MAKERERE UNIVERSITY BUSINESS SCHOOL

Bachelor of Business Computing

BUC 2225: Business Intelligence and Data Warehousing

Course Description

- The aim of the course is to equip students with the skills to effectively leverage data for decision-making in business contexts.
- Focusing on Business Intelligence and Data Warehousing, the course aims to provide a solid understanding of data principles, ETL processes, and the use of BI tools.
- By fostering hands-on experience, the goal is to prepare students for roles in data analysis, business intelligence, and related fields, enhancing their ability to contribute to data-driven decision-making processes within organizations.

Course Objectives

- To equip students with the skills to effectively leverage data for decision-making in business contexts.
- To provide a solid understanding of data principles, ETL processes, and the use of BI tools.
- To prepare students for roles in data analysis, business intelligence, and related fields, enhancing their ability to contribute to data-driven decision-making processes within organizations.

Learning Outcomes

- After completing the course, students will be able to:
  - Design and implement a functional data warehouse, mastering dimensional modelling and architectural principles.
  - Execute ETL processes using tools like Talend, seamlessly integrating and transforming data from various sources.
  - Use BI tools like Power BI to craft interactive and insightful reports and dashboards, effectively communicating data-driven insights.
  - Apply analytics concepts, including data quality and governance, to strategically analyze and interpret data, driving informed decisions across organizations.

Assessment

- Coursework 30%
  - Course test
  - Project
- Final Examination 70%

MAKERERE UNIVERSITY BUSINESS SCHOOL

Business Intelligence and Data Warehousing

TOPIC 1

Introduction to Business Intelligence and Data Warehousing

BUC 2225

Topic 1: Outline

- Definition and significance of Business Intelligence (BI)
- Historical evolution and key milestones in BI
- Overview of Data Warehousing and its role in decision support
- Importance of data-driven decision-making in modern organizations

Business Intelligence (BI):

- **Definition:**
  - Business Intelligence (BI) refers to the technologies, processes, and tools that help organizations collect, integrate, analyze, and present business information to support decision-making.
- The primary goal of BI is to provide actionable insights and support better decision-making within an organization.
  - BI systems help convert raw data into meaningful information, enabling executives, managers, and other stakeholders to make informed and strategic decisions.

Business Intelligence (BI)… Key Components

- Data Sources:
  - BI relies on data from various sources, including databases, spreadsheets, and external sources.
- Data Warehousing:
  - Centralized repositories that store, integrate, and organize data for BI analysis.
- Data Analysis:
  - Techniques and tools to analyze data, discover patterns, and derive insights.
- Reporting and Dashboards:
  - Visualization of analyzed data to facilitate understanding and decision-making.
- Decision Support Systems (DSS):
  - Tools that aid decision-makers by providing relevant information and insights.

Business Intelligence (BI)…

- Importance of Business Intelligence:
  - Informed Decision-Making: BI provides timely and accurate information for making informed business decisions.
  - Competitive Advantage: Organizations gain a competitive edge by leveraging data to identify trends and opportunities.
  - Operational Efficiency: BI helps streamline processes, optimize resources, and improve overall efficiency.
  - Predictive Analysis: BI enables organizations to forecast future trends and make proactive decisions.

Business Intelligence (BI)… Use cases

- **Sales and Revenue Analysis:**
  - Track sales performance and revenue trends over time.
  - Analyze customer purchasing behavior and identify upsell or cross-sell opportunities.
  - Forecast sales and set realistic targets.
- **Customer Analytics:**
  - Understand customer preferences and behaviors.
  - Analyze customer satisfaction and feedback.
  - Improve customer retention strategies and identify high-value customers.

Business Intelligence (BI)… Use cases

- **Financial Analysis:**
  - Monitor and analyze financial performance.
  - Create financial forecasts and budgets.
  - Identify cost-saving opportunities and optimize financial processes.
- **Supply Chain Optimization:**
  - Track and manage inventory levels.
  - Analyze supplier performance and optimize procurement processes.
  - Improve demand forecasting and reduce lead times.

Business Intelligence (BI)… Use cases

- **Marketing Campaign Effectiveness:**
  - Analyze the success of marketing campaigns.
  - Track website traffic, social media engagement, and conversion rates.
  - Optimize marketing spend based on ROI analysis.
- **Employee Performance and HR Analytics:**
  - Monitor employee performance metrics.
  - Analyze workforce demographics and trends.
  - Identify training needs and improve talent acquisition strategies.

Business Intelligence (BI)… Use cases

- **Operational Efficiency:**
  - Analyze operational data to identify bottlenecks and inefficiencies.
  - Optimize resource allocation and streamline business processes.
  - Monitor key performance indicators (KPIs) for operational excellence.
- **Risk Management and Compliance:**
  - Identify and assess potential risks in real-time.
  - Ensure compliance with industry regulations and standards.
  - Implement proactive risk mitigation strategies.

Business Intelligence (BI)… Use cases

- **Product Analytics:**
  - Monitor product performance and customer feedback.
  - Analyze product lifecycle and plan for product improvements or new launches.
  - Identify market trends and competitive positioning.
- **Healthcare Analytics:**
  - Analyze patient data for improved healthcare outcomes.
  - Monitor hospital operations and resource allocation.
  - Identify patterns in disease prevalence for public health initiatives.

Business Intelligence (BI)… Use cases

- **Education Analytics:**
  - Monitor student performance and engagement.
  - Evaluate the effectiveness of teaching methods and curriculum.
  - Implement data-driven decision-making in educational institutions.
- **Real-Time Dashboards:**
  - Create real-time dashboards for executives and stakeholders.
  - Monitor key metrics and performance indicators at a glance.
  - Enable quick decision-making based on up-to-date information.

Data Warehouses:

- **Definition:**
  - A Data Warehouse (DW) is a centralized repository that stores large volumes of data from various sources, making it accessible for analysis and reporting.
- They are designed to support business intelligence and reporting activities by providing a consolidated and optimized view of data.
- Data warehouses enable efficient querying and analysis of historical and current data, which is crucial for decision-making.
- They help organizations in organizing and managing their data for better reporting, analysis, and data-driven decision-making.

Reasons for Data Warehouses …

- Data Integration:
  - Consolidate data from different sources into a unified and consistent format.
- Historical Analysis:
  - Store historical data for trend analysis, performance evaluation, and decision support.
- Query and Reporting Performance:
  - Enhance query performance by pre-aggregating and indexing data.
- Scalability:
  - Data warehouses are designed to handle large volumes of data and scale as the organization grows.
- Business Intelligence:
  - Facilitate business intelligence activities by providing a single source of truth for data analysis.

Components of Data Warehouses …

- Data Extraction:
  - Process of pulling data from source systems into the data warehouse.
- Data Transformation:
  - Convert and integrate data into a common format within the data warehouse.
- Data Loading:
  - Load transformed data into the data warehouse for analysis.
- Data Modeling:
  - Designing the structure of the data within the warehouse for optimal query performance.

Data Mining:

- **Definition:**
  - Process of discovering patterns, correlations, and insights from large datasets using various techniques, including statistical analysis, machine learning, and artificial intelligence.
- Data mining can be applied to different types of data, such as structured databases, text documents, and multimedia files.
- The goal is to **extract meaningful information** that can be used for decision support, prediction, and optimization.
- Common data mining techniques include clustering, classification, regression, association rule mining, and anomaly detection.

Key Concepts in Data Mining …

- Pattern Recognition:
  - Identifying patterns and trends within data that may not be apparent through traditional analysis.
- Classification:
  - Categorizing data into predefined classes or groups based on patterns.
- Clustering:
  - Grouping similar data points together based on their characteristics.
- Association Rule Mining:
  - Discovering relationships and associations between variables in a dataset.

Applications of Data Mining …

- Marketing and Sales:
  - Targeted marketing, customer segmentation, and sales forecasting.
- Healthcare:
  - Disease prediction, patient profiling, and treatment optimization.
- Finance:
  - Fraud detection, risk assessment, and investment analysis.
- Manufacturing:
  - Quality control, process optimization, and supply chain management.

Historical evolution and key milestones in BI

- **1960s-1970s: Emergence of Decision Support Systems (DSS)**:
  - Decision Support Systems (DSS) emerged as precursors to modern BI,
    - Focused on providing analytical tools to help managers make decisions.
  - Early DSS mainly relied on mainframe computers and batch processing techniques to analyze structured data.
    - Simple reporting systems to extract and analyze data
    - Allowed users to interact with data and generate reports based on specific criteria.

Historical evolution and key milestones in BI …

- **1980s-1990s: Rise of Data Warehousing and Executive Information Systems**:
  - The 1980s saw the development of data warehousing concepts,
    - Pioneered by researchers such as Bill Inmon and Ralph Kimball.
  - Data warehouses emerged as centralized repositories for structured data from various sources within an organization.
  - OLAP (Online Analytical Processing) technologies gained popularity,
    - Enabled multidimensional analysis of data for reporting and decision-making.
  - Executive Information Systems (EIS) provided senior executives with **summarized reports** and easy **access to key performance indicators (KPIs)** for monitoring organizational performance.

Historical evolution and key milestones in BI …

- **1990s-2000s: Expansion of BI Tools and Data Integration**:
  - The 1990s witnessed the proliferation of BI tools from vendors like Cognos, BusinessObjects, and MicroStrategy.
    - These tools offered capabilities for **reporting, querying, and data visualization**, making it easier for users to access and analyze data.
  - Data mining techniques gained popularity for uncovering patterns and insights from large datasets
  - Advance in data integration technologies
    - Enabled organizations to consolidate data from different sources into data warehouses for analysis.

Historical evolution and key milestones in BI …

- **2000s-2010s: Advent of Self-Service BI and Big Data**:
  - Self-service BI platforms gained prominence,
    - Allowed business users to perform ad-hoc analysis and create reports without heavy reliance on IT.
  - The rise of big data technologies like Hadoop and NoSQL databases enabled organizations to process and analyze large volumes of structured and unstructured data.
  - Data discovery and visualization tools such as Tableau, QlikView, and Power BI became popular,
    - Offered intuitive interfaces for data exploration and visualization.

Historical evolution and key milestones in BI …

- **2010s-Present: Integration of AI and Predictive Analytics**:
  - The integration of artificial intelligence (AI) and machine learning (ML) into BI platforms
    - Enabled advanced analytics, including **predictive modeling and prescriptive analytics**.
  - BI solutions increasingly moved to the cloud,
    - Scalability, flexibility, and reduced infrastructure costs.
  - Mobile BI applications became prevalent,
    - Allow users to access insights and reports on smartphones and tablets from anywhere.

Historical evolution and key milestones in BI …

- **2020s and Beyond: Continued Convergence and AI-driven Insights**:
  - The lines between BI, data analytics, and data science **continue to blur** as organizations seek comprehensive insights from their data.
  - AI-driven BI solutions will become more sophisticated,
    - Automate insights discovery, anomaly detection, and decision-making processes.
  - Real-time analytics capabilities will become more prevalent,
    - Enable organizations to make data-driven decisions instantaneously.

Role of BI and DW in Decision Making/Support

- BI and DW facilitates decision support by providing decision-makers with **timely, relevant, and actionable insights**.
- Decision support systems (DSS) **leverage data** from warehouses and BI tools to assist users in making strategic, tactical, and operational decisions.
- Enable users to **analyze trends, patterns, and performance metrics** over time.
- BI tools offer a wide range of **data visualization options**, including charts, graphs, and heatmaps, to help users visualize complex data relationships and trends.

Importance of data-driven decision-making in modern organizations

- **Improved Accuracy and Objectivity**:
  - Organizations can **make decisions based on evidence, reducing the risk of biases and errors** that may arise from subjective judgments.
- **Better Strategic Planning**:
  - Data-driven insights help organizations **formulate and refine their strategies**.
    - By analyzing **historical data and market trends**, organizations can identify patterns, opportunities, and potential risks, enabling them to make informed decisions about future directions and investments.

Importance of data-driven decision-making in modern organizations …

- **Enhanced Operational Efficiency**:
  - Organizations analyze operational data to **identify inefficiencies, streamline processes, and allocate resources** more effectively to achieve operational excellence.
- **Enhanced Customer Understanding**:
  - Organizations analyze customer data to **personalize their offerings, improve customer experiences, and enhance customer loyalty and satisfaction**.

Importance of data-driven decision-making in modern organizations …

- **Competitive Advantage**:
  - By making data-driven decisions, organizations **can identify market trends, anticipate customer demands, and respond to changing market conditions** more quickly and effectively than their competitors.
- **Innovation and Adaptability**:
  - Using customer feedback, market trends, and emerging technologies, organizations can **identify new opportunities for innovation** and stay ahead of the competition.

Importance of data-driven decision-making in modern organizations …

- **Risk Management**:
  - Analyzing historical data and using predictive analytics, organizations **can identify potential risks and develop strategies to mitigate them**, thereby minimizing potential losses and disruptions to their operations.
- **Regulatory Compliance**:
  - In many industries, compliance with regulatory requirements is essential.
    - Data-driven approaches help organizations ensure compliance by **providing accurate and timely reporting, monitoring, and analysis** of relevant data.