

# **Analytics, Data Science and AI: Systems for Decision Support**

**Eleventh Edition, Global Edition**



## **Analytics, Data Science, & Artificial Intelligence *Systems for Decision Support***

ELEVENTH EDITION

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## **Chapter 1**

**Overview of Business Intelligence,  
Analytics, Data Science, and  
Artificial Intelligence: Systems for  
Decision Support**

# Learning Objectives

- 1.1 Understand the need for computerized support of managerial decision making.
- 1.2 Understand the development of systems for providing decision-making support.
- 1.3 Recognize the evolution of computerized support.
- 1.4 Describe the business intelligence (BI) methodology and concepts.
- 1.5 Understand the different types of analytics.
- 1.6 Understand the basic concepts of artificial intelligence (AI).

# Organizational Decisions

## 4 groups of organizational decisions:

- Big-bet, high-risk decisions.
- Cross-cutting decisions, which are repetitive but high risk that require group work.
- Ad hoc decisions that arise episodically.
- Delegated decisions to individuals or small groups.

# Decision Making Process (1 of 2)

The four step managerial process:

- Define the problem
- Construct a model
- Identify and evaluate possible solutions
- Compare, choose, and recommend a solution to the problem

# Decision Making Process (2 of 2)

A more detailed process is offered by Quain (2018):

1. Understand the decision you have to make.
2. Collect all the information.
3. Identify the alternatives.
4. Evaluate the pros and cons.
5. Select the best alternative.
6. Make the decision.
7. Evaluate the impact of your decision.

# The Influence of the External and Internal Environments on the Process

- Technology, IS, Internet, globalization, ...
  - More alternative
- Government regulations, compliance, ...
  - Political factors
  - Economic factors
  - Social and psychological factors
  - Environment factors
  - Increases uncertainties and making it difficult to predict consequences.
- Need to make rapid decision, changing market conditions, ...

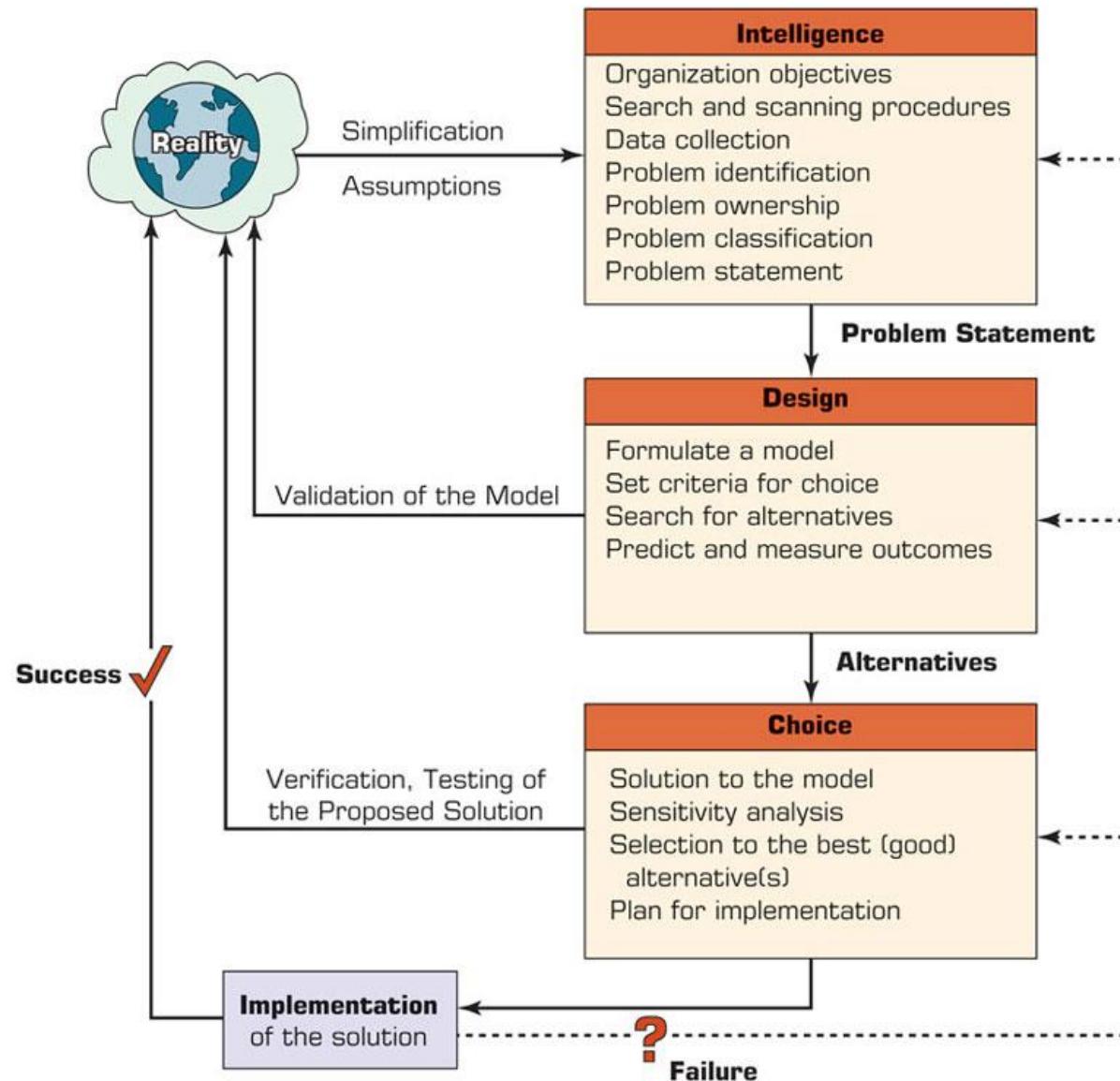
# Technologies for Data Analysis and Decision Support

- Group communication and collaboration
- Improved data management
- Managing giant data warehouses and Big Data
- Analytical support
- Overcoming cognitive limits
- Knowledge management
- Anywhere, anytime support
- Innovation and artificial intelligence

# Decision-making Processes And Computerized Decision Support Framework

- **What is “Decision making”?**
  - The process of choosing among two or more alternative courses of action for the purpose of attaining one or more goals.
- **Simon’s Decision Making Process**
  - Proposed in 1977 by Herbert Alexander Simon (an American economist and political scientist)
  - Includes three phases:
    1. Intelligence
    2. Design
    3. Choice
  - [+] Implementation
  - [+] Monitoring

# The Decision-Making Process



Optimize (Max. or Min.)  $Z = C_1 X_1 + C_2 X_2 + \dots + C_n X_n$

Subject to the linear constraints

$$a_{11} X_1 + a_{12} X_2 + \dots + a_{1n} X_n (\leq, =, \geq) b_1$$

$$a_{21} X_1 + a_{22} X_2 + \dots + a_{2n} X_n (\leq, =, \geq) b_2$$

$$\vdots \quad \vdots \quad \vdots$$

$$\vdots \quad \vdots \quad \vdots$$

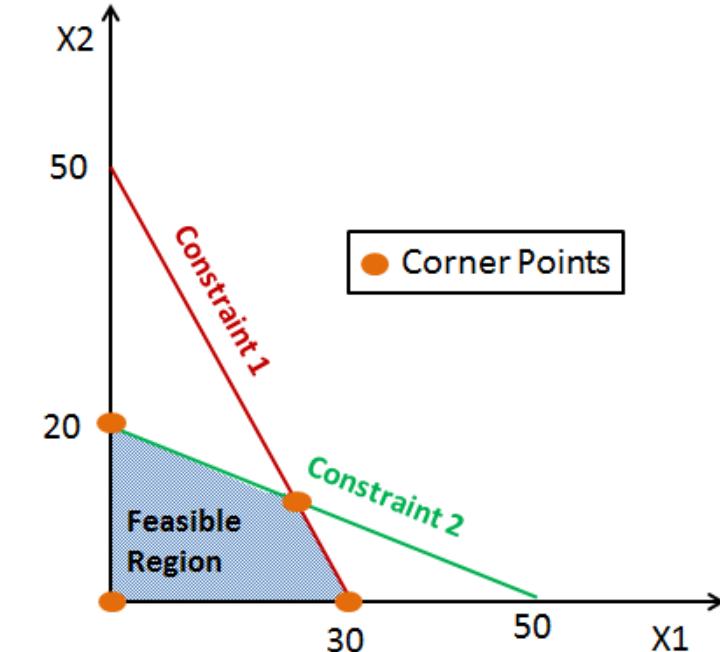
$$a_{m1} X_1 + a_{m2} X_2 + \dots + a_{mn} X_n (\leq, =, \geq) b_m$$

and  $X_1, X_2, \dots, X_n \geq 0$   $\longrightarrow$  Non negativity constraints

$C_j$ 's are coefficients representing the per unit profit.

$X_j$ : It is called decision variables.

$a_{ij}$ 's are input-output coefficients,  $b_i$  is called Resources



$$Y = a + bX$$

$$b = \frac{N \sum XY - (\sum X)(\sum Y)}{N \sum X^2 - (\sum X)^2} \quad a = \frac{\sum Y - b \sum X}{N}$$

Where,

N = number of observations, or years

X = a year index (decade)

Y = population size for given census years

# Decision-making Processes (1 of 2)

## Phase 1 - The Intelligence Phase: Problem (or Opportunity) Identification

- Issues in data collection
- Problem classification
- Problem decomposition
- Problem ownership

# Decision-Making Processes (2 of 2)

## Phase 2 - The Design Phase

- Models

## Phase 3 - The Choice Phase

- Evaluating alternatives

## Phase 4 - The Implementation Phase

- Implementing the solution

## Phase 5 – Monitoring

- Phase 4 and 5 were not part of Simons' original model

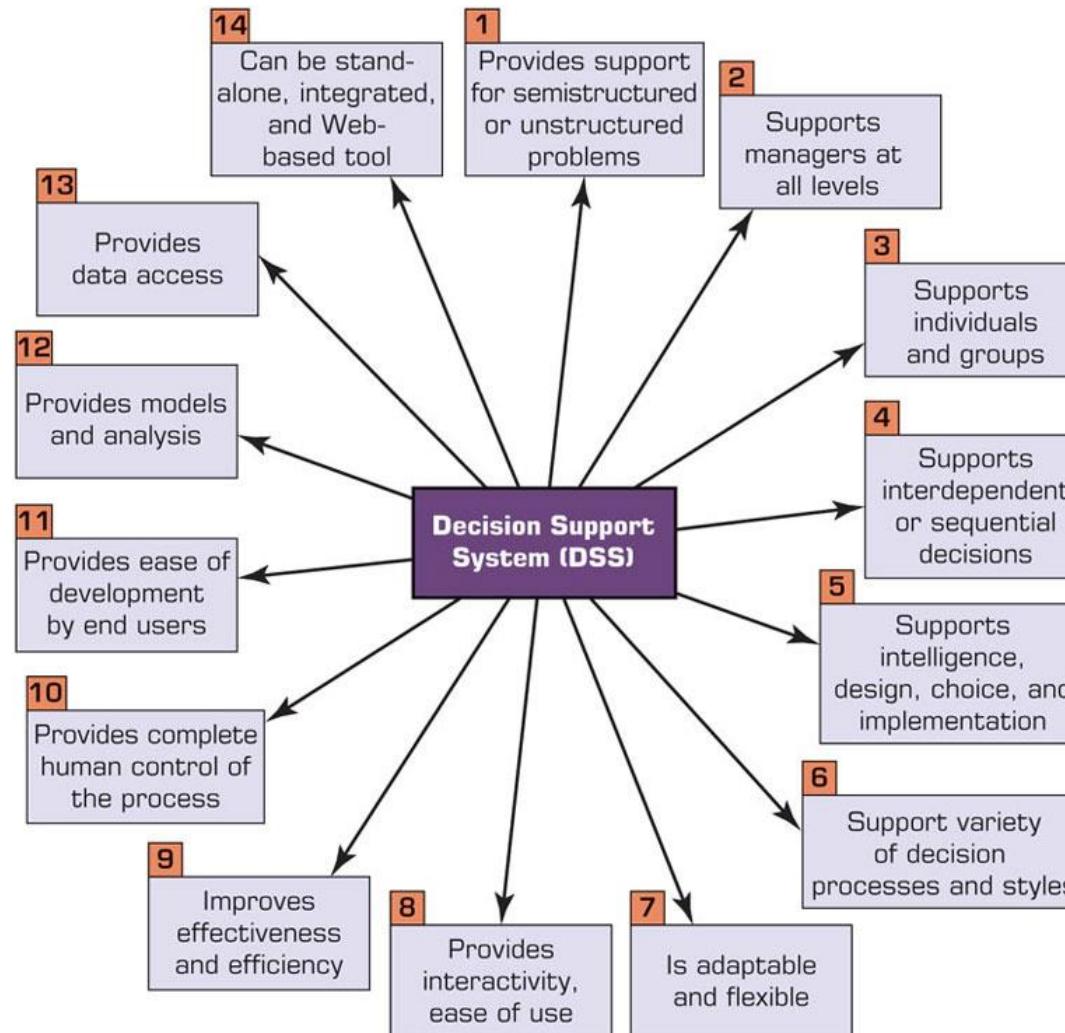
# The Classical Decision Support System Framework

- Degree of structuredness
  - Structured, unstructured, semistructured problems
- Type of control
  - Operational, managerial, strategic
- The decision Support matrix
- Computer support for ...
  - Structured decisions
  - Unstructured decisions
  - Semistructured problems

# Decision Support Framework

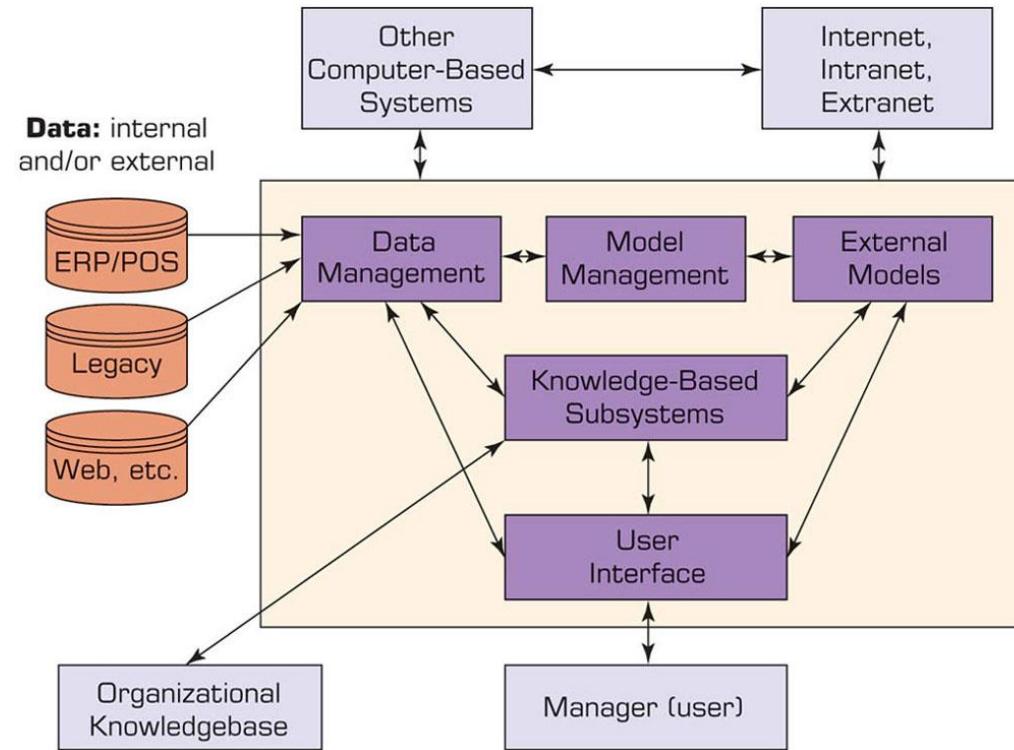
Type of Decision	Type of Control		
	Operational Control	Managerial Control	Strategic Planning
<b>Structured</b>	1 Monitoring accounts receivable Monitoring accounts payable Placing order entries	2 Analyzing budget Forecasting short-term Reporting on personnel Making or buying	3 Managing finances Monitoring investment portfolio Locating warehouse Monitoring distribution systems
<b>Semistructured</b>	4 Scheduling production Controlling inventory	5 Evaluating credit Preparing budget Laying out plant Scheduling project Designing reward system Categorizing inventory	6 Building a new plant Planning mergers and acquisitions Planning new products Planning compensation Providing quality assurance Establishing human resources policies Planning inventory
<b>Unstructured</b>	7 Buying software Approving loans Operating a help desk Selecting a cover for a magazine	8 Negotiating Recruiting an executive Buying hardware Lobbying	9 Planning research and development Developing new technologies Planning social responsibility

# Key Characteristics and Capabilities of Decision Support System (DSS)



# Components of a DSS (1 of 2)

- The Data Management System
  - DSS database
  - Database management system (DBMS)
  - Data directory
  - Query facility

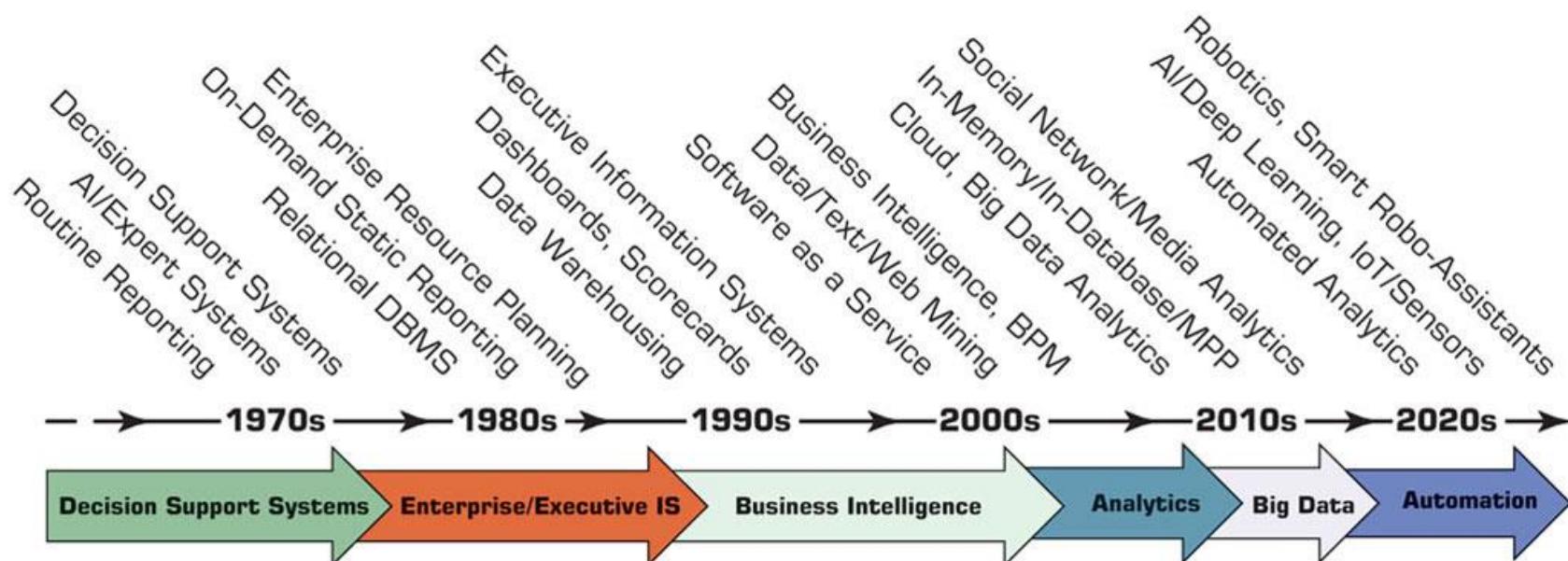


# Components of a DSS (2 of 2)

- The Model Management Subsystem
  - Model base
  - MBMS
  - Modeling language
  - Model directory
  - Model execution, integration, and command processor
- The User Interface Subsystem
- The Knowledge-Based Subsystem

# Evolution of Computerized Decision Support to Business Intelligence, Analytics, Data Science

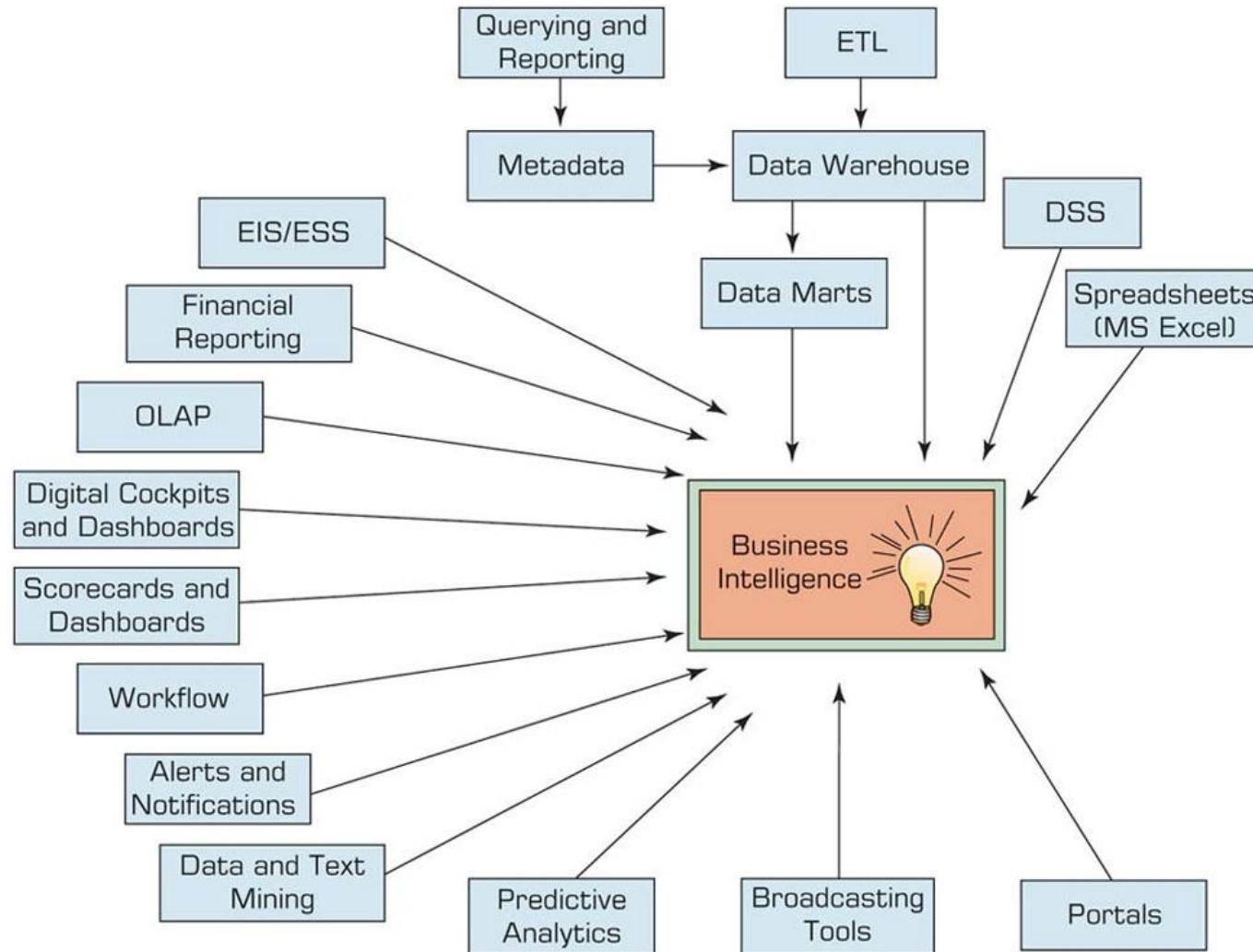
**Figure 1.5** Evolution of Decision Support, Business Intelligence, Analytics, and AI.



# A Framework for Business Intelligence

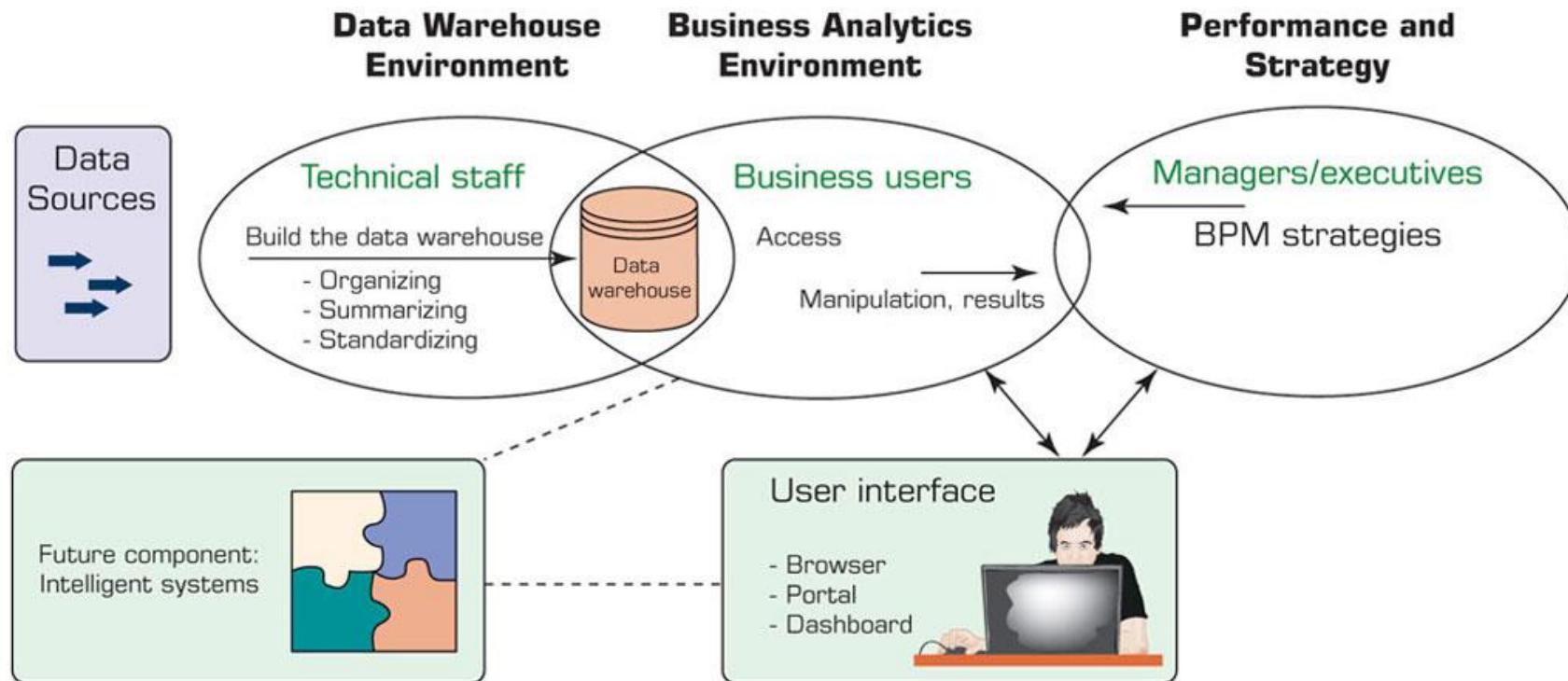
- Definitions of business intelligence (BI):
  - combines architectures, tools, databases, analytical tools, applications, and methodologies.
- The architecture of BI
  - Data warehousing (DW) [as a foundation of BI]
  - Business performance management (BPM)
  - User interface (dashboard)
- Transaction processing versus analytics processing
- Appropriate planning and alignment of BI with the business strategy

# Evolution of Business Intelligence (BI)



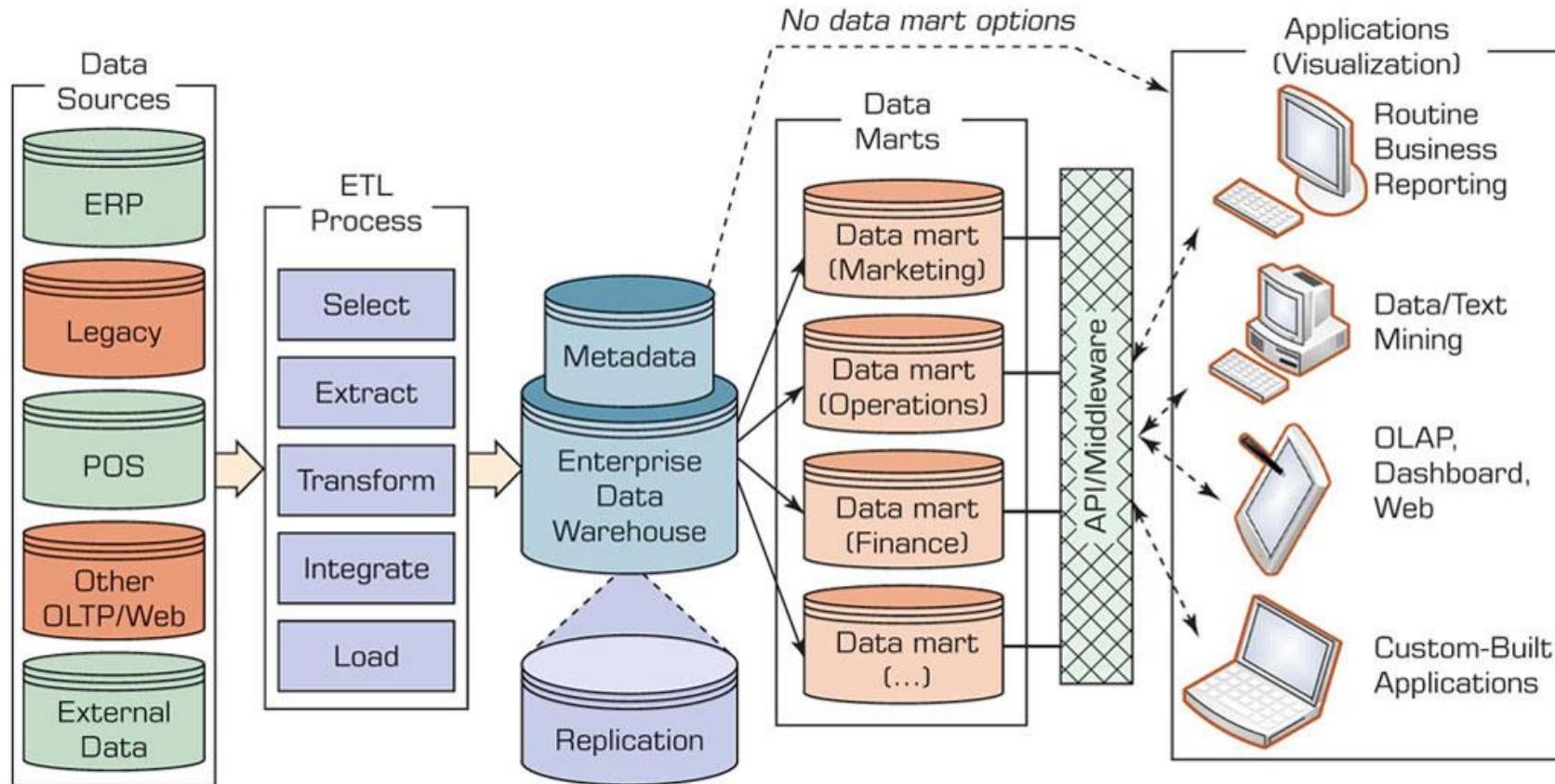
# The Origins and Drivers of BI

Figure 1.7 A High-Level Architecture of BI.



Source: Based on W. Eckerson. (2003). *Smart Companies in the 21st Century: The Secrets of Creating Successful Business Intelligent Solutions* Seattle, WA: The Data Warehousing Institute, p. 32, Illustration 5.

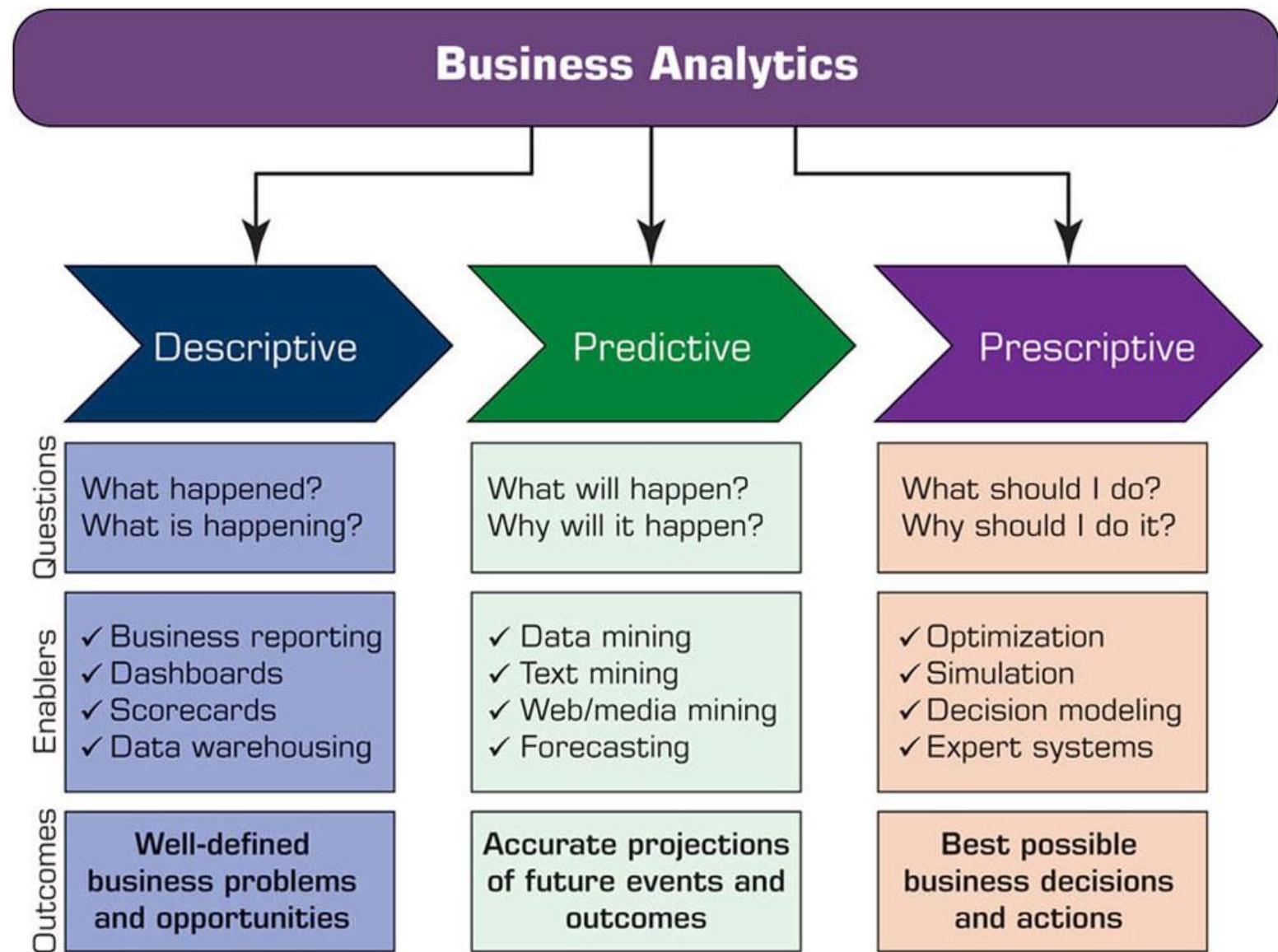
# Data Warehouse Framework



# Analytics Overview (1 of 2)

## Analytics:

- The process of developing actionable decisions or recommendations for actions based on insights generated from historical data.
- = computer tech + management science + statistics



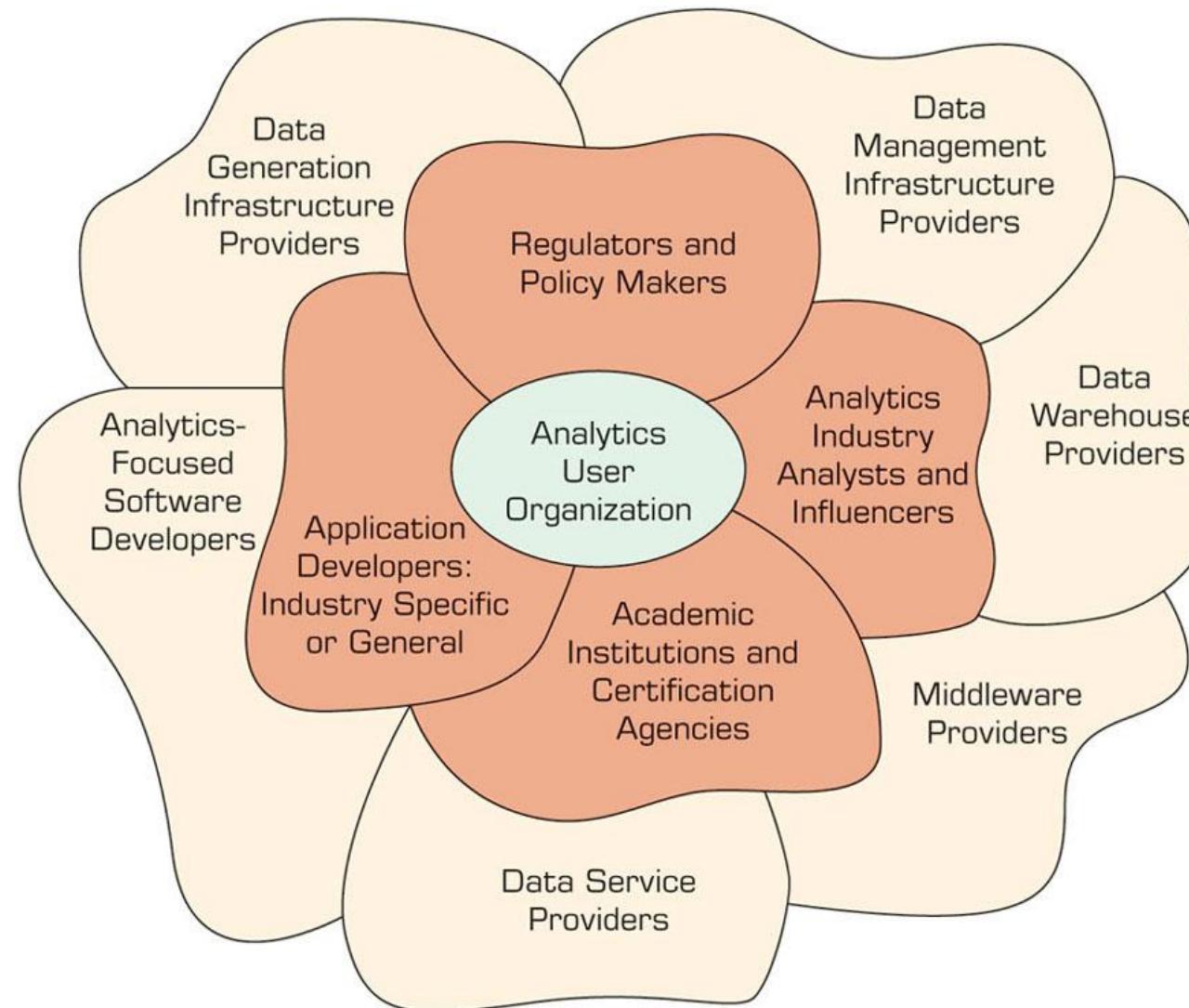
# Analytics Overview (2 of 2)

- Three types of analytics
  - Descriptive (or reporting) analytics ...
  - Predictive analytics ...
  - Prescriptive analytics ...
- Analytics applied to different domains
- Analytics or data science?
- What is Big Data?
  - Big Data typically refers to data that come in many different forms: structured, unstructured, in a stream, and so forth.
  - Data can't be stored in a single storage unit.
  - 3 V's = Velocity + Variety + Volume.

# Artificial Intelligence Overview

- What Is artificial intelligence (AI)?
  - Technology that can learn to do things better over time.
  - Technology that do tasks currently done by human.
    - Reasoning, thinking, learning, and problem solving.
  - Technology that can answer questions.
- The major benefits of AI
  - Reduction in the cost of performing work.
  - Work can be performed much faster.
  - Work is more consistent than human work.
  - Increased productivity, profitability, ...

# Overview of Analytics Ecosystem



# Q & A