

Review on Business Intelligence, Its Tools and Techniques, and Advantages and Disadvantages

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Abstract- Today, a huge array of data is available virtually. Business Intelligence (BI) is a data-driven mechanism that examines data and provides actionable insights to executives, administrators, and employees to help them make better business decisions. The paper discusses three major components of BI – Data Integration, Data Warehousing and Business Intelligence. The study also focuses on the business intelligence tools and techniques which are conveniently used for obtaining the in-depth information in much simpler form. In addition, the study compares business intelligence with big data and explains the two distinct concepts, big data and business intelligence, that coexist in the same domain. The paper also outlines what the future of business intelligence holds. Every technological innovation introduces some advantages, but it also introduces certain disadvantages. So, merits and demerits have been discussed in this paper.

Keywords- Business Intelligence (BI), Data Integration (DI), Data Warehousing (DW), Business Intelligence Techniques, Business Intelligence Tools, Future of Business Intelligence, Advantages of Business Intelligence, Disadvantages of Business Intelligence

I. INTRODUCTION

Today, the data has become comprehensively available. The information has widely grown in the post-pandemic world due to the hike in virtual connection between the people. There is abundance of messy information available, this information needs to be organized in a tidy and accessible form in order to navigate the data easily and help people find what is needed to them without relying on others. In the data extensive world, the success of business depends on how the data is managed. Here, the Business Intelligence (BI) comes into the picture. BI is about conveying authentic and definitive information to the right people at the right time with the goal of achieving better decisions faster. In order to have systematic access to precise and explicit information, BI might be right for business organization. During the last decade, significant numbers of organisations of varying sizes and within a broad range of industrial sectors, from manufacturing to health services to the financial sector, have been implementing systems for BI in order to support decision makers and help achieve improvements in the performance of organisations [1].

It was very innovative and difficult to get the data out of relational database earlier. Organizations have used BI tools for long period of time, the traditional BI approach was very time consuming and required hands-on work to get insightful data. But, today, modern BI approach has ease up the interaction of business users with the data. Business Intelligence tools are the software applications used by IT

professionals; which helps in capturing and analyzing the large amount of the data precisely, and helps in presenting the analytical as well as statistical reports of the data. There are multiple business intelligence tools available which performs specialized functions or techniques to analyze the massive data in order to produce quality insights and help organization understand business.

BI needs lots of data to gain the relevant insights for accurate decision making. Some people refer this huge data as Big Data (BD). But big data isn't only about size of data, it is also about capturing and analyzing structured as well as unstructured data. Business intelligence and big data involve abundant information to give insight in order to achieve things. But they vary in terms of nature and quantity of data each of them focuses on. They also diverge on the tools which is used to process the data. Their outcomes sometimes coincide but not always. But when they are used correctly, they would provide appropriate outcomes.

Having looked at the basic concepts of BI; the rest of the paper explores the BI, BI tools, techniques of BI, comparison with big data and future of BI. The paper also discusses advantages and issues of business intelligence.

II. BUSINESS INTELLIGENCE

Business intelligence has the power to change people's way of working, to enable businesses to compete more effectively and efficiently, and to help non-profits stretch their income further. For past several years, top business organisations have listed Business Intelligence as their one of the most important priority. The latest trends in Business Intelligence such as Business Analytics (BA) and big data management have contributed to the constant growth of the business intelligence software market. Business intelligence (BI) is the process of transforming data into actionable lessons that help enterprises make clever and tactical business decisions by leveraging on software and services. To provide customers with comprehensive intelligence on the state of the market, BI tools navigate and evaluate data sets and display empirical results in analyses, summaries, dashboards, graphs, charts, and maps.

BI is comprised of three major components - Data Integration (DI), Data Warehousing (DW), and Business Intelligence (BI). DI is the core of DW, sequentially DW is the base of BI.

A. Data Integration

It is the convergence of technological and business methods used to clean and integrate data from disparate sources into usable and useful information. If an organisation

has inconsistent and inaccurate data, it's most clear that it has a data integration issue. The data sources; the methods for gathering, consolidating, transforming, cleansing, and aggregating data and metadata; standards; tools; and resources and skills are indeed components of data integration. Data integration is displayed by consistency in the measurement of variables, naming conventions, physical data definitions across the data.

B. Data Warehousing and Data Marts

1) Data Warehouse

The data warehouse is an important part of business intelligence. It is a decision support system. It is the task of managing and staging information and optimizing it for access and analysis in an organisation. Data flows from data producers to the data warehouse, where it is transformed into information wanted for business consumers. Bill Inmon once said, "*A Data Warehouse is a subject oriented, integrated, non-volatile, and time variant collection of data in support of management's decisions.*"

a) Subject Oriented

Data naturally congregates around major categories within any corporation. These categories are called subject areas. For example, subject areas are bill of material, customer, product, and criminal profile. The subject area will be designed to contain only the data appropriate for decision support analysis.

b) Integrated

Data integration is displayed by consistency in the measurement of variables, naming conventions, physical data definitions across the data. There will be only one definition, identifier, etc., for each subject area.

c) Nonvolatile

Once data has been entered into the data warehouse, it cannot be changed.

d) Time Variant

This nature allows for analysis of past, relates information to the present and enables forecasts for the future.

2) Data Mart

A data mart is a plain, uncomplicated and simplest structure of a data warehouse. Data marts are warehouses of data gathered for analysis on a certain component or unit of a company. There are various reasons for creating data marts:

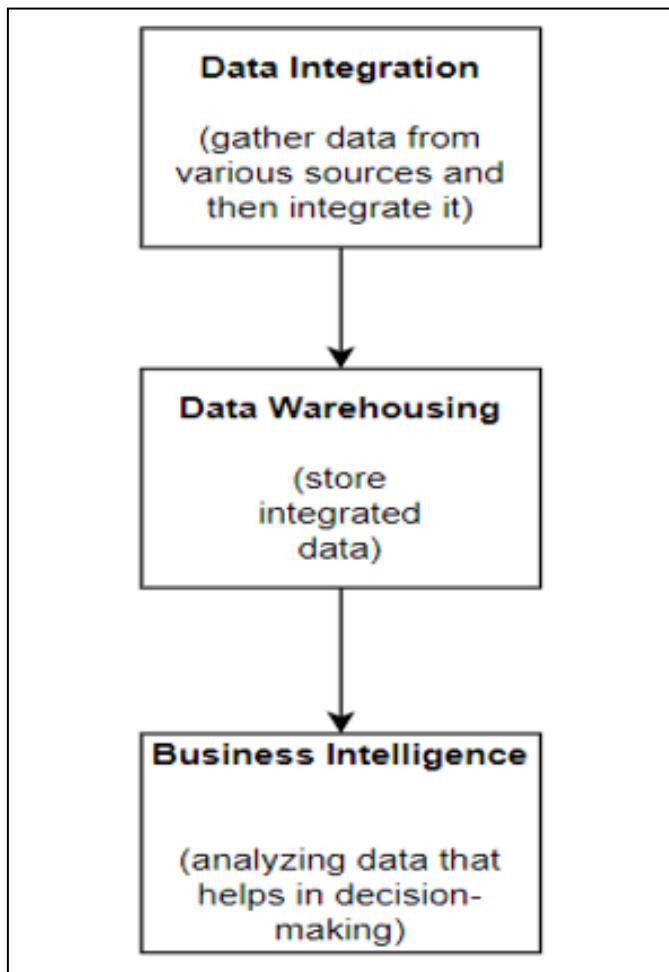
- To provide people with access to the data they need to evaluate quite frequently.
- Improve end-user response time by limiting the number of data to be processed.
- To offer suitably organised data as determined by the end user access tools' needs.
- Data marts are easy to implement and build than data warehouse.
- Comparatively, the implementation cost of data mart much is less than that of data warehouse.

C. Business Intelligence

With the help of various tools and techniques, BI helps in presenting the data to the business executives so they can use it to gain knowledge. The data is acquired from hierarchical data sources or business software such as Enterprise Resource Planning (ERP), Customer Resource

Management (CRM), and Supply Chain Management (SCM). BI enables access and delivery of information to business users. Unlike data warehouse, it is the visible part of data system.

Fig. 1. Major Components of Business Intelligence



III. BUSINESS INTELLIGENCE TOOLS

IT practitioners were the main consumers of BI technologies in the past. BI tools, on the other hand, have become more intuitive and user-friendly, allowing a vast range of people from various corporate domains to use them. Business firms require certain help in order to make sustainable and profitable decisions. Modern and professional business tools help them counter all the challenges. Business intelligence tools are types of application software that collect and process large amounts of unstructured data from internal and external systems, including books, journals, documents, health records, images, files, email, video, and other business sources [2]. BI tools allow you to collect data and use it to locate info, predominantly through queries. The tools also aid in the preparation of data for analysis, allowing you to generate charts, data visualizations, visual analytics, building interactive dashboard, predictive analytics, reports, spreadsheets, KPIs and performance scorecards. It's used for more simple enterprise data querying and monitoring. A wide range of data collection applications, such as ad-hoc analysis and querying, pull and analyze data from a CRM,

integration with cloud computing services, Online Analytical Processing (OLAP) and location intelligence can be combined with business intelligence software. BI tools help in identifying new business opportunities. In short, BI tools help to eliminate manual tasks, minimize business costs, bring together all relevant data, users get prediction advantage and service is always available.

TABLE I. BUSINESS INTELLIGENCE TOOLS AND FEATURES

BI Tools	Key Features
SAS Business Intelligence	Visual Data Exploration, Reports and Dashboards across devices, Collaboration, Text Analytics.
IBM Cognos Analytics	Data Visualization, Reporting, AI Assistant, Provides Automatic Data Exploration and Prediction, Web-based Data Modelling.
Qlik	Augmented Intelligence, Visually Highlighted Dashboards, Self-service Analytics, Guided Analytics, Associative Exploration.
Oracle BI	Data Analytics, Embedded Analytics and Real-time Reporting, Data Visualization, Search Mechanism.
Microsoft Power BI	Mobile Application that has touchscreen facilities for reporting, Self-service Analytics, Smart tools for faster and better results, Data Analytics.
Domo	Magic ETL feature, Provides HTML5 interface, Embedded and Extended Analytics, BI and Analytics, Intelligent Applications that allow for automation via apps.
Dundas BI	True Mobile Device experience, Data Visualization, Data Integration, Limitless customization, Tailored Analytics.
Tableau	AI-driven analytics and predictions, Uses NLP, Embedded Analytics, Device Designer helps in customization on desktop, Phone and Tablet, Secure collaboration, Flexible Deployment.

IV. BUSINESS INTELLIGENCE TECHNIQUES

The most important features and functionality which is used for business intelligence are:

A. Online Analytical Processing (OLAP)

OLAP is a method for responding to Multi-Dimensional Analytical (MDA) queries such as time, product and geography. OLAP is a form of business intelligence that includes things like relational databases, report writing, and data mining. It enables business users to see the data in the data warehouse in a multidimensional and logical manner. Data centres or data marts built for advanced business intelligence systems may benefit from OLAP techniques and software. This method of evaluating business data utilizes dimensional models, which are similar to multidimensional pivot tables in spreadsheets. It consists of four basic analytical operations such as roll-up, drill-down, slicing and dicing and pivot. Relational Online Analytical Processing (ROLAP) and Multidimensional Online Analytical Processing (MOLAP) are the models of OLAP. The Hybrid Online Analytical Processing (HOLAP) combines them both.

B. Extraction-Transformation-Load (ETL)

This concept implies for a set of tools that are used to extract, transform and load data in BI Systems. These tools are mainly responsible for data transfer from transaction systems and the Internet to data warehouses. They involve the processes of extracting data from outside sources, transforming it to fit operational needs which can include quality levels, loading it into the end targets such as databases or data warehouses [3].

C. Dashboards

Business intelligence dashboards are data analysis and knowledge processing tools for analyzing data. Dashboards are an essential part of a company's business analytics approach. They should be developed with the aim of analyzing data from key datasets in order to improve business decisions. Dashboards are one of the most common BI features and functionality because they present simple data analysis, allow you to configure which details you want to see, and also plays helping hand in sharing the results with fellow business executives. Thus, dashboards are very convenient in understanding complex reports.

D. Visualization

In the whole business intelligence, data visualization is critical. Data visualizations is needed in order to make data easier to comprehend and extract knowledge from. Data visualization is the process of converting information into a graphic medium, enabling the viewer to observe, browse, make sense, and understand the information. It also plays an important role in big data projects. It identifies patterns, trends and outliers in large data sets, and then helps in presenting this data in the form of graphs, charts, maps or histograms, which is convenient for users to understand and visualize. Thus, data visualizations tools are quite helpful.

E. Reporting

The key aim of business intelligence reports is to provide accurate data that can be quickly obtained, analyzed, and used to make decisions. BI reporting tools and techniques lend a hand to get data insights which ultimately helps to support decision making. There are two types of reporting in BI – Ad hoc Reporting and Managed Reporting. Ad hoc research provides data to users rather than displaying it in a pre-built report, it allows them to generate their own personalized reports using queries and data they like. Managed reporting is nothing but technical users put together data for non-technical users. In this way, BI reporting helps users to improve decisions and business performance.

F. Advanced Analytics

Advanced analytics demonstrates how to utilize analytics not only to learn about what has occurred but also to predict the future and act on them. Advanced analytics consists of Predictive analytics, data visualization, and data discovery. Advanced analytics consists of Predictive Analytics, Data Visualization, and Data Discovery. Business intelligence examines previous data to determine what has happened by measuring and monitoring it, advanced analytics allows business executives to generate predictions and projections based on evaluating that past data in new ways.

G. Predictive Analytics

It's a form of business intelligence that incorporates statistical analysis, data visualizations, and ad hoc querying or data exploration. It gives idea about upcoming or otherwise unpredictable events by analyzing actual and historical evidence. Business people in their business analysis uses this kind of analysis to create predictive models. Predictive analytics solutions are currently mostly employed by companies who specialize in statistical analysis, data mining, or other advanced analytics. This is a part of advanced analytics.

H. Data Mining

Data mining is a method of analyzing vast amounts of data in order to uncover trends such as groups of records, unusual records, and dependencies. Data mining is also known as Knowledge Discovery in Data (KDD). Data mining is an essential part of data management and data pre-processing because it guarantees proper data structuring. Data mining process includes selection, pre-processing, transformation, data mining and interpretation.

1) Selection:

Selecting pertinent data from distinct sources for mining process.

2) Pre-processing:

Here, raw data is converted into a format that is both usable and effective.

3) Transformation:

Here, data is transformed into a form that can be mined. It's possible to use feature collection, sampling, and grouping.

4) Data Mining:

Here, the patterns are extracted and discovered in large datasets. It is an important step to choose a mining algorithm that is appropriate for the data pattern.

5) Interpretation:

The data is presented in order to draw relevant conclusions, such as predictions.

I. Real time Business Intelligence

Real-time BI is a vividly visual, human-centered data exploration experience that takes advantage of unique and continuously evolving data.

V. COMPARISON WITH BIG DATA

Big data and business intelligence need to be coordinated. They are not the same thing, yet they share many aims. It is critical to integrate them. Big data becomes a valuable asset in providing the insights when integrated with BI. As a result, big data is a part of BI, that gives in-depth knowledge and detailed view of the activities. The data considered to be part of BI is far more comprehensive than that deemed to be part of big data.

Business intelligence encompasses all types of data, from sales reports to enormous web databases. Big data, on contrary, is made up of enormous data sets. The tools used in big data and business intelligence techniques differ as well. A business intelligence tool can analyze normal data sources, but it may not be able to handle big data. Other, more powerful systems are purpose-built for massive data

processing. BI experts employ a variety of technologies to extract value from information, including spreadsheets, market insight resources, data warehouse services, business analytics software, and database management languages. Big data specialists, on the other hand, employ highly specialized tools such as big data platforms, cluster programming models, and database programme to explore and make sense of essentially unstructured data.

Business intelligence, which may be described simply as data-based analysis of business activities, might be regarded as the umbrella term under which these notions exist. In short, big data is collected and processed in order to get business intelligence.

VI. FUTURE OF BUSINESS INTELLIGENCE

The business intelligence is constantly developing in response to changing customer demands and technological advancements. To keep ahead of developments and upcoming events, businesses will have to focus more heavily on their business intelligence programme.

A. Artificial Intelligence and Business Intelligence

Firms may include AI insights into a larger BI strategy as artificial intelligence and machine learning are continuously evolving. Artificial intelligence may use historical patterns and developments to make educated assumptions about the data inquiries. So generally, insight and self-service can be powered by machine learning. BI systems will become more and more intuitive in forthcoming years.

B. Data Visualization

Data visualization involves presenting data in graphical or pictorial form which makes the information easy to understand. It helps to explain facts and determine courses of action [5]. Data visualization will become progressively more important as teams and organizations collaborate across boundaries. In near future, third-party systems can become more integrated with BI, making data collection and responding to actionable insights easier. The technology for storing vast volumes of data, big data, and supporting business intelligence applications will be expanded.

C. Data Driven Business Intelligence

The business teams should be data-driven if they want to get the best out of data analysis in an existing or newly adopted BI system. Giving all workers the tools to integrate BI into daily operations will be part of adopting a data-driven community. As companies strive to be more data-driven, efforts to share data, and collaborate will increase.

D. Augmented Analytics

Augmented analytics is the combination of multiple automated steps that will produce clear, actionable answers [6]. Future BI tool advancements can result in outputs that include actionable, strategy-changing recommendations. If businesses want to stay competitive, they'll need to exploit data more than their rivals, and augmented analytics would be the most effective way to do so.

E. Mobile BI

Mobile BI has lately become popular. Users may simply stay connected to their data and manage their enterprises using their smartphones and tablets. Customers can securely access and see live Power BI dashboards and reports on any device using native mobile BI applications. Users may

simply share reports from within the application, making Mobile BI a useful collaborator.

VII. ADVANTAGES OF BUSINESS INTELLIGENCE

Business intelligence technologies will develop rapidly in coming years and businesses will have to adopt to it quickly in order to take massive advantages.

BI boosts the overall performance of the firms that exploits it. Business intelligence technologies may help in a variety of ways. Businesses that use BI, reap many benefits. Business intelligence tool has a number of advantages: There are various reasons for creating data marts:

- It helps organization to know their business.
- The purpose of the Business Intelligence Software with Location Analytics Market Research Report is to give insights that depict the market dynamics, size, trends, opportunities, and future outlook. The Business Intelligence Software with Location Analytics market research study examines and evaluates all of the elements that are favorably or adversely influencing the industry's trajectory to aid stakeholders in making the best decisions. Example, the impact of COVID-19 on the industry's compensation scale, detecting dominating market trends, as well as the benefits and drawbacks of various sales channels.
- Business Intelligence in the healthcare industry can be used to a great advantage. BI technologies are utilized to properly handle all of the clinical data associated with each new medicine, monitor the benefits, and analyze the dangers by combining data from numerous sources.
- Business intelligence tool helps you to view your reports independently.
- Helps in identifying waste in the system.
- Helps in identifying strengths and weakness of the firm.
- Improves decision making process.
- BI has also offered insurance firms the ability to detect money laundering illicit activity.
- Enables real-time analysis with quick navigation. With the help of real-time analysis, users may readily organise critical information and receive real-time updates very quickly. This saves a lot of time.
- Budgeting and planning are being integrated into a consolidated platform.
- Determine contractual metrics to obtain the best payment conditions while increasing revenue, this example falls under regulatory compliance.
- Make it easy to share and access information.
- Minimize the risk of bottlenecks.
- Revenue optimization, that is, identifying cross-selling and up-selling opportunities.
- Detect and discourage fraudulent conduct.
- Very quick answer to business queries and problems.
- Gain vital insight into the behavior of the consumers.
- Consumers with no training in data science can benefit from BI by using visual data to make better

business choices. Thus, increases the experience and satisfaction of both consumers and workers.

- Provides capability to enter new markets and create new goods. Example, choose new markets or sectors to target with specialized products.
- Corporations may use BI tools to set data-driven goals, such as sales targets or target delivery dates, and then track progress on a daily basis. Thus, corporations can easily evaluate and manage performance.
- For better business choices, BI gives reliable data, faster reporting capability and actionable insights. As a result, it aids in the elimination of guesswork.
- Businesses use BI to stay up with industry developments, track seasonal fluctuations in the market, and foresee client requirement.
- BI tools provide data visualization due to which data become so easy to read, comprehend and interpret.

VIII. ISSUES WITH BUSINESS INTELLIGENCE

Every new technology brings with it some novelty, but it also brings with it certain problems. Businesses encounter a range of business intelligence difficulties as they acquire more data, complicating attempts to make BI procedures prolific, operative, and meaningful.

1) Data Warehousing

A data warehouse is a large IT project, and like many large IT projects, it can consume a lot of IT man hours and budgetary funds to provide a solution that isn't utilized frequently enough to justify the installation cost. On average, a DW installation cost is \$1.5 million and, in some cases, exceeds \$50 million [7]. Thus, a great deal of care must be taken to determine the nature of its ultimate development and use [7]. So, there is a big concern of spending and maintaining DW and updating the DW as market grows. Also, data warehousing works with identical data formats in various data sources. It is possible that some valuable elements of the data will be lost as a result.

2) Poor Quality of Data

A lot of data is available today. Sometimes it could be a little bit tricky to use all the data. This leads BI tools to analyze unwanted and unneeded data which slows down the process of getting meaningful outcomes.

3) Insufficient Skills

Lack of sufficient skills for using BI tools and techniques can lead to problems. The organization is very much depending on the expert, for example, to integrate BI with other system such as ERP. The expert needs to be familiar with any technical difficulties for both systems that occur during BI implementation [8]. Many organizations face significant challenges when some individuals are unable to integrate BI into operation. If the organization does not implement these processes in all areas, they will be ineffective. BI deployment demands high technological facilities that are compatible with BI needs.

4) Data Integration from Various Data Sources

The biggest challenge is to analyze the data, irrespective of the size, from different sources. An expertise is needed to integrate BI with big data as it consists of structured as well

as unstructured data. This issue is rapidly fading as a result of extremely sophisticated BI tools, but still remains.

5) Very Expensive

The cost of business intelligence tools is prohibitively high. Although the potential for a significant ROI may justify this, the initial cost may be prohibitive for smaller businesses. Expenditures and assets are scarce everywhere, but particularly in small firms. The cost of installing BI is a major worry for small and medium-sized businesses. The company must also evaluate the price of the hardware and IT personnel required to successfully integrate the technology.

IX. CONCLUSION

In this paper concepts, tools and techniques of Business Intelligence were reviewed. Over the last decade, Business Intelligence has been heavily reliant on huge set of data. Business insight is gained by analyzing this large amounts of data. In short with the help of this vast data, Business Intelligence tools and techniques would help you get a better view of your business and, as a result, more efficient processes which would boost efficiency and profit. The implementation of BI will also improve the decision-making. Furthermore, the study contrasts business intelligence with big data. In this paper, the future scope of Business Intelligence was also addressed. So, the machine learning and augmented analytics when collaborated with BI, would provide massive insights.

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