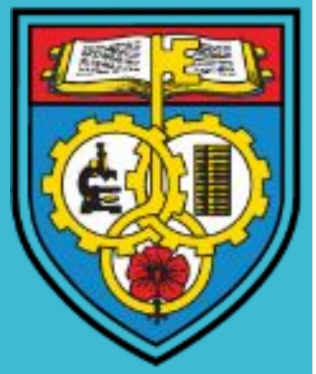
BAIT3013
Business Intelligence

Week 1: Introduction to Business Intelligence (BI)



TARC

TUNKU ABDUL RAHMAN
UNIVERSITY COLLEGE

Course Synopsis

- Students will learn the concepts of **business intelligence** and enhance their understanding by **using contemporary software** tools to produce reports and performance dashboards. For example, SAS Visual Analytics, Tableau, Power BI are used for data preparation, analytics, and report creation.

Course Learning Outcomes (CLO)

CLO	Description
CLO 1	**Apply** the concepts and importance of business intelligence strategies in business operations (C3,PLO2).
CLO 2	**Explain** the use of BI business analytics and data visualization for creating better business insight and performance management (A4, PLO5).
CLO 3	**Demonstrate** the topic with precise content and clear explanation, and interactive visualization (P4, PLO3).

References

- [1] Sharda, R., Delen, D., Turban, E., 2018. **Business Intelligence, Analytics, and Data Science : A Managerial Perspective**. Pearson. (**Main**)
- [2] Samaddar, S. and Nargundkar, S.. 2019. Data Analytics : Effective Methods for Presenting Results. CRC Press.
- [3] Verbeke, W., Baesens, B. and Bravo, C.. 2018. Profit Drive Business Analytics : A Practitioner's Guide toTransforming Big Data into Added Value. John Wiley & Sons.

Practical

- [4] Tableu help. [ONLINE] Available at: https://www.tableau.com/support/help
- Additional
- Power BI - Dashboard in a Day Power BI Training | Microsoft Power BI

Introduction to Business Intelligence (BI)

Learning objectives

- Understand the need for computerized support of managerial decision making
- Recognize the evolution of such computerized support to the current state - analytics/data science
- Describe the business intelligence (BI) methodology and concepts
- Understand the various types of analytics, and see selected applications
- Understand the analytics ecosystem to identify various key players and career opportunities

Motivations

(Applications of Business Analytics)

- **Sports Analytics**
  - An exciting frontier for learning and understanding applications of analytics
  - Sports analytics is becoming a specialty within analytics.
  - Is the art and science of **gathering data** about **athletes** and **teams** to create **insights** that **improve** sports **decisions**, e.g.
    - *Which players to recruit*
    - *How much to pay them*
    - *Who to play*
    - *How to train them*
    - *How to keep them healthy*
    - *When they should be traded or retired*
    - *Analyze competitor's strengths and weaknesses*
    - *Game-day decisions*
    - *etc.*

- **Example in Malaysia:**
  - **https://www.datasukan.com/ds/solutions_aa.php**

Two types of business analytics in sports

Front-office analytics	Back-office analytics
• Fan behavior • Financial analysis	• On individual athletes and team • For individual athletes, there is a focus on recruitment models, strength and fitness, and development. • Team analytics include strategies and tactics, competitive assessments, and optimal roster choices.

Motivations

(Applications of Business Analytics)

- **Supply Chain Management in Retail Analytics**
  - Improved decision making, increased visibility, enhanced customer service, reduced costs.
  - *Example use cases:*
    - Product forecasting: Retailers can use business analytics to forecast demand for products. This information can then be used to determine how much inventory to order and when to order it.
    - Inventory management: Retailers can use business analytics to track inventory levels and identify potential stockouts. This information can then be used to make adjustments to the supply chain to ensure that products are always in stock.
    - Transportation: Retailers can use business analytics to optimize transportation routes and schedules. This can help to reduce transportation costs and improve delivery times.
    - Customer service: Retailers can use business analytics to track customer satisfaction and identify areas where they can improve the customer experience. This information can then be used to make changes to the supply chain that will improve customer service.

Example 1: The business office

- Aim: Improve sales
- Analyze: Ticket sales (season tickets and single-tickets)
- Questions:
  - *Q1: Why season ticket holders renew or not renew.*
  - *Q2: What factors drive last minute ticket purchase.*
  - *Q3: How to price the tickets.*

Example 1: The business office (cont.)

Tier	Highly Likely	Likely	Maybe	Probably Not	Certainly Not
1	92	88	75	69	45
2	88	81	70	65	38
3	80	76	68	55	36
4	77	72	65	45	25
5	75	70	60	35	25

Source: Season Ticket Renewals - Survey Score [1, Fig. 1.1]

Technique:

- Use **simple statistics** on fan behavior like overall attendance and answers to survey questions about likelihood to purchase again.

Gain **insights** from the results.

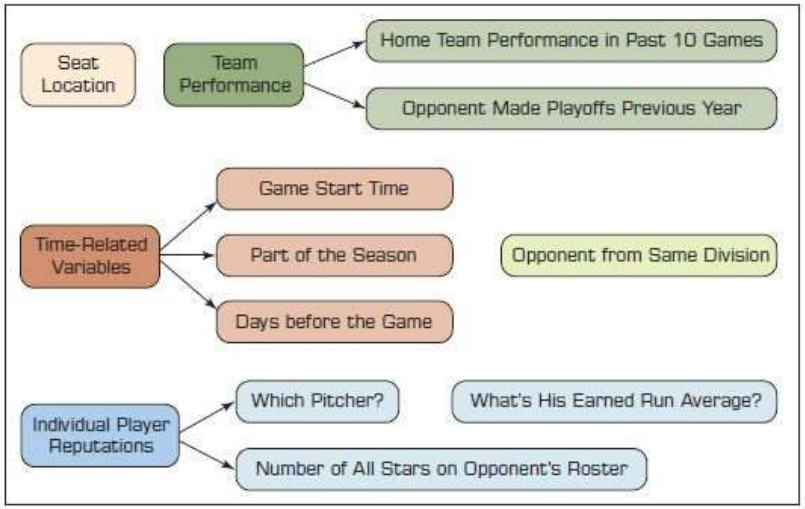
Potential **actions**:

- *customers in the green cells are the most likely to renew tickets, so require fewer marketing touches compare to those in the blue cells.*

Example 1: The business office (cont.)

To answer Q2: What are the ***factors***? (e.g. fig 1.2)

- **Techniques**:
  - Use regression model from statistic to find key factors
  - Create predictive model (PM) to identify how to spend marketing resources.
  - Build churn model – segment customers into who will renew, won't renew, etc.
  - Conduct sentiment scoring on fan comments like tweets to help in segmenting fans into different loyalty segments.



Source: Dynamic Pricing Previous Work—Major League Baseball [1, Fig. 1.2]

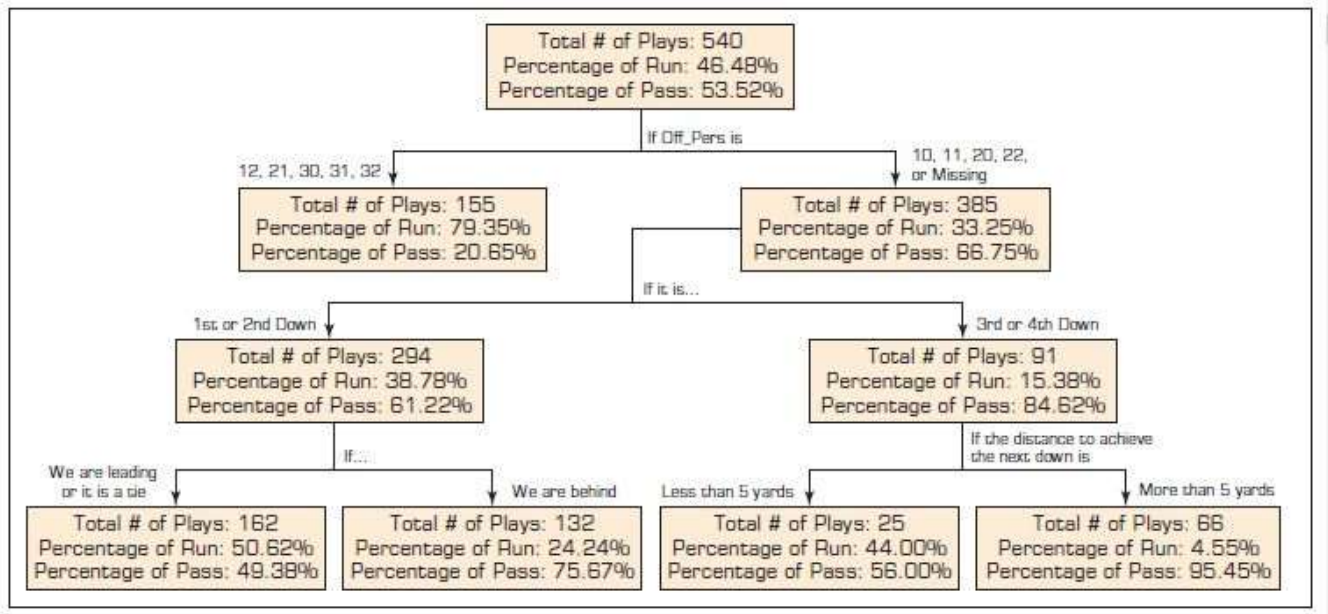
Example 2: The Coach

- Aim: To win the game!
- Questions:
  - *Q1: Who to recruit?*
  - *Q2: What drills help develop their skills?*
  - *Q3: How hard to push the athletes?*
  - *Q4: Where are opponents strength / weakeness?*

Example 2: The coach (cont.)

- **Techniques**:
  - Build decision tree model to predict the next play (fig 1.3).

The goal of this model is to **predict whether the next play will be a run or pass**, based on historical data (540 plays in total).



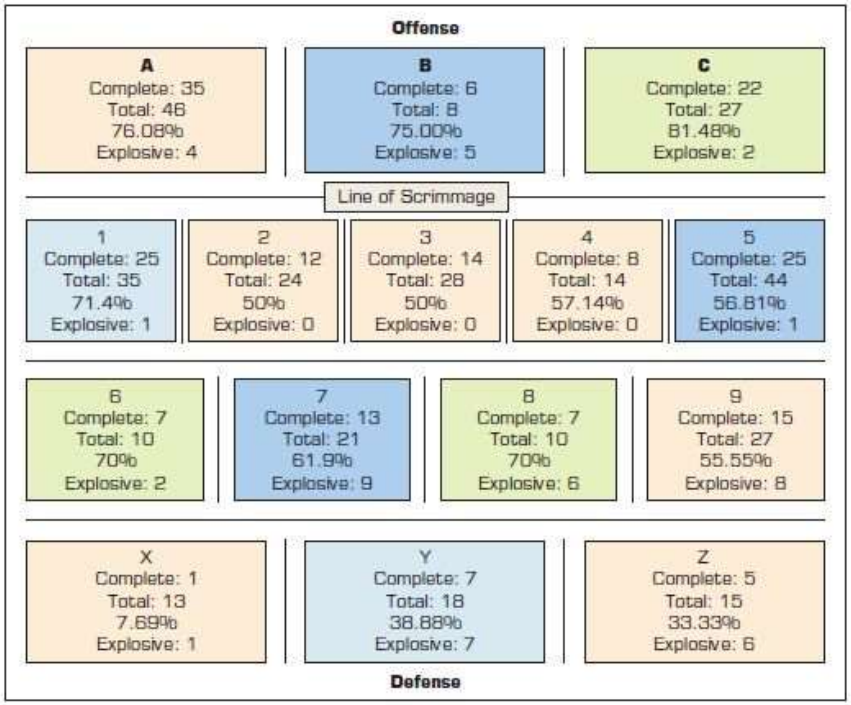
Source: Cascaded Decision Tree for Run or Pass Plays [1, Fig. 1.3]

Decision trees help identify patterns in historical data.
e.g., “Should a coffee shop open a new branch? Use data like time, customer flow, location.”

Example 2: The coach (cont.)

A **heat map** is a data visualization tool that uses **color to represent values.** The **purpose** of using heat maps is to make it **easy to identify patterns, trends, and outliers** in large datasets.

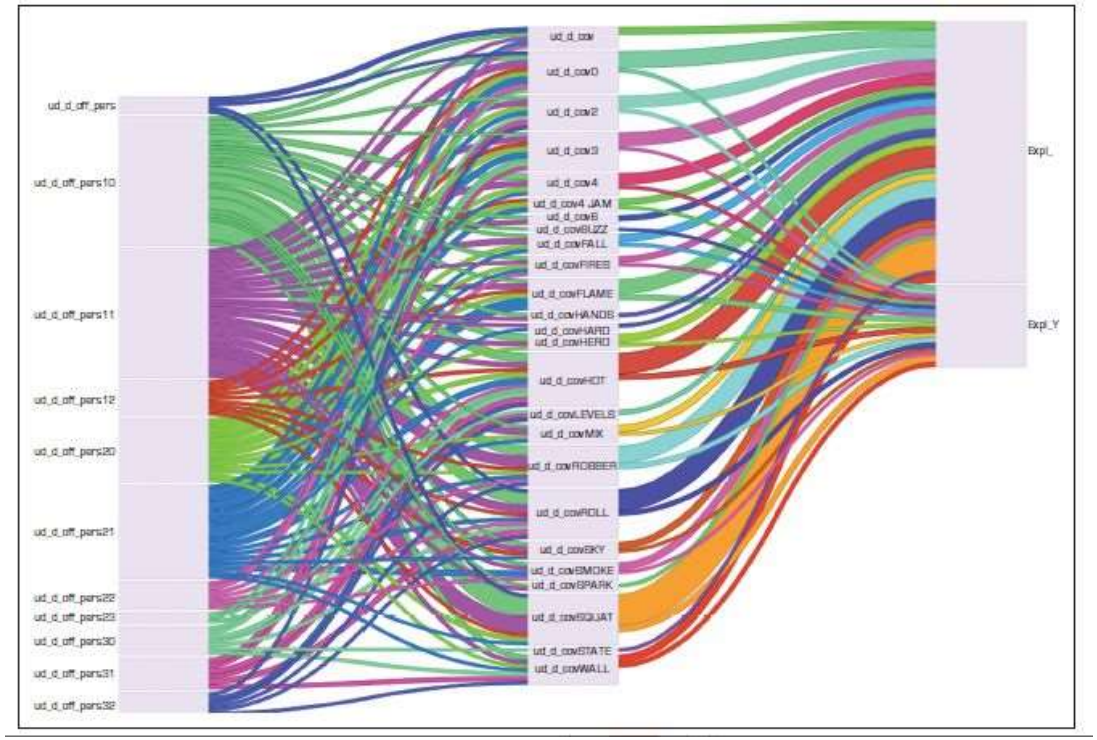
- **Techniques**:
  - Build heat maps of opponent's passing offense (fig 1.4).



Source: Heat Map Zone Analysis for Passing Plays [1, Fig. 1.4]

Example 2: The coach (cont.)

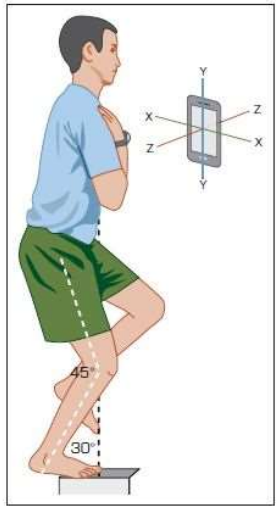
- **Techniques**:
- Build time series analysis on explosive plays as a gain of more than 16 yards for a passing play or more than 12 yards for a run play (fig 1.5).



Source: Time Series Analysis of Explosive Plays [1, Fig. 1.5]

Example 3: The Trainer

- Aim: To take care about player's well-being so that he/she is ready for the game
- Questions:
  - *Q1: Predict or prevent player injuries.*
- **Tools**:
  - Wearable, e.g.
    - Vest with sensors (measure body temperature, respiration rates, etc)
    - Sleep sensor



Source: Single Leg Squat Hold Test - Core Body Strength Test [1, Fig. 1.7]

Quick summary

- Collect Data → Analyze → Decisions → Actions
- Other application areas of BI:
  - Education
    - https://ieeexplore.ieee.org/abstract/document/8696019
  - Healthcare
    - https://www.sciencedirect.com/science/article/abs/pii/S0040162516306382
  - Organization in general
    - https://www.sciencedirect.com/science/article/abs/pii/S0306457321002090
  - Production/manufacturing
    - https://link.springer.com/chapter/10.1007/978-3-030-37218-7_31
  - Etc.
- Additional leisure reading:
  - Liang, T.P. and Liu, Y.H., 2018. Research landscape of business intelligence and big data analytics: A bibliometrics study. *Expert Systems with Applications*, *111*, pp.2-10.
    - Brief: *Review academic literature associated with "Big Data" and "Business Intelligence" to explore the development and research trends.*

Business Objective

Data Requirement

Data Collection

Exploratory Data Analysis

Data science process

Modeling

Evaluation

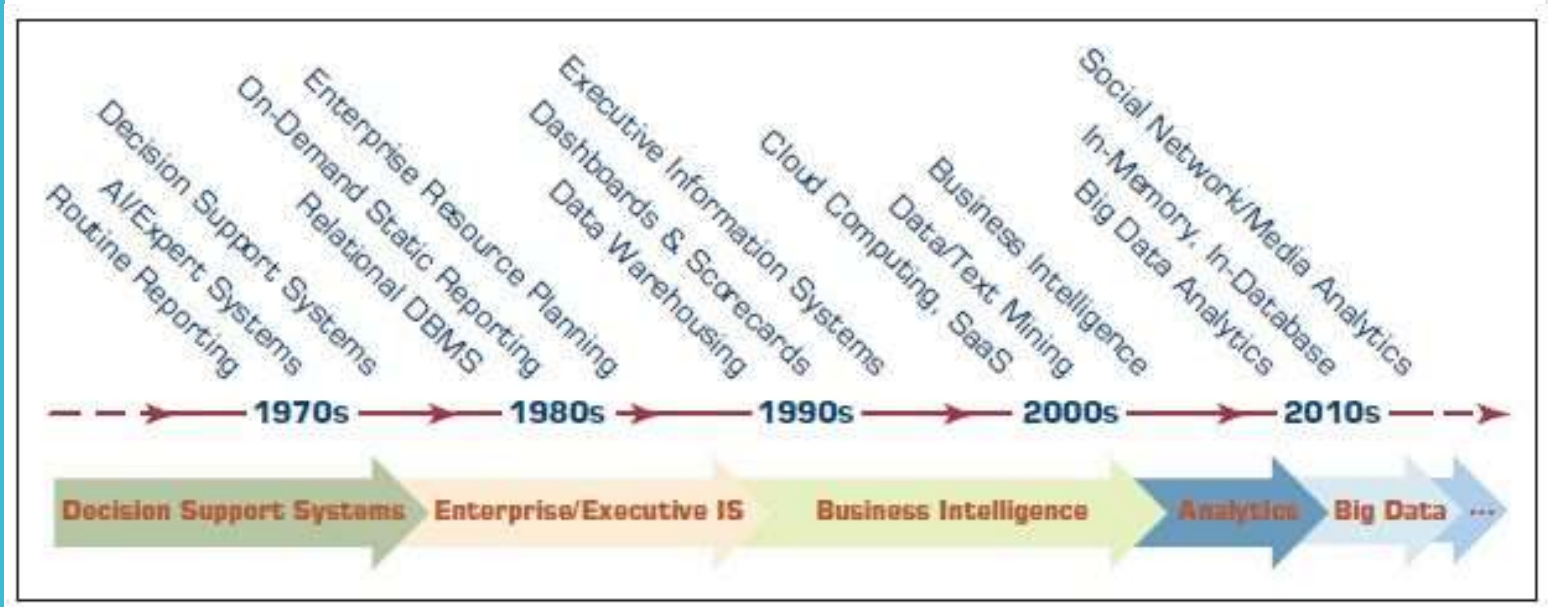
Deployment

Monitoring

Factors driving BI

- Increased hardware, software, and network capabilities
- Group communication and collaboration
- Improved data management
- Managing giant data warehouses and big data
- Analytical support
- Overcoming cognitive limits in processing and storing information
- Knowledge management
- Anywhere, anytime support

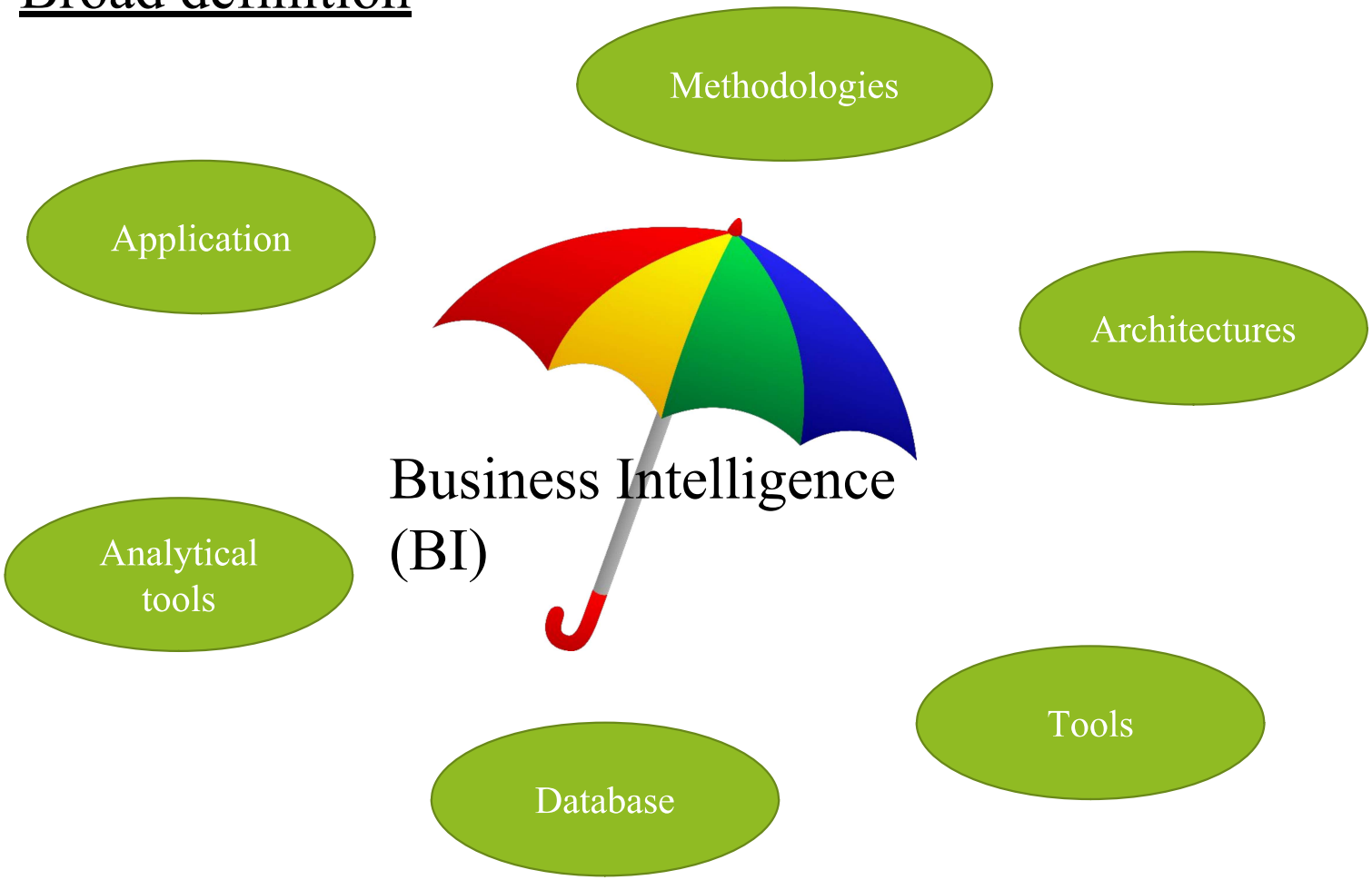
Evolution of Decision Support, BI and Analytics



Source: Evolution of Decision Support, BI, and Analytics [1,fig 1.8]

A Framework for BI

Broad definition



A Framework for BI (cont.)

Narrow definition

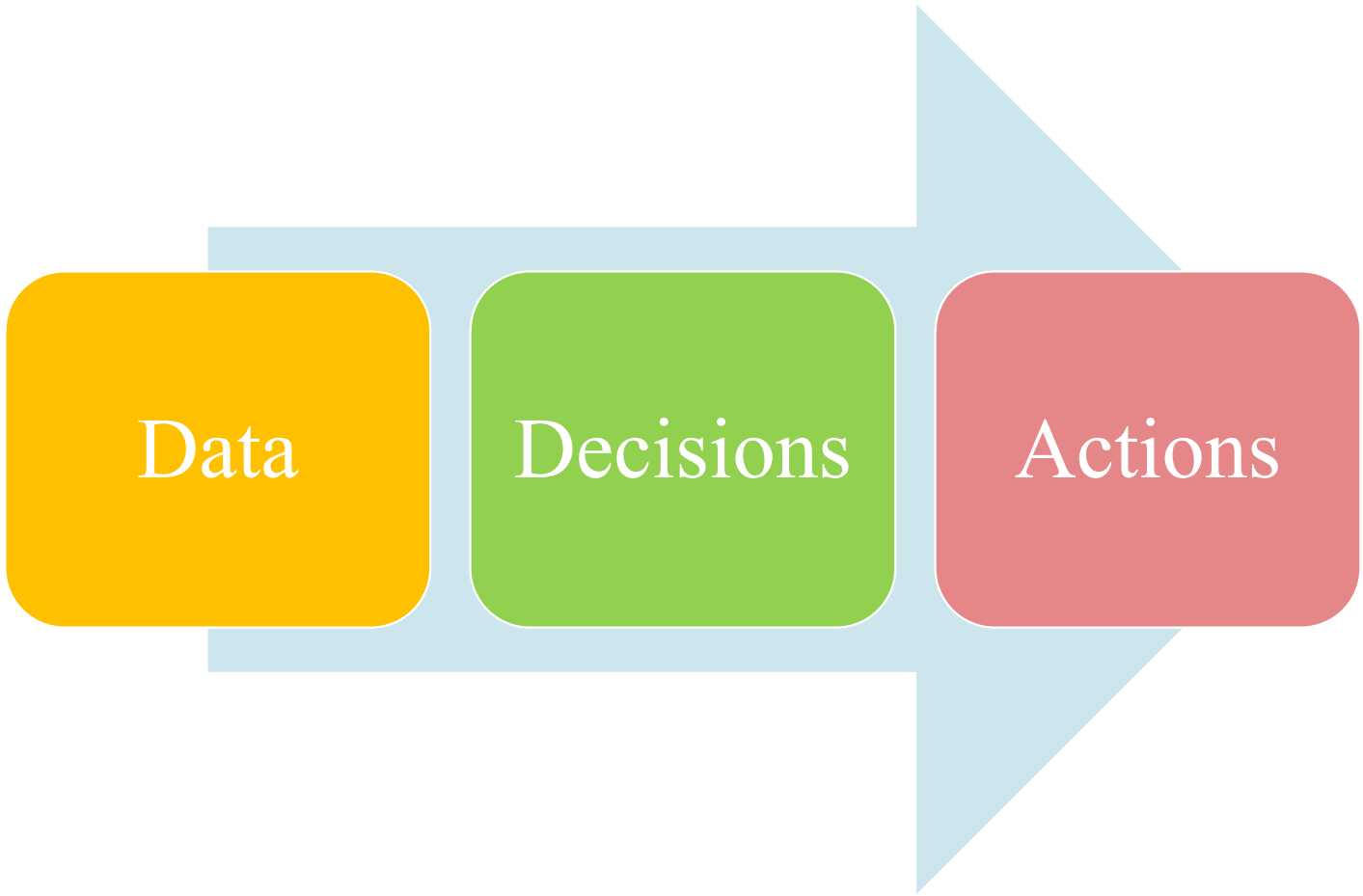
- Descriptive analytics tools and techniques (i.e., reporting tools)

A Framework for BI (cont.)

- Main aims of BI:
  - Enable interactive access (sometimes real-time) to data
  - Enable manipulation of data
  - Allow business managers or analyst to conduct appropriate analysis for better decision making

**more points explained in extra notes

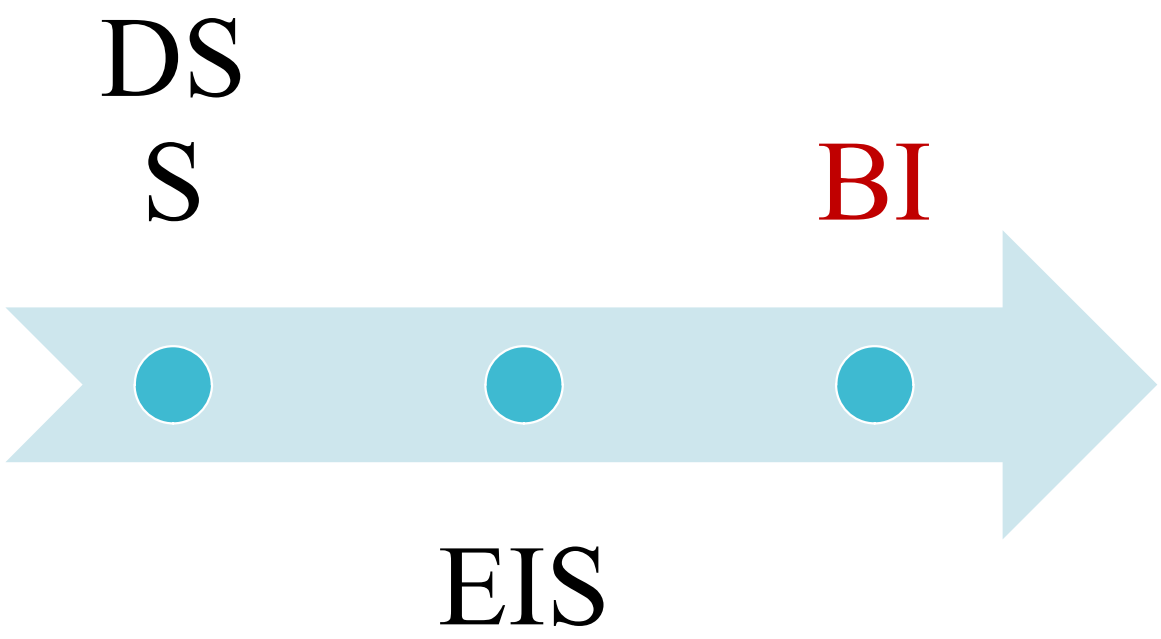
Process of BI



A brief history of BI

Era	Comments
1970s	Has its roots in the MIS reporting system Reporting systems were static, 2D, no analytical capabilities
1980s	The concept of EIS emerged Then expanded the computerized support to top-level managers and executives System capabilities included • Dynamic multidimensional reporting • Forecasting and prediction • Trend analysis • Drill-down • Etc
Mid 1990s	• The capabilities in 1980s have been more widely adopted.
By 2005	• BI includes AI capabilities and powerful analytical capabilities

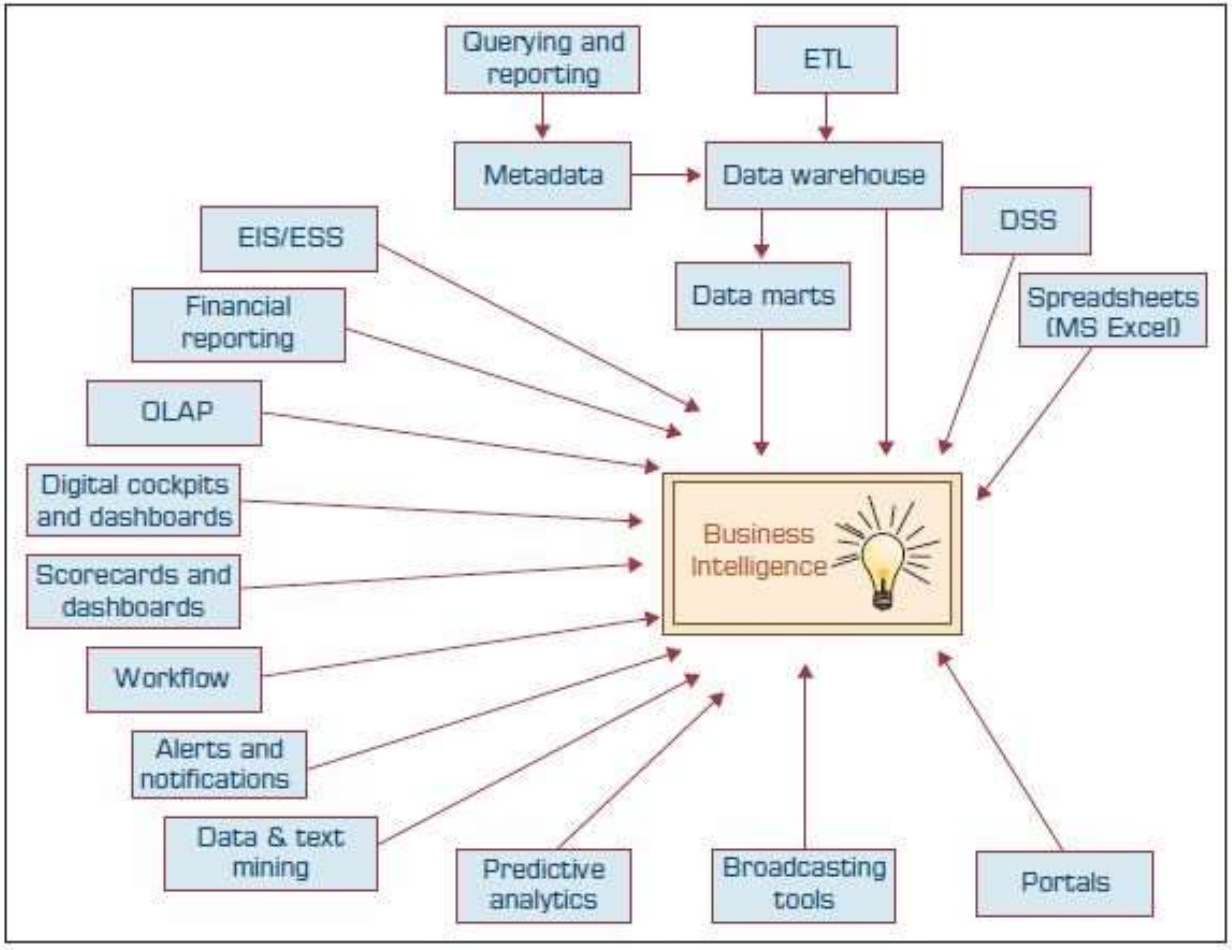
A brief history of BI (cont.)



Summary

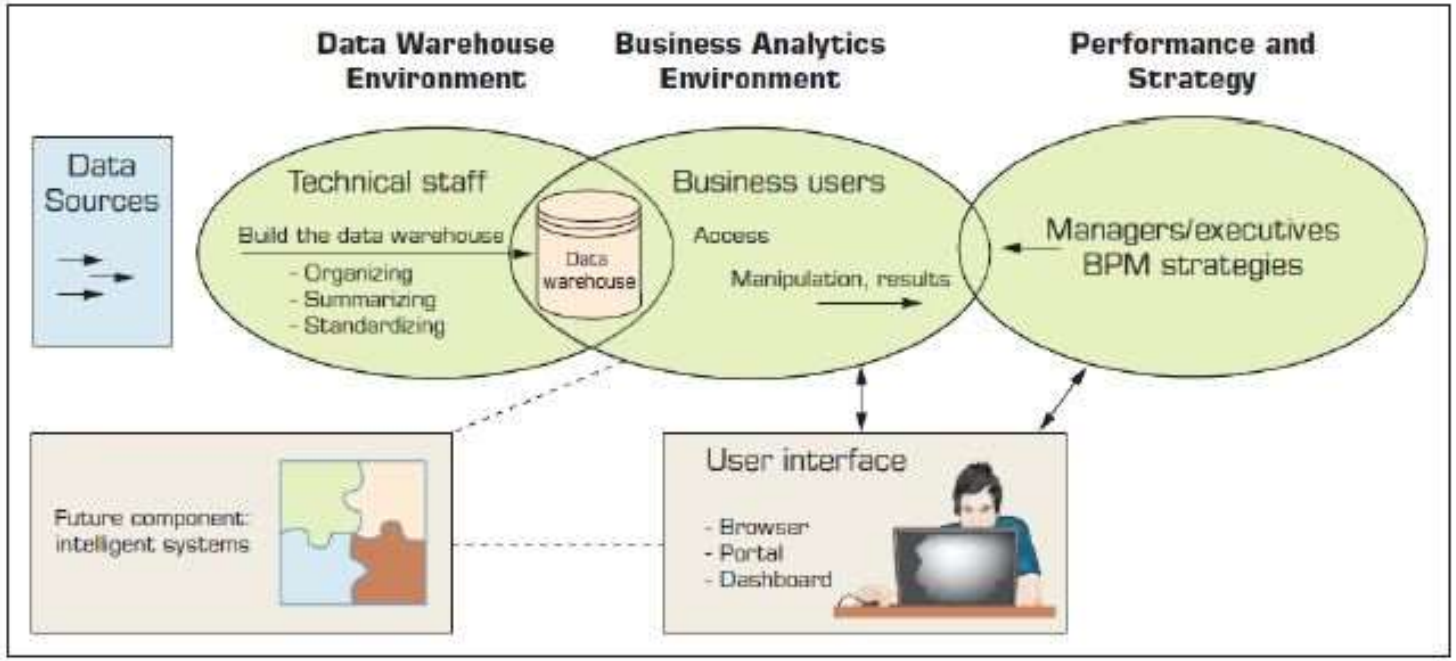
Feature	DSS	EIS	BI
Purpose	To help decision-makers make better decisions	To provide senior executives with a summarized view of the business	To collect, analyze, and interpret data for business decision-making
Target audience	Middle managers and other decision-makers	Senior executives	Businesses of all sizes
Tools	Data analysis, modeling, visualization	Data analysis, visualization	Data mining, data warehousing, predictive analytics
Capabilities	Semi-structured and unstructured decision-making	Structured decision-making	Structured, semi-structured, and unstructured decision-making

Tools and techniques in BI and their evolutions



Source: Evolution of BI and its tools and techniques [1, fig.1.9]

The Architecture of BI



Source: A high-level architecture of BI [1, fig. 1.10]