University of Tiaret

Faculty of Economic Sciences Commercial and Management Sciences

A series of lectures in:

Business intelligence and competitiveness of organizations

For first–year Master's students in: Management

By LAKEHAL Elamine

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Introduction

The capacity to obtain, analyze, and react on knowledge has in current fastchanging and fiercely competitive business environment become a determining element in guaranteeing organizational success and sustainability. Companies need to use wise tactics to stay ahead, maximize performance, and forecast future trends given sophisticated consumer behavior and ever more saturated markets. Effective businesses in this case seem to use business intelligence (BI) to help them change unprocessed information into usable knowledge that directs strategic decision making and improves operational efficiency.

Students will learn about BI concepts, tools, and uses in this Business Intelligence (BI) and Organizational Competitiveness course, therefore giving them a strong base in the subject. It seeks to investigate in the real business world as well as to clarify the conceptual basis of Business Intelligence. Students will have acquired by the end of this course the knowledge and skills necessary for supporting datadriven decisionmaking and therefore the competitive advantage of a company in a rapidly changing digital economy. Each of the ten thorough lessons covers a fundamental element of Business Intelligence and the course subject. These subjects are chosen to give practical exposure as well as theoretical knowledge:

1. **General Introduction to Business Intelligence (BI):** Explores definitions, the history, evolution, and significance of BI in contemporary business.
2. **Data Warehouse and Database Management (DW & DBA):** Examines how data is collected, stored, and managed effectively to support BI applications.

3. **Business Analytics and Data Visualization (DV & BA):** Introduces key analytical techniques and tools used to interpret and communicate data insights.
4. **Geographic Information System (GIS):** Investigates the spatial dimension of data and its application in strategic planning and market analysis.
5. **Data Mining:** Covers the process of discovering patterns, correlations, and trends from large datasets using various statistical and computational methods.
6. **Business Performance Management (BPM):** Focuses on monitoring and improving business processes through data-driven performance metrics.
7. **Management Information Systems (MIS):** Analyzes the integration of technology, people, and processes in managing organizational information.
8. **Neural Networks and Decision Trees (NN & DT):** Introduces basic concepts of machine learning and predictive modeling in decision-making.
9. **Business Intelligence and Decision Making:** Discusses how BI tools support and enhance managerial and strategic decisions.
10. **Business Intelligence (BI) Ethics:** Highlights the ethical challenges and considerations in data usage, privacy, and responsible analytics.

By the end of this course, students will not only have a solid grounding in the key concepts of Business Intelligence but will also acquire practical skills in using BI technologies to enhance organizational competitiveness. Whether pursuing careers in business management, IT, or data science, participants will

be better equipped to navigate the complexities of data-driven environments and contribute meaningfully to their organizations' strategic goals.

This academic program serves as both an introduction and a springboard into the vast world of Business..

Dr. LAKEHAL Elamine

The first lecture:

General introduction to Business Intelligence (BI)

The first lecture: General introduction to Business Intelligence (BI)

"The new oil is data" – said someone, and this is particularly true in this age of extracting useful insights from unprocessed data. Indeed, in the world of business, something as simple as data collection and analysis is assigned high value, and is referred to as Business Intelligence (BI). The term BI refers to the duration of time channeled into analytics and technology methods because of the essence of the gathered data to develop it into necessary strategy information. The focal point of business intelligence is to make the right decisions in terms of available information and to increase the effectiveness of the company:

1. Business Intelligence (BI) Definition's

(the analysis in information systems which helps in decision making, integrates Information Technology, Data Warehousing, Data Mining, and Visualization).

The primary emphasis of BI, is within Information Technology. It involves dealing with collecting, processing and all other widely perceived activities of business data and decision making. It also includes providing good business processes within an organization. In view of this, BI is made up of and entails main components of: Data Analysis, which is the backbone feature of business intelligence is the processes of analyzing the analytic principles and observing practical data for insights and patterns as well as decision making: BI seeks to provide effective and interpretable information to make different levels of decisons (strategic or tactical) within the organization.

En raison de sa croissance rapide, le domaine relativement nouveau de l'intelligence d'affaires dans le système d'information mérite une attention académique. Néanmoins, une grande partie de la littérature sur l'informatique

décisionnelle provient du milieu des affaires, du secteur informatique et des fournisseurs. La recherche académique dans le domaine des systèmes d'information en est encore à ses débuts, et il n'existe donc pas de définition universellement acceptée du BI. Vitt et al. ont reconnu que ce terme est complexe et est « employé par divers experts et fournisseurs de logiciels pour décrire une vaste gamme de technologies, plateformes logicielles, applications spécifiques et processus ». Par conséquent, c'est une expression vide de contenu qui signifie différentes choses pour différentes personnes[1].

Table 1: Summary of varied BI definitions

BI Vendor / Author	Definition of BI
Turban *et al*. (2007)	An umbrella term that encompasses tools, architectures, databases, data warehouses, performance management, methodologies, and so forth, all of which are integrated into a unified software suite.
Moss and Atre (2003)	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.
Chang (2006)	The accurate, timely, critical data, information and knowledge that supports strategic and operational decision making and risk assessment in uncertain and dynamic business environments. The source of the data, information and knowledge are both internal organisationally collected as well as externally supplied by partners, customers or third parties as a result of their own choice.
Gangadharan and Swami (2004)	The result of in-depth analysis of detailed business data, including database and application technologies, as well as analysis practice.
Kulkarni and King	A product of analysing business data using business intelligence

[1] Lee- kwun chan & min hoii chan, Business Intelligence Systems: State-of-the-art Review and Contemporary Applications, Symposium on Progress in Information & Communication Technology (2009), p 95. on line : https://api.semanticscholar.org/CorpusID:17292396 (16/01/2025- 10 :10)

(1997)	tools. It emerges as a result of this analysis.
Moss and Hoberman (2004)	The processes, technologies, and tools needed to turn data into information, information into knowledge and knowledge into plans that drive profitable business action. BI encompasses data warehousing, business analytics tools and content/knowledge management.
Adelman and Moss (2000)	A term encompasses a broad range of analytical software and solutions for gathering, consolidating, analysing and providing access to information in a way that is supposed to let an enterprise's users make better business decision.
Gartner Research (Hostmann 2007)	An umbrella term that includes the analytic applications, the infrastructure and platforms, as well as the best practices.
IBM (Whitehorn & Whitehorn 1999)	An umbrella term that broadly covering the processes involved in extracting valuable business information from the mass of data that exists within a typical enterprise.
Business Objects (Business Objects 2007)	The use of an organisation's disparate data to provide meaningful information and analysis to employees, customers, suppliers, and partners for more effective decision making.
Cognos (Cognos 2007)	Business intelligence brings people and data together, offering a variety of ways to see the information that backs fact-based decision-making.
SAS Institute (Ing 2007)	Delivering the right information to the right people at the right time to support better decision making and to gain competitive advantage.
Oracle (Oracle 2007)	A portfolio of technology and applications that provides an integrated, end-to- end Enterprise Performance Management System, including financial performance management applications, operational BI applications, BI foundation and tools, and data warehousing.

Source: Lee- kwun chan & min hoii chan, op cit, p 96.

2. The Influence of Business Intelligence:

Intelligence in business matters greatly, and its value can be summarized as follows[2]:

a. Improvements on performance:

These days, it is inevitable for organizations to utilize Business Intelligence (BI) because it allows accurate performance monitoring as well as understanding what influences performance on both internal processes and external results. For example, in the retail sector, certain stores such as Amazon perform analysis of sales through BI to improve inventory management, effectively lowering costs while increasing profits. This can also be done in service providers where customer satisfaction can be measured via KPIs absentee rate, stock turn days and service completion time.

b. Enhancing operational processes:

Specialized BI software can pinpoint bottlenecks in the production or supply chain, such as spending more money and time than necessary purchasing materials out of stock, or automation of routine tasks like monthly report generation. saved employees time in focusing on strategic tasks, for example enabling DHL to optimize shipping routes and reduce delivery times.

c. Forward-looking trends:

Business intelligence uses historical data and predictive analytics to forecast future trends, providing organizations with a forward-looking posture. The one

[2] Emad Ahmed (2021), Utilization of Business Intelligence Tools among Business Intelligence, International Journal for Innovation Education and Research, 9 (06) : pp 240-243

thing we can be sure will be predictable. Based on that we can say that F-LT seeks for:

- Customer behavior forecasting: like tea leaves analysis of previous purchase data or browsing habits to predict customer needs. BI algorithms are also used by online services like Netflix to analyze the behavior of viewers and make persnalized recommendations, resulting in more engagement of users. So its:
- **Forecast market trends:** by analyzing market data (e.g. competitors ' prices, economic changes) to predict future opportunities or threats. As an example in the aviation industry, BI tools are used to predict flight demand during tourist seasons and dynamically adjust ticket prices.

e. Instantaneous response to developments:

Technologies such as real-time analytics enable businesses to respond to trends as they retailers, for example, leverage insights from real-time sales data to make adjustments to promotions during events like “Black Friday”.

f. Risk analysis:

Risk assessment and management is one of the most weighted benefits of business intelligence as advanced tools are capable of identifying potential threats before they worsen via: Abnormal pattern detection (Anomaly Detection) Operational risk assessment: * Strategic risk management.

Table 2: Characteristics of BI from the product perspective

Characteristics	Descriptions
Integrated	Must have a single, enterprise-wide view
Data integrity	Information must be accurate and must conform to business rules
Accessible	Easily accessible with intuitive access paths, and responsive for analysis
Credible	Every business factor must have one and only one value
Timely	Information must be available within the stipulated time frame

Source: Lee- kwun chan & min hoii chan, op cit, p 98.

3. Components of business intelligence:

A powerful business intelligence system includes many interrelated components that work together to turn raw data into actionable insights. The following are the basic elements[3]:

a. Data sources :

Any business intelligence system begins at data sources as raw data gathered from various and heterogeneous places. These sources can be traditional ways of storing information in structured tables (like SQL), or non-relational ways to store unstructured data like images or text (NoSQL). Furthermore, the data comes from ERP systems which aggregate inner processes like finance and goods, and Customer Relationship Management (CRM) platforms which monitor customer interactions and sales. And BI systems do pay attention to social media data that can give insights into the opinions and popularity of the people. When an

[3] JAYANTHI RANJAN, 2009, BUSINESS INTELLIGENCE: CONCEPTS, COMPONENTS, TECHNIQUES AND BENEFITS, Journal of Theoretical and Applied Information Technology, p 61.

enterprise lacks the diversity of these sources, it loses the complete view of its performance or its market.

b. Data warehousing:

Involves storing collected data, in specialized warehouses of handling both unstructured information in large quantities.These repositories stand out for their capacity to bring together data from sources into a location, for easier access and analysis.Take "Amazon " for instance; it could utilize this approach to store its sales data efficiently. Information, from sources like websites and customer interactions is consolidated into a repository in data warehouses for organized storage based on distinct categories such as sales or customer data with robust security measures, in place to safeguard the information effectively. Serving as the core foundation of analytical systems.

c. During the "ETLetl operations :

The information undergoes a phase before being analyzed – referred to as "ETLetl," which stands for extraction, transformation and loading. The procedure kicks off by retrieving information from its sources, like Excel spreadsheets or databases. Up is tidying up the info by eliminating duplicates fixing errors (like mismatched dates) and aligning its layout to match the intended system. Ultimately the refined details are transferred to either a database or analysis platforms, for examination and interpretation. One scenario could involve an airline consolidating reservation information from systems. consolidating them into a single format, before using them to predict the peak demand for flights.

d. Visual aid and analytics:

This is the phase in which the facts is turned into reasonable understanding. While visualization tools (such Tableau or Power BI) are devoted to show data in

appealing visual forms, such graphs or interactive maps, statistical and predictive models are built using analysis tools—such as Python or R. Using a heatmap displaying optimal zones, a tableau marketing company might show, for instance, how an advertising campaign affects sales in various places. Visual aids not only improve data understanding but also enable the identification of obscure trends in text reports.

e. Reports and dashboards:

The primary user interface managers depend on to instantly view performance is dashboards. With the option of personalizing them to match the demands of every department, these panels are meant to provide important performance indicators (KPIs) such profit rate or customer happiness. For example, a production manager may watch a panel that displays the efficiency of manufacturing lines, while a financial management concentrates on cash flows and expenses. The capacity of modern panels to automatically refresh guarantees that decisions are grounded on the most recent information.

f. Data mining:

Data mining is the process of identifying links between data that are not readily obvious and hidden patterns. This procedure uses machine learning algorithms to forecast future trends or artificial intelligence techniques, like clustering, to group clients into groups according to their behavior. For instance, a merchant may see that consumers who purchase one product frequently purchase another related item (for instance, cameras and bags), which aids in the creation of strategic marketing plans.

4. Business intelligence tools

Business Intelligence (BI) tools encompass a broad range of software applications and technologies designed to collect, process, analyze, and visualize data to support informed decision-making across an organization. These tools serve as the backbone of BI systems, transforming raw data into actionable insights that drive strategic planning and operational improvements.

BI tools include, but are not limited to, dashboards, reporting tools, online analytical processing (OLAP), data mining platforms, data visualization applications, and advanced predictive analytics software. With such tools, organizations can identify patterns, detect anomalies, track key performance indicators (KPIs), and forecast future trends with greater accuracy. delicate, the course has also stressed the value of ethical responsibility in data management.

Therefore, graduates of this program will be wellprepared to assist companies in using BI for longterm development and strategic management. They will not only grasp how to convert data into practical information, but also how to ethically and efficiently align BI policies with more general corporate objectives.

Eventually, this class seeks to create next generation experts equipped to flourish in the datadriven environment that is professionals capable of converting complexity into simplicity and data into competitive edge. And the next tab presents the most popular business intelligence tools.

Tab 03: The most popular business intelligence tools

Tools	Its advantages
Power BI	The software affiliate Microsoft which is considered one of the most popular tools because to its ease of Use and its ability to link with the Azure Cloud Platform, making it excellent for analyzing and displaying data via interactive dashboards.
Tableau	Which features advanced visualization technologies and the ability to handle big data, making it the Prince's choice for companies that need complex visual analytics
Qlik Sense	Which has advanced visualization tools and the ability to handle massive data, making it the Prince's choice for enterprises that need complicated visual analytics
SAP BusinessObjects	It is meant for major enterprises to combine it with operational systems such as EPR, giving integrated solutions for financial management and analytics.
Google Data Studio	A free tool that allows Google data (such as Analytics or Ads) to be quickly transformed into visual reports.

Source: Prepared by lecturer

The vague definitions and uses of business intelligence systems have been ex mined in this lesson...It began by classifying the various definitions of business in

telligence (BI) into three primary viewpoints: technological, managerial, and pro duct el-ements.

The essential elements of a standard BI system were then described. It should be mentioned that a business intelligence (BI) system is not thought of as a whole new system, but rather as an integrated, progressive result of numerou s tols and computing methods.

These comprise, but are not restricted to, web technologies, data mining, dat a warehousing, online analytical processing

The second lecture:

Data warehouse and database management DW & DBA

The second lecture : Data warehouse and database management DW & DBA

In the era of Big Data, Data Management, storage and analysis have become the cornerstones of company success. Data warehouse and database Administration are two essential areas in the IT sector that help strategic decision - making based on data. In this lecture, we will examine the basic ideas of data warehouse and database administration, their importance, and the issues they encounter.

Part I. Data Warehouse

The volume of data saved in electronic systems is increasing dramatically every day. But these enormous volumes of data, which were acquired for comparatively little money, don't have a analysis of the benefit claimed to organizations, particularly in light of the fact that they don't supply information.

In actuality, a company may have a lot of data but little information. Additionally, the economy's increasing internationalization is making competition in several management fields more fierce. Businesses must be adaptable and quick to react to everything that goes on around them in order to thrive in this unstable climate. Therefore, managers nowadays require all relevant information at the appropriate moment—information that is, of course, accurate. They require new information systems, providing them with not only[1].

1. Definition of a Data Warehouse

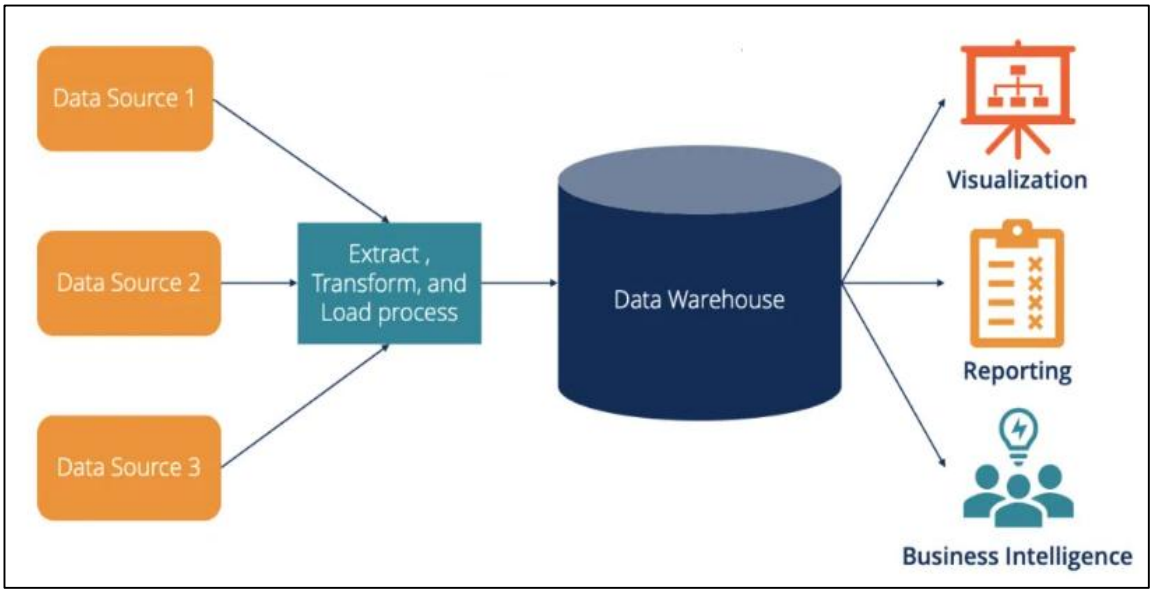
Google difines it A data warehouse, also called an enterprise data warehouse (EDW), as : "an enterprise data platform used for the analysis and reporting of structured and semi-structured data from multiple data sources, such

[1] Rodero, Jos & Toval, Ambrosio & Informticos, Sistemas & Piattini, Mario. (1999). The audit of the Data Warehouse Framework.p 0 1.

as point-of-sale transactions, marketing automation, customer relationship management, and more.[2]"

The same corporation (google) sees that the Data warehouses include an analytical database and critical analytical components and procedures. They support ad hoc analysis and custom reporting, such as data pipelines, queries, and business applications. They can consolidate and integrate massive amounts of current and historical data in one place and are designed to give a long-range view of data over time. These data warehouse capabilities have made data warehousing a primary staple of enterprise analytics that help support informed business decisions.

Fig 01. Data Warehouse System



Source: Corporate finance institute (CFI), at the link: https://corporatefinanceinstitute.com/resources/business-intelligence/data-warehousing/ (30/12/2024- 10:30)

[2] Google cor pat the link : https://cloud.google.com/learn/what-is-a-data-warehouse (30/12/2024-06:00)

Also, a data warehouse is a system used to store data from numerous sources in an organized and regulated manner, in order to enable analysis, reporting and decision-making processes. The data warehouse is characterized as:

- **Centralized:** gathers data from many sources.
- **Unified:** the data is cleansed and converted to be consistent.
- **Historical:** retains historical data that lets to carry out chronological studies.

2. Components of the data warehouse

Effective data retrieval to support business intelligence projects depends on a wellorganized data warehouse or data mart setup. This setting has a thorough infrastructure that guarantees data travels smoothly from source systems to enduser applications, thus permitting accurate, timely, and meaningful decisionmaking. Among the most important features of this setting are the following[3]:

2.1 Source Data System

These are the underpinning systems inside a company for gathering and preserving operational data. Usually, they feature enterprise resource planning (ERP) systems, customer relationship management (CRM) software, transactional databases, and other lineofbusiness applications. Relational database technologies underpin most of these source systems, which supply the main data for the data warehouse. Analytical processing draws data from these operational systems.

2.2 ETL Procedures and Data Integration Technologies

The data integration process is one of the most vital phases of data warehouse construction. Data is pulled from several source systems, transformed to fit the

[3] Rodero, Jos & Toval, Ambrosio & Informticos, Sistemas & Piattini, Mario. Op cit, pp 1-2

chosen data model (i.e., standardized formats, solved conflicts, duplicates removed), and loaded into the data warehouse or personal data marts using ETL technologies and tools. Before the information is made ready for study, this method might encompass sophisticated changes and purifying exercises to guarantee data integrity, completeness, and consistency.

2.3 Data storage architectures

The design of a data mart or data warehouse determines its storage, organization, and access of information. Star schemas, snowflake schemas, and multidimensional cubes are some of the common designs. By means of nimble querying and reporting, these structures let customers to assess information across many dimensions (such as time, geography, or product lines). Depending on company requirements and resources, storage solutions could be onpremise, in the cloud, or hybrid.

2.4 End User Software and Utilities

Different users such analysts, toplevel managers, and business managers can interact with the data by means of many tools laid on top of the warehouse or store. Data visualization platforms, dashboards, reporting software, and selfservice analytical tools make controlling your data much easier. Every one is designed with the technical ability and analytical demands of its targeted customers in mind so that knowledge is available and functional up and down the company.

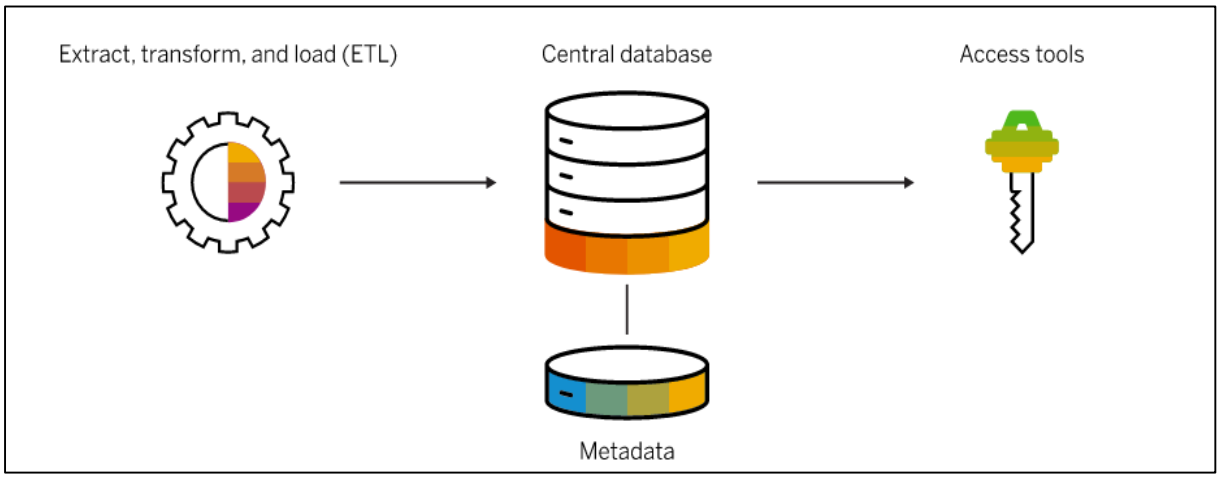
2.5 Metadata, Data Integrity, and Governance Processes

Total Metadata management is a frequently ignored but crucial aspect of the data warehouse environment. Metadata includes information about the data itself—that is, data sources, table and columns definitions, transformation logic, usage statistics, and data refresh schedules. Together with robust data quality controls and governance systems, metadata guarantees openness, traceability, and

data trust. Furthermore defining roles, duties, access rights, and compliance measures, data governance policies protect the integrity and security of company data properties.

Taken together these components create the foundation of a strong data warehouse and mart system that lets companies combine information from several sources; maintains high data quality; and provides constant insights supporting wise business decisions.

Fig 02. Diagram showing the components of a data warehouse



Source: SAP Company, What is a data warehouse? at the link: https://www.sap.com/hk/products/data-cloud/datasphere/what-is-a-data-warehouse.html#:~:text=A%20typical%20data%20warehouse%20has,components%20of%20a%20data%20warehouse. (15/02/2025-11 :50)

3. The relevance of the data warehouse

By acting as a central repository of integrated, subjectoriented, and timevariant data, a data warehouse is instrumental in contemporary business intelligence systems. It is especially meant to help with analytical operations by providing a solid base for strategic decisionmaking. By means of these main dimensions, one can appreciate how important the data warehouse is within a company:

3.1 Strategic DecisionMaking Support

A main aim of a data warehouse is to provide senior executives and decisionmakers with dependable, uniform, and uptodate information. A data warehouse allows comprehensive study and longterm planning by combining data from different functional parts of a company—such as finance, operations, marketing, and human resources. Using thorough and historical information helps executives—better knowledgeable on strategic decisions—for example market enlargement, merchandise development, and investment planning.

3.2 Deliverance of a thorough companywide data view

The data warehouse links information from various sources throughout the organization, but operational systems are typically siloed and restricted to particular functions. This integration helps to provide a consistent and comprehensive view of consumer interactions and corporate performance. Stakeholders can get crossfunctional perspective, reveal unanticipated links, and spot patterns usually hidden in standalone programs.

3.3 Data Quality Enhance by Cleaning and Transformation

Data warehouses use strict ETL (Extract, Transform, Load) processes including deduplication, validation, and normalization in addition to data cleaning. Such methods increase the credibility and quality of the information by removing errors and guarantee conformity with specified standards and formats. Users can therefore rely on the information they are studying, which is vital for valid forecast, compliance, and reporting.

3.4 Allow for chronological study and historical contrast. let nature:

Data warehouses stand out for their ability to keep historical data for many years. Users can run timeseries analyses, track performance trends, and contrast outcomes between several timeframes. Companies can, for example, monitor yearoveryear sales growth, seasonal changes in consumer demand, or the

longterm consequences of strategic policies. For strategic refinement and performance review, such longitudinal perspective are extremely useful.

Part II : Database Administration – DBA

Computer databases are managed by a database administrator (DBA). Capacity planning, installation, configuration, database design, migration, performance monitoring, security, troubleshooting, backup, and data recovery are some of the possible responsibilities[4].

1. Definition of database Administration

"Database Administration is the process of administering and maintaining database systems to assure their availability, security, and efficiency. The database manager (DBA) handles numerous duties including installation, configuration, monitoring, backup, and data recovery" [5]

Also Database Administration is a critical function that involves the use, management, repair, and enhancement of database systems in a business. Experts in the field, known as Database Administrators (DBAs), are responsible for managing and guaranteeing the availability, performance, and security of an organization's databases.[6] .

2. Tasks of the database manager (DBA)

Maintaining and protecting databases is the major goal of database administration, which has grown in importance in the information-driven commercial world of today. Database security, performance optimization, data backup and recovery, database monitoring, troubleshooting, and expansion planning are among the main areas of emphasis. In addition to taking ownership,

[4] US data base administration at the link : https://www.bls.gov/ooh/computer-and-information-technology/database-administrators.htm (12/02/2025)
[5] Wanigasooriya, Sithara. (2024). Database Administration Developments and Research in Contemporary Digital Environments. 10.13140/RG.2.2.25897.81763. p 02
[6] Drimio corp at the link : " https://www.dremio.com " (20/02/2025- 14 :20)

authenticity, and utility into account, databases must follow the C.I.A. principles of confidentiality, integrity, and availability. To guarantee these elements, a variety of instruments and methods are used. Therefore, we can say that the importance of of database Administration lies in[7]:

2.1 Controls for Confidentiality

Hardware blocking, role-based authentication, auditing methods, real-time threat identification systems, encryption both in-flight and at rest, and row-level data masking are some of the tools and procedures used to ensure secrecy.

2.2 Controls for Integrity

Regular restore testing of database backups, check constraints, CASCADE feature utilization, locking protocols, administrator supervision, block/record/table-level integrity tests, and extended logical checks are all part of maintaining integrity.

2.3 Controls of Availability

High availability and disaster recovery solutions, cloud multi-region availability, clustered database instances (active/passive automatic failover), query performance tuning, real-time monitoring solutions, backup solutions, load balancing, and server splitting are some of the ways availability is maintained.

Part III: The link between data warehouse and database Administration

The relationship between the data warehouse and the database Administration lies in their integration to ensure the effectiveness of data systems inside the organization. The data warehouse is generally built on databases to store aggregated data from many sources, where ETL procedures (extract, convert, upload) extract data from operational databases and transform them into a

[7] Wanigasooriya, Sithara. (2024). OP cit. p 03

consistent format before loading them into the data warehouse [8]. Here Comes the role of the database manager (DBA) who ensures that the databases run efficiently, are secure, and are available for day-to-day and analytical activities. While the data warehouse focuses on enabling analytics and reporting, database administration is concerned with data correctness and the performance of operational systems. In other words, the success of a data warehouse depends on robust database administration that offers the required infrastructure for data storage and processing. Based on that we can see the differant use of the two technologies in this points :

- **Purpose :** Data Warehouse Designed for data analytics and business insights by consolidating data from multiple sources & Database: Supports applications by storing and retrieving data quickly with ACID-compliant transactions.
- **Example Use :** Data Warehouse Analyses customer lifetime value across personas & Database Processe e-commerce payments or storing user notes.
- **Data Structure :** Data Warehouse Optimized for read performance, often denormalized and designed for business needs & Database Depends on type (relational/non-relational), generally normalized to speed up transactions.
- **Data Collection :** Data comes from various tools and systems via pipelines or connectors like Fivetran & in Database, Data is collected in real time directly from user inputs or app interactions.

[8] Nur Rachman Dzakiyullah (2018) ; Identify the Different Between Database and Data Warehouse, on line ; https://www.researchgate.net/publication/325760700_Identify_the_Different_Between_Database_and_Data_Warehouse (14/03/2025)

- **Data History :** Data Warehouse Stores historical data, updated on a schedule (can be near real-time) & Database Stores real-time operational data for ongoing processes.
- **Data Volume :** Data Warehouse Handles massive data volumes (GB to PB) due to long-term accumulation & Database Handles smaller, process-specific data for performance efficiency.

Tab.4 : Comparison between Database & Data Warehouse

Comparison	**Data Warehouse**	**Database**
Purpose	Data analyses &data activation	Power activations
Data structure	Data can be structured or not	Depanding on the strcture of the data base
Data collection	Collected from extarnal sources	Collected from users only
History	historical	Real-time
Data storage	Vast amounts of data	Relative to the volume of data in the data werehouse

Source: Highttouch Cor pat the link : https://hightouch.com/blog/data-warehouse-vs-database (30/12/2024 : 13 :30)

Without efficient database administration, data warehouse operations may encounter challenges such as sluggish performance, data loss, or insecurity. Thus, coordination between these two domains is required to assure the availability of accurate and reliable data to assist strategic decision-making in the organization.

The third lecture:

Business analytics and data visualization

(DV & BA)

The third lecture : Business analytics and data visualization (DV & BA)

corporate analytics is a rapidly growing field in today's corporate environment. It enables firms to have a better knowledge of their performance and base strategic decisions on data. In this course, we will go over the key concepts of business analytics and how to extract value from data.

Part I. The Concept of Business Analytics

Business analytics makes extensive use of analytical modeling and numerical analysis, including explanatory and predictive modeling,[2] and fact-based management to drive decision making. It is therefore closely related to management science. Analytics may be used as input for human decisions or may drive fully automated decisions. Business intelligence is querying, reporting, online analytical processing (OLAP), and "alerts"

1. Definition of business analytics

Business analytics implies using data and analytics to understand and enhance an organization's performance. It can also be referred to as a specialist discipline that depends on information technology and statistics to translate data into explanatory and analytical tools, helping executives in organizations to make educated decisions

Tableau Corp difined it as: ‘*technologies, and practices for iterative exploration and investigation of past business performance to gain insight and drive business planning. Business analytics focuses on developing new insights and understanding of business performance based on data and statistical methods. In contrast, business intelligence traditionally focuses on using a consistent set metrics to both measure past performance and guide business*

planning. In other words, business intelligence focusses on description, while business analytics focusses on prediction and prescription'[1]

Business analysis is a methodological approach that focuses on data analysis to analyze patterns and trends, and uses statistical models and analytical procedures to turn these facts into useable ideas for making managerial decisions[2]

2. **Business analytics is crucial for increasing organizational performance and making strategic decisions.**

The followings are few points that emphasize the relevance of business analytics[3]:

- Improve decision-making: Managers and decision-makers may make better choices and get better outcomes by using business analysis to gain a deeper understanding of the present state of affairs and emerging trends.
- Improved consumer comprehension: Businesses may enhance customer happiness and loyalty by using business analytics to better understand customer behavior and wants.
- Increase operational efficiency: Costs may be decreased and operational process efficiency raised through process and performance analysis.
- Enhance strategic performance: By employing insights to pinpoint upcoming opportunities and obstacles, business analysis of organizations may enhance their strategic performance.
- Adapt to quick changes: Businesses may better adjust to variables by using business analysis to enable quick responses to changes in the business environment.

[1] Tableau Cor pat the link : https://www.tableau.com/analytics/business-analytics-vs-data-analytics (07/01/2025- 11:00)
[2] Abbasi, A., Sarker, S., & Chiang, R. H. L. (2016). Big data research in information systems: Toward an inclusive research agenda. *Journal of the Association for Information Systems*, 17(2), p 43
[3] Y. Jiarui, F. Vicenc (2020) Journal of Industrial Engineering and Management, A systematic review on business analytics, 13(02), p 284.

- Understand market trends: business analysis may assess market trends and understand competition, enabling organizations to take proactive action.
- Improved risk management: business analysis adds to the analysis and estimate of possible hazards, enabling firms to take steps to mitigate risks.
- Promote innovation: business analysis helps to inspire and promote innovation by understanding the demands, expectations and changes in the market.

3. Types of business analytics

There are many types of BA such as predictive analysis, Real-time analytics & many others types and we wil focuce on the tow types mentioned before.

3.1 predictive analysis

The use of data to forecast future trends includes the application of Statistics and mathematics to analyze the connections between variables and build rules and models. Various approaches are utilized[4], such as machine learning techniques, which are used to evaluate data and continually construct reliable prediction models, especially in light of the rapid advancement of machine learning technology. We also discover regression analysis and temporal analysis . They are advanced approaches that may be used to study the connections between variables and forecast occurrences in time. Challenges may occur owing to uncertainty about the future and the effect of unanticipated circumstances. Such as data quality where prediction analysis is a difficulty when the data quality is poor or when there are gaps in the data

3.2 Real-time analytics

Real-time analytics describes the process of applying data and analysis tools to analyze events and patterns in real time. Real-time analytics systems are

[4] Abbasi, A., Sarker, S., & Chiang, R. H. L., Op cit, p45.

utilized in numerous industries such as digital marketing, where real-time analytics allows marketers to analyze the effectiveness of their campaigns and alter them depending on instant engagement. Ecommerce shops also benefit from real-time analysis to manage inventories and identify consumer behavior.

3. Business Analytics in practice

To undertake business analytics, a series of phases must be accomplished, namely:

3.1 Data collection

Data might be organized like databases, or unstructured like text and photos. Sources include sales data, customer records, surveys, Internet of Things (IoT) devices, social media, and market studies.

3.2 Data purification

Processing missing values by techniques such as statistical estimate or elimination. Remove aberrant values and inconsistent data. Converting data into a format suited for modeling, such as digital coding of text categories.

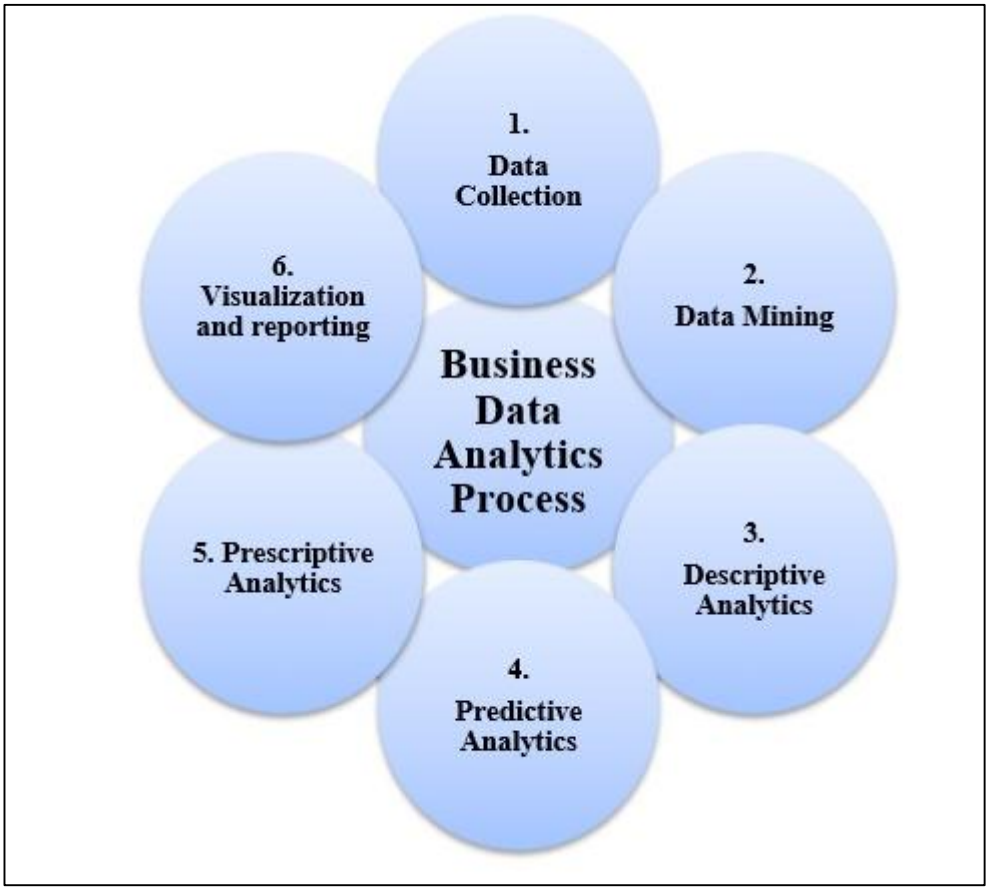
3.3 Modeling

it’s including statistical analysis techniques such as regression, time series analysis. Using artificial intelligence and machine learning approaches to construct prediction models. Evaluate models and pick the best one based on performance parameters such as accuracy and coverage.

3.4 Interpretation and decision-making

Provide insights via dashboards and interactive reports. Correlate outcomes with corporate strategies to make educated judgments. Evaluate the impact of suggestions and update models based on fresh data.

Fig. 03: Process of Business Data Analytic



Source: Tutorialpoints Corp at the link: https://www.tutorialspoint.com/business-analytics/index.htm (02/02/202/- 22:00) **.**

Based on the figure abouve we can Remarque that Business Data Analytic Process includes[5]:

a. **Data collection**: Data collection: Business data is collected from organisations' internal departments and external boundaries like IoT devices, apps, spreadsheets, or social media. The collected data is pooled and centralized for access and processing as and when required.

[5] Tutorialpoints Corp

b. **Data mining** : Collected data stored in Data Lake and then processed using advanced tools and techniques like Machine learning algorithms, data visualisation techniques, statistical methods etc.

c. **Descriptive analytics** : Descriptive analytics answers like what is happening and why is it happening. Its analytical results give a better understanding of the story behind the data.

d. **Predictive analytics** : Predictive analytics predicts the future like what can be in future. Its analytical results include forecasting. Predictive analytics supports making future decisions regarding business and organizational choices.

e. **Prescriptive Analytics** : Recommending actions based on data analysis.

f. **Visualization and reporting** : Visualization and reporting present data visually in an attractive manner. It includes a graphical form of data using reports and dashboards.

Part II. Data Visualization

Data visualization can be utilized for a variety of purposes, and it`s indéfini to compte that is not only reserved for use by data teams. Management also leverages it to convey organizational forme and hierarchy while data analysts and data scientists use it to discover and explain patterns **and trends.**

1. Definition of visualization

Data representation may be described as the translation of data into a form that can be used visually utilizing graphs to ease understanding make the data legible, beautiful, and usable.

IBM difines DV as: *‘The representation of data through use of common graphics, such as charts, plots, infographics and even animations. These*

visual displays of information communicate complex data relationships and data-driven insights in a way that is easy to understand.[6]*'*

2. The relevance of data visualization

The Importance Data visualization is not merely a visual depiction of information, it is a powerful tool for successfully comprehending and analyzing data. The followings are the most essential reasons why data visualization is vital in numerous domains, notably in business analytics[7]:

- Improve knowledge and assimilation: it helps reduce difficult information and put it into visual forms that are easier to learn quickly and makes patterns and trends more obvious through graphical representation instead of abstract numbers
- Decision support: enables decision makers to comprehend current performance and estimate the future based on visual patterns and helps to discover problems or opportunities more rapidly through data visualization
- Pattern recognition and connections: data visualization can uncover correlations and linkages between distinct variables. It also illustrates seasonal trends, volatility, and variables impacting the data.

2. Data visualization tools

These are a few of the well-known tools utilized in the subject of business analytics. There are other tools available for business analysis, and they differ from one another in terms of their features and capabilities.

2.1 Tableau

[6] IBM Cor pat the link : https://www.ibm.com/think/topics/data-visualization#:~:text=Data%20visualization%20is%20the%20representation,that%20is%20easy%20to%20understand. (03/01/2025- 11 : 30)
[7] Y. Jiarui, F. Vicenc, Op cit, p 289.

One of the greatest tools for business analysis and data visualization is Tableau. Users may generate interactive reports and dashboards using its user-friendly design.

2.2 Microsoft Power BI

This program provides sophisticated tools for data analysis and visualization. Custom reports may be made by users and shared efficiently.

2.3 Google Analytics

analyzes website data using Google Analytics. It monitors user activity and offers information on site visits and traffic sources.

2.4 IBM Cognos Analytics

This comprehensive data analysis and reporting solution offers businesses sophisticated insights.

2.5 QlikView

QlikView provides special tools for interactive report creation and dynamic data exploration.

3. Types of data visualizations

The earliest form of data visualization can be traced back the Egyptians in the pre-17th century, largely used to assist in navigation. As time progressed, people leveraged data visualizations for broader applications, such as in economic, social, health disciplines. Perhaps most notably, Edward Tufte published The Visual Display of Quantitative Information, which illustrated that individuals could utilize data visualization to present data in a more épais manner. His book continues to emplacement the modèle of time, especially as companies turn to dashboards to délai their record metrics in real-time. Dashboards are épais data visualization tools for tracking and visualizing data from populeux data sources, providing visibility into the effects of specific behaviors by a team or an

attenant one on record. Dashboards include common visualization techniques, such as[8]:

- Tables: This consists of rows and columns used to compare variables. Tables can spectacle a great deal of inédite in a structured way, but they can also overwhelm users that are simply looking for high-level trends.
- Pie charts and stacked bar charts: These graphs are divided into sections that represent parts of a whole. They provide a chancelant way to organize data and compare the size of each component to one other.
- Line charts and area charts: These visuals spectacle formule in one or more quantities by plotting a series of data points over time and are frequently used within predictive analytics. Line graphs utilize lines to demonstrate these changes while area charts connect data points with line segments, stacking variables on top of one another and using color to distinguish between variables.
- Histograms: This graph plots a uniformisation of numbers using a bar chart (with no spaces between the bars), representing the quantity of data that falls within a particular range. This visual makes it easy for an end errer to identify outliers within a given dataset.
- Scatter plots: These visuals are beneficial in reveling the relationship between two variables, and they are commonly used within regression data analysis. However, these can sometimes be confused with bubble charts, which are used to visualize three variables via the x-axis, the y-axis, and the size of the bubble.

[8] IBM Cor pat the link : https://www.ibm.com/think/topics/data-visualization#:~:text=Data%20visualization%20is%20the%20representation,that%20is%20easy%20to%20understand. (03/01/2025- 11 : 30)

- Heat maps: These graphical representation displays are helpful in visualizing behavioral data by engagement. This can be a engagement on a map, or even a webpage.

Tree maps, which display hierarchical data as a set of nested shapes, typically rectangles. Treemaps are great for comparing the proportions between categories via their area size.

The fourth lecture :

Geographic Information System (GIS)

The fourth lesson : Geographic Information System (GIS)

Geographic and descriptive information collecting, inputting, processing, analyzing, presenting, and outputting for particular uses is the science of This definition comprises the capacity of systems to enter geographic information (maps, aerial images, space visuals) and descriptive (names, tables), process (error-corrected), store, retrieve, query, analyze (spatial and statistical analysis), and display on a computer screen or on paper in the form of maps, reports, and graphs.

1. Geographic Information System definition

A geographic information system (GIS) is a technology tool enabling spatial or geographical data analysis. To grasp the spatial interactions between several elements on the surface of Earth, GIS depends on the integration of spatial data from several sources, such maps, aerial and satellite photos, Applications for GIS abound and include public administration, environmental science, natural resource management, and urban planning[1].

Geographic information systems (GIS) are a method of technological analysis, storage, and display for spatial or spatial data. The primary notion of GIS is the ability to grasp the spatial relationships between things and assess the processes and fluctuations that occur on the Earth's surface using geographical data. This data is examined using tools and software meant for this use; it comprises maps, aerial photos and other geographical information. The usage of GIS includes prominent placement, city planning, natural resource management, environmental analysis, and many more applications that benefit from geographic knowledge of data.

2. Historical overview of the Geographic Information System (GIS)

[1] P. Burrough, R.A Mc Donnell, (2015), Geographic Information System, 3rd edd, Oxford university,p 03.

With a brief historical study, we find that GIS was created in Canada in 1964 by Roger Tomlinson, frequently called the father of GIs. Over the seventies, the number of companies specializing in GIS software expanded. the Eighties experienced a surge in the cash provided to government agencies and private companies for GIS, as well as an increase in the number of professionals and a fall in the prices of computers and software. The nineties witnessed an improvement in software and the possibility of one application to do work that in the past needed more than one program. With the development of computers throughout the third century, the use of multimedia and the internet began, and the future period will witness a revolution in the use of mobile maps, thanks to the marked improvement in hand-held computers (Palm PC, internet, and wireless connection(WAP).

3. The importance of geographic information systems

The ability of GIS to search databases and perform geographic queries has saved many companies literally millions of dollars. GISs have helped with the the following tasks[2]:

3.1 Improve Organizational Integration :

Many organizations that have implemented a GIS have found that one of its main benefits is improved management of their own organization and resources. Because GISs have the ability to link data sets together by geography, they facilitate interdepartmental information sharing and communication. By creating a shared database one department can benefit from the work of another--data can be collected once and used many times. As communication increases among individuals and departments, redundancy is reduced, productivity is enhanced, and overall organizational efficiency is improved. Thus, in a utility company the customer and infrastructure databases can be integrated so that when

[2].high poin city municipale, USA, at the link : https://www.highpointnc.gov/Search?searchPhrase=GIS&pageNumber=1&perPage=10&departmentId=-1 (05/01/2025- 20 :00)

there is planned maintenance, affected customers can be sent a computer-generated letter.

3.2 Cost reduction

Analyzing the two benefits described above, we see that they are targeted at reducing the cost, and according to economic theories, time is money, and cutting production and labor time represents a financial gain. Here it should be highlighted that the initial cost of building GIS may be considerable, but the return will be significant, and sometimes the return may not be direct material in money terms, but it may be in the form of Human Resources Development and qualification. Information management also helps to boost efficiency and increase the cost-benefit ratio.

3.3 Make Better Decisions

The old adage "better information leads to better decisions" is as true for GIS as it is for other information systems. A GIS, however, is not an automated decision making system but a tool to query, analyze, and map data in support of the decision making process. GIS technology has been used to assist in tasks such as presenting information at planning inquiries, helping resolve territorial disputes, and siting pylons in such a way as to minimize visual intrusion. GIS can be used to help reach a decision about the location of a new housing addition that has minimal environmental impact, is located in a low risk area, and is close to a population center. The information can be presented succinctly and clearly in the form of a map and accompanying report, allowing decision makers to focus on the real issues rather than trying to understand the data. Because GIS products can be produced quickly, multiple scenarios can be evaluated efficiently and effectively.

3.4 Make Maps Maps

have a special place in GIS. The process of making maps with GIS is much more flexible than are traditional manual or automated cartography approaches. It begins with database creation. Existing paper maps can be digitized and

computer-compatible information can be translated into the GIS. The GIS-based cartographic database can be both continuous and scale free. Map products can then be created centered on any location, at any scale, and showing selected information symbolized effectively to highlight specific characteristics.

4. Components of geographic information systems

Information about the world is stored in a GIS as a set of thematic layers that are connected by geography. This straightforward but incredibly effective and adaptable idea has been crucial in resolving a wide range of practical issues, such as tracking delivery trucks, documenting planning application details, and simulating the global atmospheric circulation.

4.1 Geodata

Geodata is a sort of data relating to geographical locations or places on the Earth's surface. This data includes a variety of information that can be represented by geographical coordinates or by digital maps. The following are some examples of geographical indications[3]:

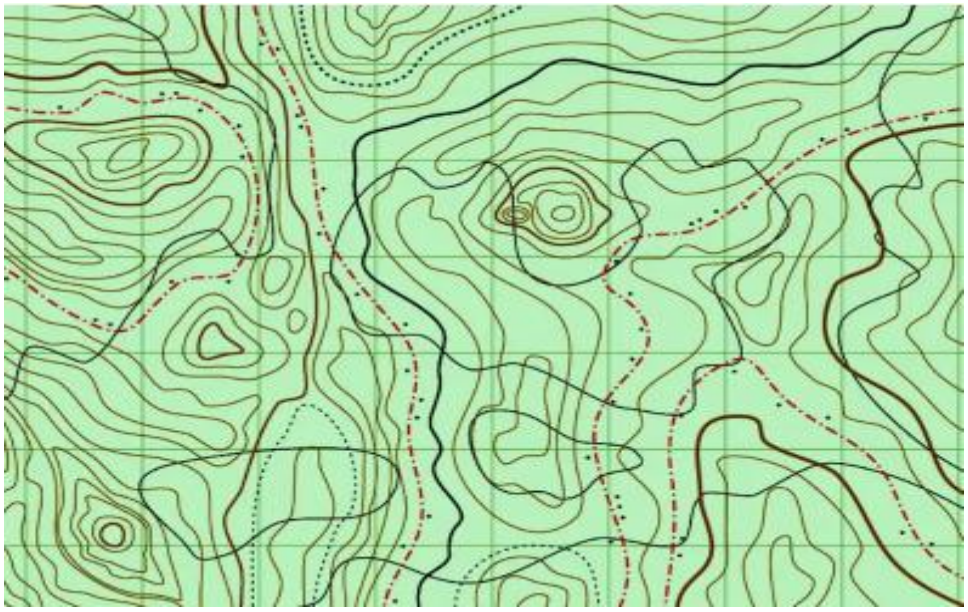
- digital maps places and landmarks on the Earth's surface are represented by geographical coordinates, maps can include information such as administrative borders, roads, rivers.

[3] Burrough, R.A Mc Donnell, p 04

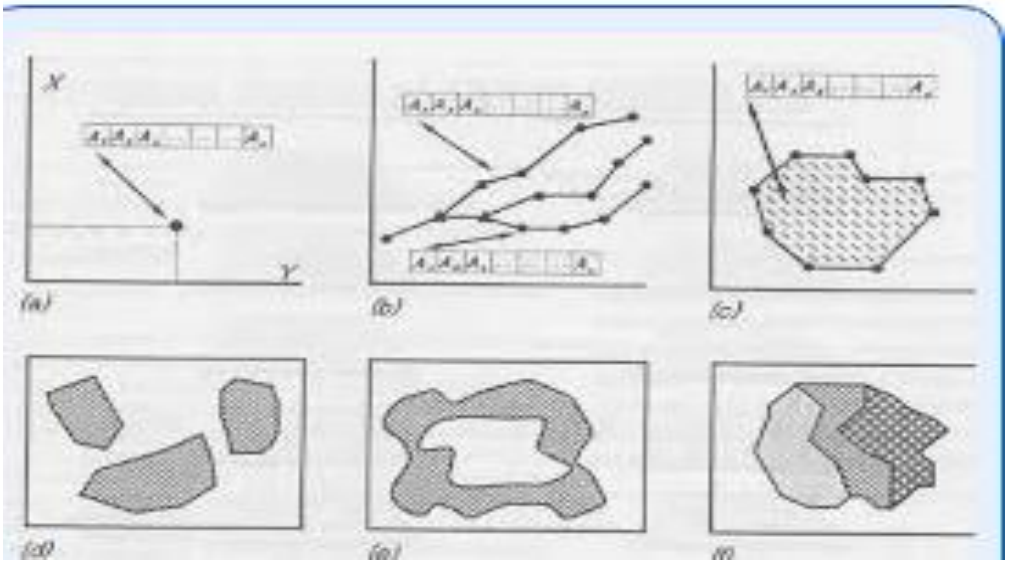
- Aerial photographs from airplanes or satellites, aerial pictures of geographical regions are given.

- Satellite imagery, In essence consists of pictures of Earth taken by imaging satellites, which are run by governments and corporations worldwide, and which are then made available through satellite imaging services and firms.

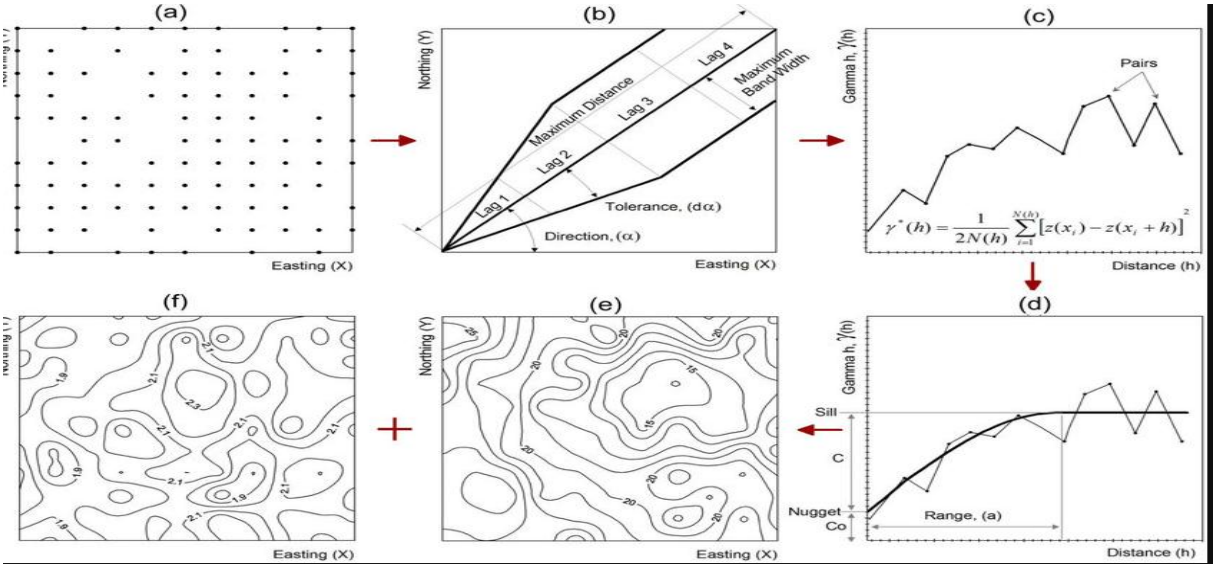
- Topographic data comprises information about the land and topography, such as heights, slope and slopes.



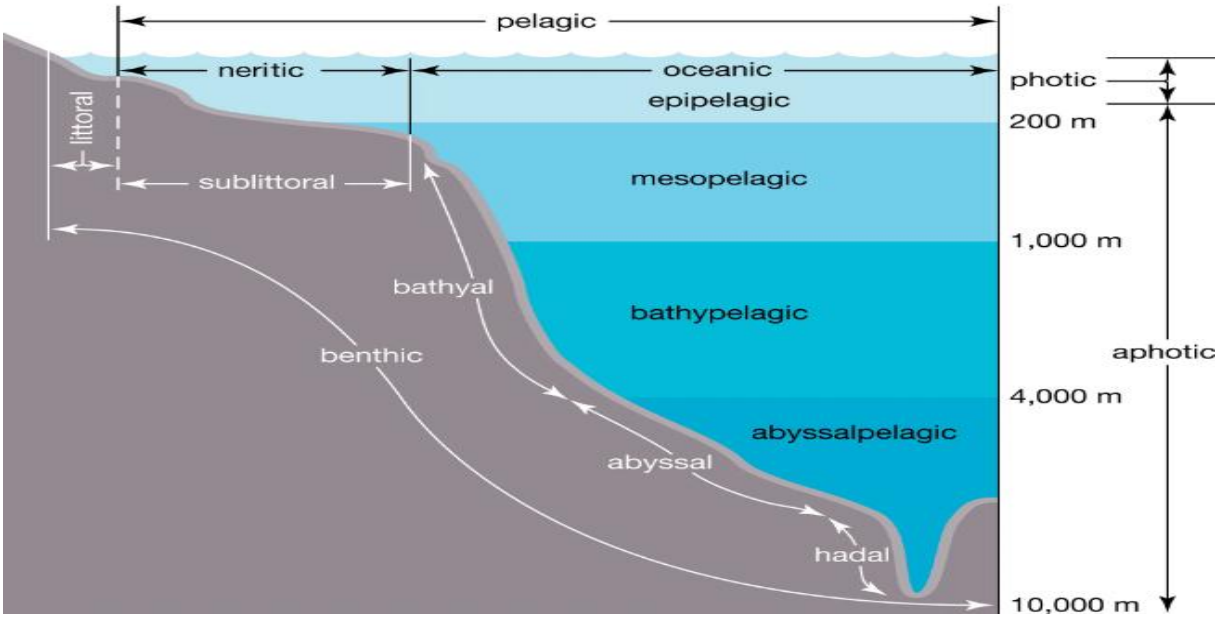
- Geographical points express precise locations by coordinates, such as the locations of cities or areas of interest.



- Geostatistical data comprises statistics that relate to people, the economy and the environment in a geographical context.



- Marine and oceanographic information linked to the oceans and seas and contains data regarding tides and sea currents.



Geodata is a strong tool for analysis and interpretation, as it may be used in various sectors such as urban planning, Natural Resource Management, Environmental Science, Scientific Exploration, and many more.

4.2 Software

Geographic information systems offer a wide range of software and tools for examining and modifying geographic data (GIS). The following are a few well-known and often utilized tools and software[4]:

4.2.2 ArcGIS software

QGIS is an open-source, free geographic information system (GIS) program. QGIS is compatible with Linux, macOS, and Windows. Viewing, editing, printing, and analyzing geographic data in various data formats are all supported. Its name is an acronym for Quantum GIS, which was its prior moniker.

As a geographic information system (GIS) program, QGIS enables users to create and export graphical maps as well as analyze and modify geographical data. Raster, vector, mesh, and point cloud layers are all supported by QGIS. Vector data is saved as features that are either points, lines, or polygons. The program can georeference images and supports a variety of raster image formats.

Shapefiles, DXF, MapInfo, PostGIS, personal geodatabases, and other industry-standard formats are all supported by QGIS. Web services, such as Web Feature and Web Map Services.

4.2.2 The QGIS program

QGIS (Quantum Geographic Information System) is a free, open-source software that allows users to create, edit, visualize, analyze, and publish geospatial information.

There are many benefits to using QGIS. First, the software offers many free online resources and maps available to download. QGIS also accepts many vector file formats. Finally, there are a variety of plug-ins for potential use, and there are

[4] Burrough, R.A Mc Donnell, Op cit, PP 12-25

always new plug-ins being created. Plug-ins are extra applications that can be downloaded to complete a specific task that is not easily accomplished otherwise.

This tutorial provides an introduction on how to download and operate QGIS. Even if you have little to no QGIS experience, you can learn to create basic maps and perform simple spatial analysis from several types of data inputs.

4.2.3. Google Earth Engine

Google Earth Engine combines a multi-petabyte catalog of satellite imagery and geospatial datasets with planetary-scale analysis capabilities. Scientists, researchers, and developers use Earth Engine to detect changes, map trends, and quantify differences on the Earth's surface. Earth Engine is now available for commercial use, and remains free for academic and research use.

Google Earth offers search functions along with the capability to pan, zoom, rotate, and tilt the Earth's view. It also provides tools for generating new data layers. Nonetheless, it isn't a Geographic Information System (GIS) with the comprehensive analytical features of ArcGIS or MapInfo, but it is considerably simpler to operate than those software solutions. Other applications of Google Earth consist of:

- Earth Studio - a tool for animation utilizing Google Earth's satellite and 3D imagery.
- Earth Engine - integrates a multi-petabyte collection of satellite images and geospatial data with large-scale analytical tools, offering scientists, researchers, and developers the ability to identify changes, map trends, and measure variations on the Earth's surface.
- Earth VR - Discover the planet from entirely fresh viewpoints. Wander through the avenues of Tokyo, glide above Yosemite, or instantaneously cross the planet.

5. Geographic data base (GDB)

A GDB is a well-structured database that holds geographic data in a manner that is favorable to finding and querying. Databases provide a tool for the effective storing and processing of geographical data. In a word, geodatabases may be regarded as specialized systems that store and handle spatial and geographic data effectively. Their operations integrated typical database characteristics with ability to undertake geographical information analysis. These databases can include coordinate systems for points, lines, and polygons, digital maps, aerial images, and demographic information connected to specified geographical regions. They allow for advanced spatial queries, such as determining certain relationship types between features, like intersection, proximity, or coverage, and computation of distance or areas, making for application development such as GIS, navigation, urban planning, and environmental resource management. They rely on technologies including Coordinate Reference Systems and unique indexing algorithms to boost performance, such as R-tree, and their use is found in government, agriculture, emergency services, and logistics.

6. The relationship between business management and geographic information systems (GIS)

The use of GIS in these activities requires logical problem analysis and breaking them down into spatial segments, which represent layers in GIS applications. This procedure requires skilled specialists who understand issues and their logical sequences, in addition to proficient GIS presentation experts, and if necessary, web environment specialists. GIS allows for the visualization of broken-down layers and their intersections, providing an excellent foundation for tracking data impacts, noticing key interrelations, and making decisions regarding problem-solving. Even when issues are resolved, additional data are incorporated

into the layers, and fresh effects can once again be visualized and examined. This allows prompt responses and tracking of data changes over time[5].

The area that is excluded from the application of GIS is business process management (BPM). Specifically, BPM is a management approach that aligns a company's strategies and objectives with the expectations and requirements of customers, concentrating on an "end to end" process. BPM encompasses policies, objectives, culture, structure, and IT to assess, design, execute, continuously enhance, and establish effective governance within the company's "end to end" processes. GIS is often undervalued as an ICT tool for illustrating current business processes along with their bottlenecks and key milestones. GIS has the potential to improve the decision-making process for a company's management. GIS can be efficiently utilized as an ICT tool in[6]:

- Gatherings intended to yield prompt decisions
- Concise delivery of various business situations to the management
- Persuading the management regarding the suggested solution
- Presentation of the situation to employees.
- Advise employees to be aware of various potential future scenarios.
- Demonstrating which solutions from the past were effective or ineffective

[5] Benedickt, T., Bilodeau, N., Vitkus, P., Powell, E. (2013). BPM CBOK Version 3.0: Guide to the Business Process Management Common Body Of Knowledge, ABPMB, ISBN-13: 978-1490516592, p 48.
[6] Burger, A. (2006). GIS, Part 3: Making the Most of Your Enterprise Data", *E commerce Times*. http://www.ecommercetimes.com/story/53544.html (20/01/2025-09:00)

The fifth lecture:

Data Mining

The fifth lecture: Data Mining

Data mining is the process of collecting effective and valuable information from massive data collections. Data Mining seeks to identify patterns and correlations in data that are difficult to spot by conventional approaches. In this session, we will examine the core ideas and typical procedures in the data mining process.

1. Definition of data mining

Data mining involves the extraction of valuable information from large datasets. By utilizing data mining techniques, organizations can uncover concealed patterns, connections, and trends within data that they can leverage to address business challenges, forecast outcomes, and enhance their profitability or productivity **.** So we can define it as:

"Data mining is the process of extracting useful information from data and using it to make decisions. The data mining process can be divided into three parts: data, analysis, and decision making. The information obtained in the decision-making process represents the main source of decisions"[1].

In addition, «DM" is a field of Computer Science, Statistics and data analysis that focuses on extracting valuable and usable knowledge and patterns from vast and complicated data sets. Data mining is the use of a collection of techniques and tools to explore and analyze data with the objective of identifying the laws, correlations and patterns hidden in it. The key objective is to obtain access to useful knowledge and generate predictions based on existing data [2]."

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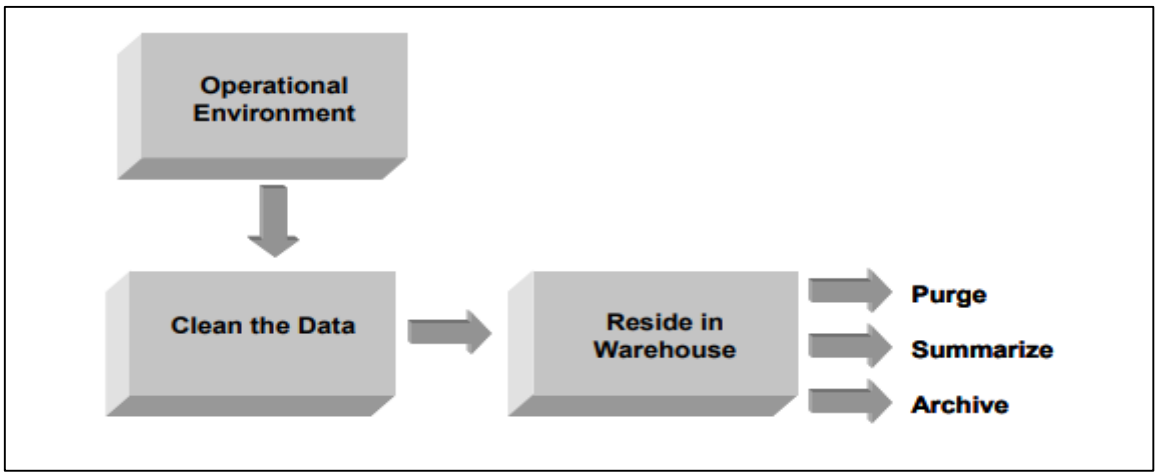
[1] *Mandan, N.; Agrawal, K.; Kumar, S. Analyzing Different Domains using Data Mining Techniques. In Proceedings of the 2020 International Conference on Computer Communication and Informatics (ICCCI), Coimbatore, India, 22–24 January 2022;*

[2] *Jiawei Han (2006), Data Mining: Concepts and Techniques, Chapter 5, University of Illinois at Urbana-Champaign on line: https://liacs.leidenuniv.nl/~bakkerem2/dbdm2007/05_dbdm2007_Data%20Mining.pdf*

2. data mining & data warehouse

The creation of a data warehouse, encompassing data cleansing and data assimilation, can be considered a crucial pre-processing phase for data mining. Nonetheless, a data repository is not necessary for data mining. Creating a vast data repository that integrates information from several sources, addresses data integrity issues, and uploads the data into a database, can be an vast undertaking, occasionally requiring years and expending millions of dollars.[3] If a data warehouse isn't accessible, the information to be analyzed can be obtained from one or more operational or transactional data stores, or data marts. Alternatively, the database for data mining might represent a logical or physical subset of a data warehouse. Data mining utilizes the data warehouse as its source for knowledge data discovery (KDD) systems by combining artificial intelligence with statistics-related elements Methods for identifying associations, sequences, classifications, clusters, and predictions demonstrate this procedure. Nearly all data comes into the warehouse from the operational surroundings.

Fig 03. Data flow system



Source: Joyce Jackson, Op cit, p 289.

[3] Joyce Jackson (2008), Data Mining; A Conceptual Overview, Communications of the Association for Information Systems, vol 8, p 288

3. Sources (mines) of data

The process of data mining requires access to relevant data sources to meet the defined aims. There are several data sources that may be mined, and these sources differ based on the type of data and the sector. And we will see two common sources as following:

3.1 Primary Sources

They are instantaneous, first-person reports of a subject from those who were directly involved with it. Law texts and other original documents are examples of primary sources. newspaper articles written by reporters who were there at the event or who cited witnesses. Interviews, letters, journals, and speeches—what the participants wrote or said. original investigation. datasets and survey information, including economic or census data. Audio, video, or pictures that document an event

3.2 Secondary Sources

Although they frequently quote or use primary sources in different ways, these sources are one step removed from primary sources. They can discuss the same subject while incorporating additional interpretation and analysis. The majority of books on a subject are examples of secondary sources. data interpretation or analysis. publications by academics or others on a subject, particularly those who are not personally involved. documentaries, even though they frequently contain images or video clips that qualify as primary materials.

4. The most essential technology utilized in prospecting Data mining

Data mining techniques comprise a wide range of approaches and tools that are used to discover patterns and relevant information from massive data collections. Here are some major approaches in data mining[4]:

4.1Machine Learning methods

[4] *Jiawei Han, Op cit.*

Machine learning is one of the most significant technologies in data mining. It comprises data categorization, Predictive Analysis, Regression Analysis. Algorithms are used to understand patterns and anticipate future behaviors. Machine learning technologies are a key aspect of sophisticated data analysis, since they rely on the use of algorithms and models to enable systems to learn from data and make choices without direct human interaction. Machine learning technologies are built on applying algorithms to data for analysis, and then improving the performance of models over time. Machine learning approaches may be split into two primary types : supervisory learning and non-supervisory learning.

- **Supervised learning:** In this mode, the model is trained using a collection of data that comprises expected input and output pairings. The objective is to learn the model to anticipate the proper result when fresh inputs are supplied. Examples of supervised learning approaches include linear regression and neural networks.
- **Unsupervised learning:** In this mode, the predicted output of the model is not supplied during training. The model examines data to find patterns and structures without particular instruction. Examples of non-supervisory learning approaches include clustering algorithms such as K-Means and primary fact.

4.2 Advanced Analytics

One crucial step in leveraging data to extract value and profound insight is advanced data analysis. This method entails looking at and analyzing big, complicated data sets using sophisticated methods and cutting-edge equipment. Utilizing deep statistical analysis, pattern analysis, predictive modeling, machine learning, and artificial intelligence approaches are all part of advanced data analysis. Understanding the intricate correlations between variables,

spotting emerging trends, and directing strategic decision-making are all made feasible by these techniques.

4.3 Analysis of Networks

Understanding the connections and interactions between the components in a system is the goal of the exploratory method known as network analysis. The goal of the linkages and communication between the network's nodes (entities) are the subjects of this kind of study. Examining nodes and concentrating on their attributes, such as proximity, centrality of the medium, and degrees of connection, is part of network analysis. It also covers the examination of linkages between nodes, including the weight, direction, and strength of the links. To comprehend internal interactions, the network may be divided into internally related groups using methods like community analysis. Using Dynamic Forces analysis tools, network analysis is also utilized to comprehend how relationships evolve over time. In a number of disciplines, including marketing, computer science, biology, and sociology, network analysis demonstrates the potential for comprehending effects and structures.

5. Data mining steps

Data mining is the process of uncovering hidden knowledge and patterns from enormous volumes of data. This procedure contains numerous phases to assure the accuracy and efficacy of the outcomes[5].

a. **aim setting:** Before commencing the prospecting process, you should establish the desired aim of it, such as discovering trends or improving predictions.
b. **Data collection:** Compilation of a vast range of accessible and target-related data.

[5] *Jiawei Han, Op cit.*

c. **Preliminary cleaning and analysis:** Analyze the data to comprehend it and clear it of any missing values or distortions.
d. **Selection and implementation of prospecting techniques:** Use relevant mining techniques like as statistical inference and machine learning to extract patterns.
e. Interpretation and evaluation: Interpret the results, evaluate them in relation to the original purpose, check the validity of the conclusions.
f. Usage and application: Use findings to make strategic decisions or enhance procedures in the organization.

6. The relevance of data mining in business

Data mining provides benefits across various sectors and can serve as a means to boost profits by cutting expenses and/or increasing income. Several of the usual methods in which those objectives can be achieved through data mining are[6]:

- Reducing expenses in the early stages of the product life cycle during development and advancement.
- Establishing the appropriate limits for statistical process control techniques in automated production methods;
- Removing costly mailings to clients who are unlikely to react to a proposal while a promotional campaign;
- Enabling personalized marketing and large-scale customization possibilities for customers management of relationships.

Numerous organizations utilize data mining to assist in overseeing all stages of the customer life cycle, encompassing gaining new clients, boosting income from current clients, and maintaining valuable clients. Through the identification of the traits of quality customers (profiling), a business can identify potential clients with comparable traits. By analyzing customers who

[6] *Joyce Jackson, Op cit, p 300.*

purchased a specific A company can direct its focus towards similar clients who have yet to purchase that product (cross-selling). Profiling also allows a company to take measures to keep customers who are likely to depart.

The Sixth lecture:

Business Performance Management (BPM)

The Sixth Lecture: Business Performance Management (BPM)

Through the utilization of tools such as business performance management solutions, BPM delivers essential insights to guarantee that your organization is heading in the correct direction, highlighting your business's strengths, opportunities for improvement, and possible challenges.

This lesson provides everything essential about BPM to assist you in applying the framework within your organization. Continue reading to discover the significance of BPM, its essential elements, effective strategies, and tips for addressing common obstacles.

1. Definition of Business Performance Management

A total systematic approach, business Performance Management (BPM) emphasizes the analysis, preparation, execution, and control of company processes across an enterprise. Through process integration and improved coordination among several departments and organizational divisions, BPM aims for constant improvement in efficiency and effectiveness. This is done using modern technology including graphical analysis process control systems, and cloud technology using software systems[1].

BPM is strongly tied to performance measurement, strategic planning, and data analytics. It lets firms to link their operations with strategic goals, providing improved performance evaluation, monitoring, and reporting. With improvements in digital technologies, BPM today includes Artificial Intelligence (AI), Machine Learning (ML), and cloud computing to boost automation and predictive analysis.

2. Business Performance Management's Importance

[1] Frolick, M. N., & Ariyachandra, T. R. (2006). Business Performance Management: One Truth. *Information Systems Management*, *23*(1), p 43.

BPM helps companies simplify their operations by deleting duplicates and improving workflow efficiency. Finding inefficiencies and rearranging activities lets BPM lower resource waste and improve performance. For example, supply chain management automation accelerates order processing and greatly reduces human errors. And we can see also[2]:

2.1 Reaching Excellence in the Organization

Fostering a culture of constant improvement, BPM helps the company to reach excellence. Companies that effectively implement BPM experience better operational consistency, reliability, and quality. Toyota, for example, is famous for its Lean Management approach, a BPM style which emphasizes enhancing efficiency and reducing waste.

2.2 Utilizing Contemporary Technologies

Cutting-edge technology like artificial intelligence (AI) are used by modern BPM systems for automated decision-making and predictive analytics.

- Graphical analytics for performance monitoring and real-time dashboards.
- Cloud computing to provide scalability and remote access in corporate processes.

2.3 Improving Reactivity to Customers

By speeding up reaction times and improving service delivery, BPM helps businesses provide better customer service. BPM, for instance, is used by e-commerce businesses to monitor client interactions and automate answers, guaranteeing quicker and more individualized service.

3. Phases of the Ideal Management of Business Performance

[2] Ariyachandra, T. R., & Frolick, M. N. (2008). Critical Success Factors in Business Performance Management—Striving for Success. *Information Systems Management*, *25*(2), 113

The identification of critical business processes is the first step in the multi-stage process of business performance management. Analysis, process design, execution, and monitoring follow[3].

3.1 Process Analysis

The first step in BPM is understanding and evaluating current processes. This involves:

- Mapping current workflows to identify bottlenecks.
- Collecting performance statistics to analyze the effectiveness of each procedure.
- Identifying critical areas for improvement.

For instance, a retail organization may assess its inventory management process and determine that delays in restocking effect consumer happiness. BPM would then recommend solutions such as real-time inventory tracking.

3.2 Process Design

Once inefficiencies are found, businesses seek to restructure procedures to boost performance. A frequently example is banks shifts in their customer onboarding process by transitioning from paper-based paperwork to digital verification, cutting onboarding time dramatically.

Companies try to overhaul policies to improve performance when they discover inefficiencies. Major goals for now are simplification of operations to eliminate superfluous complexity and processes by :

- Improving departmenttodepartment cooperation in order to foster efficiency and communication.
- Using technology to free up human power and streamline monotonous activities.

[3] Marr, B. (2004) Business performance management - the state of the art. Hyperion Solutions; Cranfield School of Management, p 52.

- Defining Key Performance Indicators (KPIs) to keep success in check.

One common case is banks' migration from paperbased document to digital verification which cuts on onboarding time strikingly by several days.

3.3 Execution of Operations

Execution entails carrying out the new process designs through:

- Training personnel on new workflows.
- Integrating new technological solutions, such as process automation technologies.
- Ensuring seamless transitions with little disturbance to operations.

For instance, in the healthcare business, BPM helps hospitals deploy electronic health record (EHR) systems to replace manual patient record-keeping, decreasing mistakes and enhancing efficiency.

3.4 Process Control and Monitoring

The final level of BPM is continual monitoring and performance review. This includes:

- Real-time tracking of business operations. • Generating reports for management review.
- Identifying areas for future development and making appropriate modifications.

Companies like Amazon deploy BPM systems to watch consumer behavior and adjust their supply chain operations dynamically, assuring timely delivery and effective inventory management.

4. Problems of executing BPM

Companies currently investing in BPM will be well placed to navigate future market changes and achieve longlasting success. Executing BPM presents

numerous difficulties. In part, we will examine four typical BPM difficulties that organizations encounter and approaches to address them [4]:

- A major obstacle in BPM implementation is opposition to change. Workers might hesitate to embrace new procedures due to concerns about job loss or increased workload.
- BPM initiatives can struggle without robust backing from upper management. Executives might not recognize the immediate importance or give priority to other initiatives.
- BPM initiatives frequently demand considerable resources in terms of time, funds, and staffing. Insufficient resources may obstruct BPM implementation.
- BPM projects may lose focus if goals and objectives are not well articulated. Without a defined goal, organizations are unable to assess progress efficiently.

5. Future Trends in Business Performance Management

The future of BPM is driven by rapid technological advancements. Key trends include:

- Artificial intelligence and machine learning allow AI-driven BPM to proactively suggest solutions and forecast operational difficulties.
- Robotic Process Automation (RPA) is the method of automating data entry and invoicing processing repetitious processes meant to lower manual labor.
- Big Data Analytics: Utilizing large-scale data processing to acquire insights into performance trends.

[4] Marr, Bop cit p 52.

- Cloud-Based BPM Solutions: Increasing team communication and accessibility over geographically scattered projects. .

Firms such IBM and SAP, for instance, are transforming performance management by means of artificial intelligence supported BPM tools offering predictive analysis and process automation.

The Seventh lecture:

Management Information Systems

(MIS)

The Seventh lecture: Management Information Systems (MIS)

In the modern company environment, management information systems (MIS) are absolutely necessary for achieving operational efficiency and underpin strategic decisionmaking needs. By organizing data, processing it, analyzing it, and displaying it systematically, these systems allow managers and decisionmakers to make knowledgeable judgments.

Along with their components, benefits, and drawbacks, we will cover management information systems in this seminar. We will also check how in several fields they prop administrative processes. Understanding MIS helps businesses keep a competitive market edge, optimize performance, and improve communication.

1. The Concept of Management Information Systems

Companies utilize information systems across all operational levels to gather, process, and retain data. Management compiles and distributes this data as information essential for conducting the daily operations of the business. Everyone involved in business, whether it's the individual handling bills or the one making hiring choices, utilizes information systems. A car dealership might utilize a computer database to monitor which products are the top sellers. A retail shop may utilize a computer-driven information system to market goods online. In reality, numerous (if not the majority of) companies focus on aligning MIS with their business objectives to gain a competitive edge over other firms.

1.1 Definition of Management Information Systems

A computerized system called a Management Information System (MIS) is made to help with administrative procedures and make business decision-making easier. These systems aid businesses in gathering, processing, and

transforming data from several sources into useful information that helps management efficiently plan, organize, control, and make decisions[1].

1.2 Objectives of Management Information Systems

MIS serves multiple objectives that contribute to an organization's success, including[2]:

- Providing timely and correct information: MIS makes sure that decision-makers are given the most current and pertinent information.
- Increasing operational efficiency: Administrative work automation lowers errors and boosts output.
- Improving communication: By enabling smooth information transfer between several departments, MIS promotes teamwork.
- Assisting with strategic planning: MIS assists companies in being ready for the future by forecasting and evaluating previous data.
- Ensuring data security: MIS incorporates security measures to shield private company data from illegal access and online threats.

2. Components of Management Information Systems

Management Information Systems (MIS) facilitate the efficient handling of data and processes. By delivering timely and precise information, MIS facilitates decision-making, boosts productivity, and connects different functions within the organization. It guarantees that managers possess the knowledge required to maneuver through intricate business landscapes. Based

[1] Gordon B. Davis, (2003), Management information systems (MIS), *Encyclopedia of Computer Science* , p 172

[2] ARAMIDE. O.& all (2020), Achieving Organization Objectives Through Management Information System In Organizations on line : https://www.researchgate.net/profile/Olufemi-Aramide/publication/338965408_Achieving_Organization_Objectives_Through_Management_Information_System_In_Organizations/links/5ea1b23c92851c87d1b0c01c/Achieving-Organization-Objectives-Through-Management-Information-System-In-Organizations.pdf (20/02/2025)

- **Hardware:** “Hardware” includes all the physical devices required to input, process, and output data. Examples include servers, computers, network devices, and storage devices.
- **Software:** “Software” refers to the applications and programs used to process data. This includes operating systems, database management systems, and application software tailored to specific business needs**.**
- **Data:** Data is the core component of Management Information Systems. It includes raw facts and figures that are processed to generate meaningful information. Data sources can be internal (sales data, employee records) or external (market trends, competitor analysis).
- **Procedures:** Procedures are the rules and guidelines that govern the collection, processing, and dissemination of data. These are essential for ensuring consistency and accuracy in data handling.
- **People:** This includes everyone who interacts with the MIS, from IT professionals who manage the system to end-users who rely on the information generated for their work.

b. Types of Management Information Systems

MIS can be classified into different types based on their function within an organization:

- TPS manages daily operations like payroll, order entry, and inventories.
- DSS enables managers to make educated decisions by evaluating massive amounts of data and presenting alternatives.
- Executive Information Systems (EIS) provides top executives with simplified reports and KPIs for strategic planning.
- Strategic Information Systems (SIS) support long-term business goals by aligning IT capabilities with organizational strategy.

- Enterprise Resource Planning (ERP) systems unify fundamental corporate activities like finance, human resources, and supply chain management.

3. The Role of MIS in Supporting Administrative Processes

MIS is important as it streamlines the administrative requirements across different areas related for any business segment;

- Planning : MIS delivers the required data to firms for goal setting and arrive strategic & operational strategies.
- Structure: Enabling efficient structuring of people and material resources through seamless process flow, resource allocation
- Control and Monitoring: MIS aids to measure performance, assess efficiency and track actual results as against the set goals.
- Decision making: MIS provides managers with correct processed data to take accurate decision supporting corporate goals
- Collaboration: MIS forges collaboration between departments to make all units converging to a common purpose

b. The Importance of Management Information Systems

The implementation of MIS has several advantages that contribute to an organization's success[3]:

- Enhancing the Quality of Decision Making: MIS gives live data, analysis and reports to managers on regular basis; they were able to take better and efficient decisions.

- Operational Effectiveness: Manual Operations when automated are error free, saves time and provide optimum productivity.

[3] ARAMIDE. O.& all, Op cit.

- Communication and Collaboration: As MIS helps to share the data easily between different departments and this smooth data sharing among various departments are not possible without mobile technology.
- Strategic Planning Support: The ability to look at historical patterns and anticipate upcoming shifts enables companies to develop long term strategy.
- Compliance & Security: MIS combines mechanisms of data security with controls which meets the regulatory compliance to safeguard essential business data.
- Improving Customer Relationship Management (CRM) MIS consolidates customer data and enables companies assist in making services customizable leading to customer satisfaction and loyalty.

Part IV: Challenges of Implementing MIS

Although there are many benefits of MIS, businesses might run into challenges in deploying it[4]:

- Big expenditure: Staff training, software, and hardware must be bought in substantial amounts when establishing an MIS.
- Complexity of Integration: Expert knowledge is often needed to link an MIS with systems already in use since it could be challenging.
- Data Confidentiality and Security: Data hacks and cyber attacks could expose sensitive business information.

[4] Salhieh, L M and Abu-Duleh J (2007) Investigating IT use and satisfaction among Commercial Banks: A Management Challenge, Jordan Journal of Business Administration, 3 (2) , p 20.

- Change Aversion: Staff could reject new technology from lack of expertise or fear of being fired. Maintenance of an MIS is necessary to keep pace with technical and business
- changes over time; regular system upgrades will also be needed.Modern companies

depend on management information systems (MIS) to increase efficiency, facilitate decisionmaking, and spur development. MIS advances better planning, coordination, and strategy implementation by merging human capital, technology, and data. Companies, though, have to deal with issues including security risks, high expenses, and compatibility problems to exploit the advantages of technology.

By enabling datadriven decisions, boosting productivity, and strengthening consumer relationships, companies effectively implementing and developing MIS have a competitive edge in the marketplace. Creating the future of corporate management will depend much more on MIS as technology keeps changing.

The eighth lecture :

Neural Networks and Decision Trees

NN & DT

The eighth lecture : Neural Networks and Decision Trees NN & DT

I. Neural Networks

In the human body, the nervous system consists of a complex network of neurons that interact with each other to process information and send electrical impulses between different areas of the body. Similarly, artificial neural networks consist of a number of artificial components known as "neurons", which process information and exchange signals.

1. The concept of neural networks

Neural networks are computing models inspired by the human nervous system. Such models are employed in the field of artificial intelligence to address a wide range of issues, such as forecasting, classification, pattern recognition, and others.

The learning process in neural networks is based on the adjustment of the weight that is related between neurons. During the training phase, the network is presented with a collection of data that comprises the expected input and output. The network optimizes the correlation weights between neurons so as to lessen the disparity between the expected and actual outputs.

Neural networks are defined by their ability to adapt and learn from input, they are able to cope with non-linear and complex data. They are used in a range of applications, including machine learning, natural language processing, computer vision, forecasting, data analysis, and many others that involve learning from data.

Therefore, neural networks can be defined as follows[1]:

[1] A.D.Dongare, R.R.Kharde, Amit D.Kachare, Introduction to Artificial Neural Network, IJEIT Journel, 02(01), jully 2012. P 190.

"Neural networks are computing models inspired by the analogy of the human nervous system, used in the field of artificial intelligence to solve a variety of problems . These models consist of a set of artificial units known as "neurons", which process information and transmit signals between different layers in the network"

The learning process in neural networks is based on the adjustment of the weight that is associated between neurons, since the network reduces the difference between the expected and actual output by adjusting these weights. Neural networks are characterized by their ability to adapt and learn from data, and are used in a variety of applications, including machine learning, natural language processing, computer vision, forecasting, data analysis, and others."

2. The evolution of artificial neural networks:

Artificial neural networks (ANN) have evolved throughout the years since they were initially invented in the fifties. This area has seen substantial breakthroughs in our understanding of how neural networks work and their practical applications. Here's an overview of the development of artificial neural networks [2] :

2.1 The initial stage (fifties and sixties)

During the earliest stage of the development of artificial neural networks in the Fifties and sixties, the main focus was on understanding how the human brain works and trying to imitate it by computers. Attempts focused on building simple models that imitate neurons and their interaction, focusing on the development of mechanisms for learning and adaptability. However, this stage was mainly based on theoretical and experimental hypotheses akin to The

[2] Q, Zhao (2001), A communication on Evolutionary design of neural network tree-integration of decision tree, neural network and GA, IEEE, 27-30 May 2001, Seoul, Korea (South), on line https://ieeexplore.ieee.org/abstract/document/934395/references#references

Theory of Hebb Donald, which claims that the process of learning and memory is a phenomenon coming from the strengthening of the link in the ganglia of the neural retina.

2.2 The second stage (seventies and eighties)

This decade saw the innovation of learning techniques like as the backpropagation algorithm by researchers David Rumelhart and Hinton Geoffrey, and Williams row, which allow the weight of connections between neurons to be better adjusted. This has boosted the efficiency of neural networks and their ability to adapt to more complicated and diverse data.

The models have also grown to include larger and deeper networks, which are formed of numerous layers of neurons. Thanks to these new technologies, neural networks began to be employed in a number of applications such as pattern recognition, forecasting, data analysis.

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2.4 Third stage

The nineties and millennium In the third stage of artificial neural networks development in the nineties and already in new millenium this

technology develop massively, both application technology level and performance. Neural networks are starting to be the basis for solving many real problems in several areas machine learning and analytical data To boost the performance of neural networks: new methods like deep learning which make larger and deeper neural network to be used Image — been created, deep learning CNN technique etc.. Other advanced software tools such as TensorFlow and PyTorch that enable the construction/ training of neural networks have also been created.

2.5 The fourth stage (after the Millennium)

At this point, neural networks have risen in size and depth, have gotten more complicated and accurate, which allowed them to tackle increasingly complex issues in such fields as deep learning, recognition of images and sounds, analysis of massive data.

The uses of neural networks have developed in a wide range of applications, including machine learning, natural language processing, computer visualization, data analysis, robotics, medicine, and more. Neural networks are projected to continue to accomplish advancement and development in the future, boosting their role in different industries and applications.

3. Components of artificial neural networks

Artificial neural networks consist of numerous basic components that work together to accomplish the desired performance in data analysis and decision-making. Here are the most prominent components of neural networks :

a. Neurons (Units): are the basic constituents in neural networks, they receive inputs and generate outputs. Each module is affected by the input it receives, and calculates the value of the resulting signal.

b. Weights: the weight denotes the strength of the link between the units in the network. A particular weight is allocated to each link between the modules, it is utilized to determine the significance of various inputs in the analysis process.

c. Active function: the active function is used to decide whether or not the unit will activate and send a signal based on the input value it receives. Active functions such as sigmoid (Sigmoid) or reactivated liner (ReLU) are utilized for this.

d. Layers: neural networks consist of consecutive layers of modules. There are usually three primary sorts of layers: the inner layer (input), the hidden layers, and the resulting layer (output)

e. Backpropagation : which is a technique used to train neural networks on training data. The back spread changes the weights based on the disparities between the actual and desired performance.

f. Training and validation: neural networks are trained on a set of training data, and then their performance is checked using a set of verification data to ensure the accuracy of the network model.

These components form the basis for the construction and operation of artificial neural networks, contribute to the achievement of superior performance in a variety of applications.

4. Applications of neural networks in business & management

Applications of neural networks in business & management encompass a wide range of usage targeted at optimizing processes and making decisions more intelligently and effectively. Here are some instances of how neural networks can be utilized in business management:

4.1 Demand forecasting and market forecasts:

neural networks can be used to examine past demand and sales data, and then predict future demand and market trends, helping organizations to make better strategic decisions.

4.2 Digital marketing and analytics

neural networks are used to evaluate digital data such as web logs and social media interaction logs, construct predictive models of customer behavior and direct marketing campaigns more specifically and effectively.

4.3 Customer management and customer service:

neural networks can be used to assess client data, forecast their requirements and behavior, and construct models to improve customer experience and raise customer satisfaction.

4.4 Financial data analysis and financial performance forecasting

Neural networks can evaluate financial data such as financial reports and financial figures, and estimate the future financial performance of a company based on previous trends and economic factors.

II. Decision Trees

1. What is a decision tree ?

A decision tree is a tool used in data analysis and decision making. A decision tree represents a succession of sub-decisions that a system or analyst makes to solve a given problem. The decision tree consists of "nodes" and "branches" that reflect the different decisions and probable outcomes of each decision [3].

2. How to construct a decision tree ?

[3] Carl Kingsford & Steven L Salzberg (2008), *Nature Biotechnology journal, 26, p 1013*

A decision tree works by analyzing data and making judgments based on a set of simple rules and available variables. Here are the stages for building a decision tree in more detail:

2.1 The Beginning

the work begins with the elaboration of a crucial question that the analyst intends to answer. This question can be relevant to any sphere, whether it marketing, finance, industry, and others. For example, "what factors influence the decision of customers to purchase a particular product?".

2.2 Branches and formats

After setting the primary question, the question is broken into sub-questions or "branches" which identify the different variables that may affect the result. For example, in our query regarding the elements impacting the decision of customers, the branches can include age, gender, income, needs, preferences, etc.

2.3 Choice

when the branches are recognized, the choice is made on how to deal with each branch. The decision can be as basic as utilizing a certain variable as a classification criterion or it can be more sophisticated employing advanced algorithms to find the correlations between variables.

2.4 Analysis

Once judgments are taken on each branch, the data is examined and the decisions are applied to get a final outcome. This result can include the classification of clients, the discovery of elements influencing behavior, or any other result of interest to the researcher or analyst.

2.5 Optimization

At the end, the performance of the decision tree is reviewed and enhanced as needed. This can include adding new variables, altering the decisions made, or refining the analysis procedures.

Using these procedures, the decision tree can be an effective tool in data analysis and decision-making in the field of business intelligence, helping firms to better understand their processes and enhance their performance.

3. Decision tree applications in business intelligence

Decision tree use for[4]:

3.1 Customer rating

Using a decision tree to score consumers might be effective in finding potential clients who are potentially interested in certain items or services. For example, consumer data can be evaluated to find variables such as age, gender, income, purchasing preferences, and use a decision tree to identify possible client groups who respond positively to marketing efforts.

3.2 Performance analysis and prioritization:

The use of a decision tree in studying the performance of products or services can assist identify the primary elements that affect performance. For example, sales and costs can be studied for each product, identify the major factors affecting the profit margin, which helps in creating priorities to enhance performance.

3.3 Making marketing decisions:

Using a decision tree, it is feasible to identify aspects that influence client behavior such as preferences, economic and social considerations . For

[4] Chee Sun Lee &all (2022), Predictive Analytics in Business Analytics: Decision Tree, advences indecision sciences, 20(01), p 06

example, client purchase records can be evaluated to uncover common factors among customers who have purchased certain products, and use this knowledge in the construction of targeted marketing campaigns.

3.4 Customer Relationship Management (CRM)

By using a decision tree, customer service can be better personalized to match varied client needs. For example, customer feedback data can be evaluated and a decision tree used to find the ideal responses and the most effective interactions with each category of customers.

In this approach, a decision tree can help firms better understand their operations, make the most productive and results-oriented decisions

The Ninth Lecture:

Business Intelligence and Decision Making

The Ninth Lecture: Business Intelligence and Decision Making

The digital revolution and the spread of big data face enterprises nowadays with a major task: turning massive amounts of raw data into valuable knowledge that propels competitiveness and sides in efficiency. Business Intelligence (BI) and Decision Support (DM) have become key strategic instruments in this setting that integrate technological analysis with managerial experience. Through these fields, firms may effectively handle information, monitor core performance measurements, forecast future developments, and support sensible decision making.

BI and DM are crucial because they can help to correlate raw data with functional decisions. Sophisticated procedures and technologies help companies uncover prospects for progress, avoid hazards, and extract vital knowledge. The lecture intends to study the mechanisms connecting data with decision-making processes while stressing modern technologies that improve this transition. It will also evaluate the many purposes of decision support and business intelligence, explore major tools and methodologies utilized in this field, analyze real-world applications across sectors, and discuss the problems of employing BI technology for decision-making.

1. The Difference Between Business Intelligence and Decision Support

The digital revolution and the spread of big data face enterprises nowadays with a major task: turning massive amounts of raw data into valuable knowledge that propels competitiveness and sides in efficiency. Business Intelligence (BI) and Decision Support (DM) have become key strategic instruments in this setting that integrate technological analysis with managerial experience. Through these fields, firms may effectively handle information,

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2. Decision Support Process with the Use of Business Intelligence Technologies

The digital revolution and the spread of big data face enterprises nowadays with a major task: turning massive amounts of raw data into valuable knowledge that propels competitiveness and sides in efficiency. Business Intelligence (BI) and Decision Support (DM) have become key strategic instruments in this setting that integrate technological analysis with managerial experience. Through these fields, firms may effectively handle information, monitor core performance measurements, forecast future developments, and support sensible decision making[2].

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1 Dawson, L, Van Belle, J-P. Critical (2013) success factors for business intelligence in the South African financial services sector, SA Journal of Information Management, p 13

[2] [2] Dawson, L, Van Belle, J-P. Critical Op Cit, p 13

decision-making processes while stressing modern technologies that improve this transition. It will also evaluate the many purposes of decision support and business intelligence, explore major tools and methodologies utilized in this field, analyze real-world applications across sectors, and discuss the problems of employing BI technology for decision-making.

3. Tools and Techniques Used in Decision-Making

The digital revolution and the spread of big data face enterprises nowadays with a major task: turning massive amounts of raw data into valuable knowledge that propels competitiveness and sides in efficiency. Business Intelligence (BI) and Decision Support (DM) have become key strategic instruments in this setting that integrate technological analysis with managerial experience. Through these fields, firms may effectively handle information, monitor core performance measurements, forecast future developments, and support sensible decision making.

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- Data Visualization Platforms: Tools like Power BI and Tableau create interactive graphs, heat maps, and trend charts to help decision-makers understand complex information.

- Python and R are popular languages for statistical computing, machine learning, and predictive analytics. These languages include substantial libraries for data modeling and automation.
- Platforms like SAP BusinessObjects, IBM Cognos, and Microsoft SQL Server offer comprehensive business intelligence solutions, including real-time data integration, reporting, and performance management.

AI algorithms improve decision-making by automating data processing, improving forecasting accuracy, and uncovering hidden patterns in vast datasets.

4. Practical Applications in Various Sectors

Business intelligence and decision support systems are widely utilized across diverse industries, considerably enhancing efficiency and competitiveness. Some notable applications include:

4.1 Healthcare

BI tools help hospitals evaluate patient data, predict illness outbreaks, and optimize treatment procedures. Predictive analytics algorithms can estimate the likelihood of chronic diseases, enabling early intervention.

4.2 Retail

Businesses utilize BI to track customer purchase trends and optimize marketing strategies. For example, e-commerce companies utilize recommendation algorithms to offer products based on customer preferences.

4.3 Logistics

By streamlining delivery routes, cutting down on transportation expenses, and enhancing inventory control, supply chain management gains from BI systems. For example, Amazon streamlines its warehousing operations with real-time information.

4.4 Finance

By examining consumer credit histories and spending trends, banks utilize business intelligence (BI) to identify fraudulent transactions and evaluate credit risk.

4.5 Education

To create focused intervention programs, educational institutions employ BI to monitor student performance, engagement levels, and dropout concerns.

5. Challenges of the Decision-Making Process Under the Use of Business Intelligence Technologies.

There many challenges as we can mention the following[3]:

- Despite a number of BI and DM benefits, employing these technologies to gain advantages is fundamentally hard for the enterprises as well. Some of the basic problems are:
- Problem with Data Quality Data quality: Inaccurate, partial or misleading data may cause bad insights which leads to less or poor-quality decision.
- Integration with Legacy Systems: Typically difficulties in integrating new BI systems with those antiquated IT systems that limit their ability for real-time analytics. Data Analytics — Data breaches, illegal access and privacy law compliance will be the major concern as data analytics becomes very essential.

[3] M.Z. Elbashir, P.A. Collier, M.J. Davern (2008) Measuring the Effects of Business Intelligence Systems: The Relationship between Business Process and Organizational Performance International Journal of Accounting Information Systems, 9 (3), p. 138

- Resistance to change: Employees are not interested in hearing or do not want to get changed to the new BI-based outputs because of their lack of knowledge and fear over losing jobs.

The next round of cloud computing innovation along with AI and real-time analytics will only make decisions better. Such organizations which succeed in incorporating BI technology will be in better to position to drive that innovation quotient and adapt to changing market dynamics. Data is needed to help organizations make faster, smarter and more appropriate decisions in our increasingly competitive world where the strategic importance of business intelligence (BI) & decision support are more dominant.

The Tenth Lecture:

Business Intelligence (BI) Ethics

The Tenth Lecture: Business Intelligence (BI) Ethics

Due to the rapid growth of Business Intelligence (BI) and Management Information Systems (MIS) technologies, ethical problems make up a considerable part of the contractual obligations, which guarantee the right and fair use of the said technologies. As enterprises increasingly rely on data-driven decision-making, they must also address the ethical dilemmas related to privacy, fairness, transparency, and accountability we face. The moral aspect of BI is diganament in stopping abuse of facts, set uping ruhande, and guaranteeing conformity with the statute and regulatory guidelines.

In defining firm decisions, influencing public policies, and altering people's life, data is very significant. Hence, firms have to strike a balance between technical growth and honoring basic human rights. Good BI rules not only avert unfavorable consequences like data breaches or biased decision-making but also encourage long-term sustainability and social acceptance of new technology. The main ethical standards, challenges, and frameworks guiding Business Intelligence and MIS ethical policies are presented in this lecture.

I. Basic Concepts of BI and MIS Ethics

By gathering, organizing, and interpreting vast volumes of information, they run. Given the sensitivity of this information, ethical rules must regulate its usage. Applying these rules helps to achieve a balance between exploiting information for economic benefits and preserving equity and privacy for society and persons[1] & the followings are the main ethics practice in BI:

[1] *Computer Ethics – Computer Ethics In The Workplace – Ethical, Companies, Company, Organizations, Norms, and Employees, (n.d.). retrieved April 25, 2011, from* http://ift.tt/1mYM5IG

1. Privacy: shielding sensitive or private information from unwanted usage or access. To protect user information, companies have to use encryption, anonymization, and secure storage technology.

2. Transparency: Companies should honestly notify users and stakeholders how data obtained, managed, kept, and dispersed. Openness promotes confidence and helps individuals to informedly chose their data.

3. Fairness: Ethical BI must offer fair decision-making processes free of bias which could create discrimination in data analysis. Recruitment algorithms, in one scenario, may not disqualify applicants on basis of gender, ethnicity, or socioeconomic class.

4. Accountability: There must be clear methods to hold organizations accountable for ethical transgressions in data utilization. Companies need to specify responsibilities and tasks so that moral considerations become part of their decision-making systems.

Rather than impeding the functioning of BI systems, these criteria assist to improve their acceptance, dependability, and trustworthiness. Including ethics into BI and MIS systems allows firms to construct environmentally sustainable and ethical digital infrastructure.

II. The Major Ethical Hurdles in BI and MIS

Because of the complexity and extent of data-driven technology, various ethical challenges arise notwithstanding the advantages of BI and MIS. Getting ahead of these difficulties needs for ethical frameworks and proactive initiatives.

1. Violation of privacy

Many businesses compile considerable personal information, hence generating worries about privacy. Some items of interest include[2] :

- selling client information without permission.
- Tracking internet activities without stated user authorization.
- Using personal information for secret or second uses.

2. Algorithmic Bias

The prejudice orgross or unfair findings may result from bias in data management and machine learning techniques. Just as is:

- Recruitment systems that by biases in historical hiring data mistakenly leave out some populations.
- credit-scoring practices that unfairly negatively affect marginalized populations.
- Prediction policing software that unjustly focus on particular demographics according to limited data sets.

3. Improper use of data

Some organizations wrongly use data to deceive clients or acquire an arbitrary edge. Examples there are :

- Social media sites deploy algorithms to guide users' activity through directed misinformation.
- Retail firms that exploit false statistics to steer customer toward unneeded buys.
- Health groups using medical data to support particular therapy misleading.

4. Digital Divide

[2] *Peslak, Alan R.. (2006).: A CURRENT EMPIRICAL STUDY OF THE MASON FRAMEWORK. The Journal of Computer Information Systems, 46(3), P 121*

Unequal use of smart technologies and BI systems could ostracize lower-income people and consequently put a divide between people who can profit from data-driven technologies and those who cannot. The digital divide presents itself in :

- Limited digital infrastructure hinders rural people's financial services access.
- unequal access to online learning tools promotes educational inequality.
- Healthcare disparity stemming from lack of digital medical services in some sections.

Dealing with these difficulties demands for unrelenting surveillance, ethical governance, and rigorous implementation of data privacy legislation.

III. Ethical Models for Encouragement of Ethical Behavior in Business Intelligence and Management Information Systems

Organizations can employ several approaches aimed to assure ethical and equitable data usage to tackle the moral challenges associated to Business Intelligence and Management Information Systems[3].

Pressing difficulties still abound with violation of privacy since unauthorized data access and usage could result in identity theft, financial fraud, and harm to reputation. Another important issue is algorithmic bias, whereby organizations need to carry out frequent audits and employ various datasets to assure equal and unbiased decision-making. Furthermore, verifying that analytics and data-driven counsel follow ethical principles would help to solve the misuse of data. Finally, the digital divide offers a huge problem that demands for measures by politicians and entrepreneurs to deliver digital resources to every society,

[3] *Peslak, Alan R, Op cit, p 118*

irrespective of monetary or geographical limits. Ethical BI policies structures include :

1. Legal Frameworks:

Authorities around the world have legislated standards aimed to support ethical BI use and data privacy. Notable legal moves in Europe are the General Data Protection Regulation (GDPR), which mandate openness, user agreement, and responsibility in data treatment. The California Consumer Privacy Act (CCPA) also allows consumers charge of their personal information, consequently more autonomy and safety. Furthermore, ISO/IEC 27001 and other international requirements offer instructions for information security management, consequently supporting firms to follow tight security standards and ethical data handling methods.

2. Best Practices and Ethical Guidelines:

By guaranteeing that data is open, accountable, and egalitarian, the FAIR Principles (Findability, Accessibility, Interoperability, and Reusability) encourage ethical data management. The necessity for ethical and responsible AI practices is further supported by the European Commission's Principles for Trustworthy AI, which place a strong emphasis on fairness, transparency, and human oversight in AI-driven systems.

3. Corporate Social Responsibility (CSR):

Companies should include ethics in their corporate strategy to assure that their MIS and BI projects coincide with public benefit. Also given priority are ethical design approaches to make sure BI solutions support social equity and sustainability. This although companies should develop independent ethics panels to review data-related choices and guarantee consistency with ethical standards..

As firms maintain adopting Business Intelligence and Management Information Systems, ethical problems need constantly to be front and center. Protecting people and communities depends on preserving privacy, openness, justice, and accountability will also assist to build public faith in digital technology. Ethical BI solutions save organizations from legal penalties, improve brand image, and help to create a more fair digital enviroment.

Companies can produce data-driven solutions that benefit society as well as satisfy corporate goals by adopting approved models such CSR programs, FAIR principles, and the General Data Protection Regulation. In BI and MIS, ethical management is not just a legal duty but also a strategic need for stimulating creativity while honoring basic human rights.

Conclusion

Given times more and more characterized by data and digital transformation, becoming a strategic must rather than a luxury is the knowledge of Business Intelligence (BI) principles and tools. Students have been meant to grasp thoroughly the part BI plays in improving organizational competitiveness in this course. Each lesson—from the basics of data management and analysis to more sophisticated methods like data mining, GIS, and machine learning—has helped to establish a solid theoretical and handson foundation.

Students should be able to apply both technical proficiency and analytical reasoning by means of studies of the ten core modules—from data warehousing to ethical issues. These will help them to address corporate problems using datadriven insight, support evidencebased decisionmaking, and help performance optimization in many business divisions.

Furthermore, together with conventional management information systems the incorporation of technologies such decision trees and neural networks guarantees that students have versatile and forwardlooking skills. Reinforcing the necessity for honesty in a time when information is both sensitive and potent, the course has also stressed the value of ethical responsibility in data management.

In consequence, students who finish this study will be wellsuited to help companies use BI for strategic leadership and continuous growth. They will see how to change data into practical knowledge as well as how to ethically and efficiently integrate business intelligence techniques with more general corporate objectives.

At bottom, this course aims to create future specialists who are prepared to excel in the datadriven world—that is, professionals who can convert information into competitive edge and complexity into clearness.

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