., Wang, M. and Wu, W. (2007), 'Techniques, process, and enterprise solutions of business intelligence', 2006 IEEE Conference on Systems, Man, and Cybernetics October 8-11, 2006, Taipei, Taiwan, Vol. 6, pp. 4722.

Gangadharan.G.R. and Swamy, N., Sundaravalli. (2004) 'Business Intelligence Systems: Design and Implementation Strategies', Proceedings of 26th International Conference on Information Technology Interfaces, Cavtat, Croatia. Retrieved 15 March, 2007 from

Golfarelli Matteo, Rizzi Stefano and Cella Luris. (2004) 'Beyond Data Warehousing: What's next in Business Intelligence?' Proceedings of DOLAP-04, Washington, DC, USA. Retrieved May 17 2006 from www.acm.org

Inmon, W.H. (1999) 'Building the Operational Data Store', Wiley Publishers-New York, 2nd edition.

Devika Ahuja Anmol Ahuja-Business Intelligence in Management – Strategic Approach, IJRIM Volume 6, Issue 1 (January, 2016) (ISSN 2231-4334)

Jayanthi Ranjan- Business Intelligence: Concepts, Components, Techniques and Benefits- Journal of Theoretical and Applied Information Technology-2005