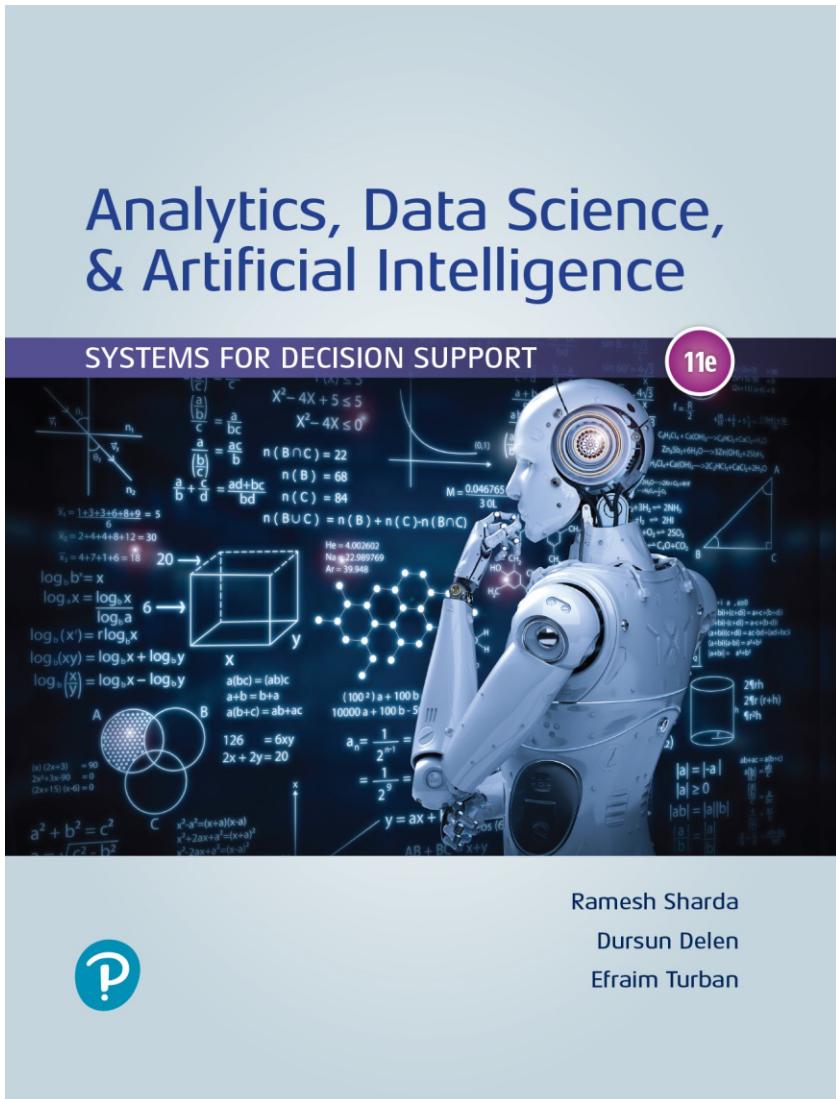


Analytics, Data Science and AI: Systems for Decision Support

Eleventh Edition



Chapter 1

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

Learning Objectives (1 of 2)

- 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 such computerized support to the current state of analytics/data science and artificial intelligence.
- 1.4** Describe the business intelligence (BI) methodology and concepts.
- 1.5** Understand the different types of analytics and review selected applications.

Learning Objectives (2 of 2)

- 1.6 Understand the basic concepts of artificial intelligence (AI) and see selected applications.
- 1.7 Understand the analytics ecosystem to identify various key players and career opportunities.

Changing Business Environments And Evolving Needs For Decision Support And Analytics

- 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

What actions or steps do you take when trying to make a decision?

Decision Making Process

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

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.



Decision Making Process

What are some of the factors
that might impact your
decision making process?

The Influence of the External and Internal Environments on the Process

- Technology, IS, Internet, globalization, ...
- Government regulations, compliance, ...
 - Political factors
 - Economic factors
 - Social and psychological factors
 - Environment factors
- Need to make rapid decision, changing market conditions,
...

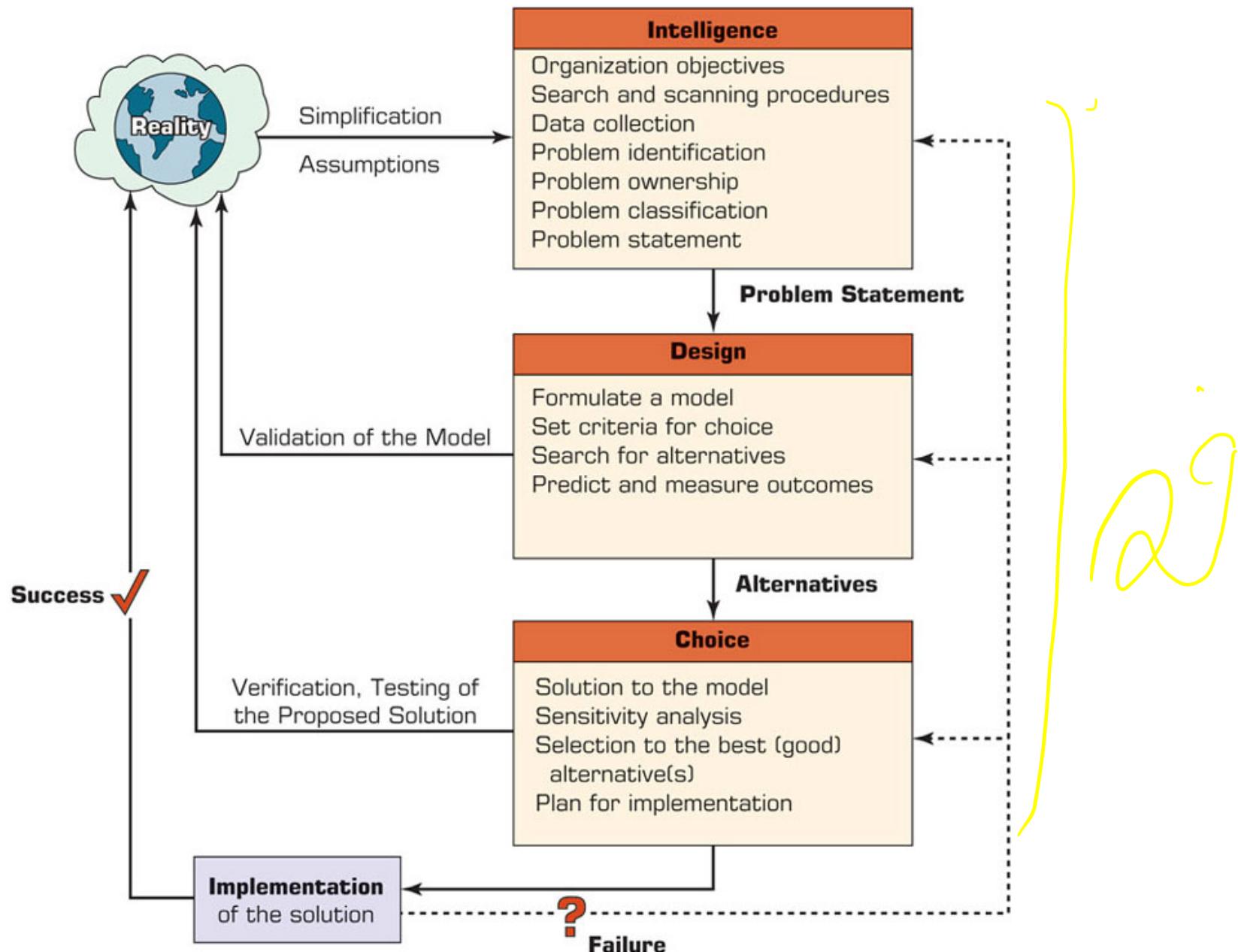
Decision-making Processes And Computerized Decision Support Framework

- What is “Decision making”?

Is a 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
 4. [+] Implementation
 5. [+] Monitoring

The Decision-Making Process



The Classical Decision Support System Framework



Degree of structuredness

- Structured, unstructured, semi-structured problems



Type of control

- Operational, managerial, strategic



The decision Support matrix



Computer support for ...

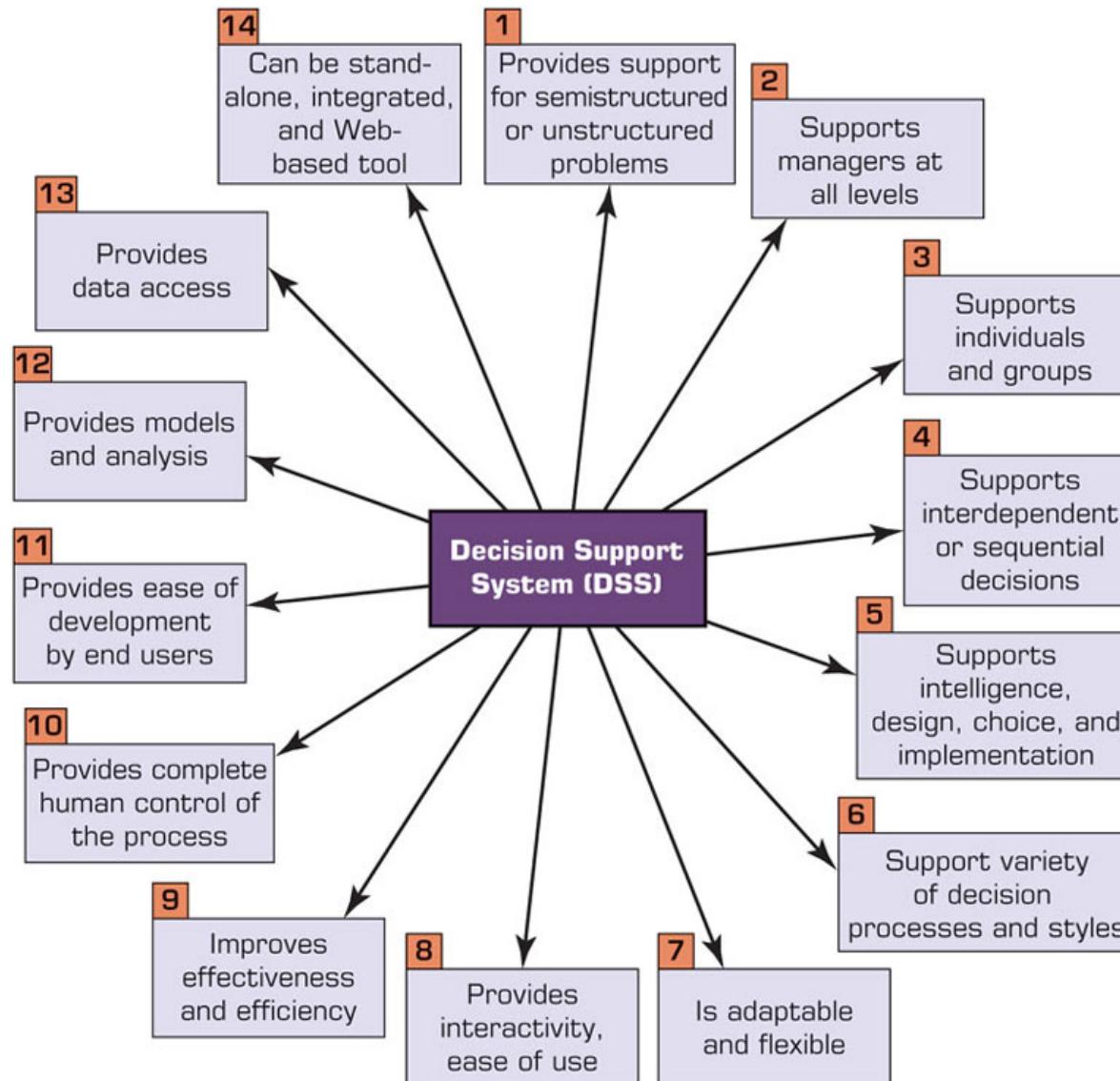
- Structured decisions
- Unstructured decisions
- Semi-structured problems

Decision Support Framework

Type of Decision	Type of Control		
	Operational Control	Managerial Control	Strategic Planning
Structured	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
Semistructured	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
Unstructured	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

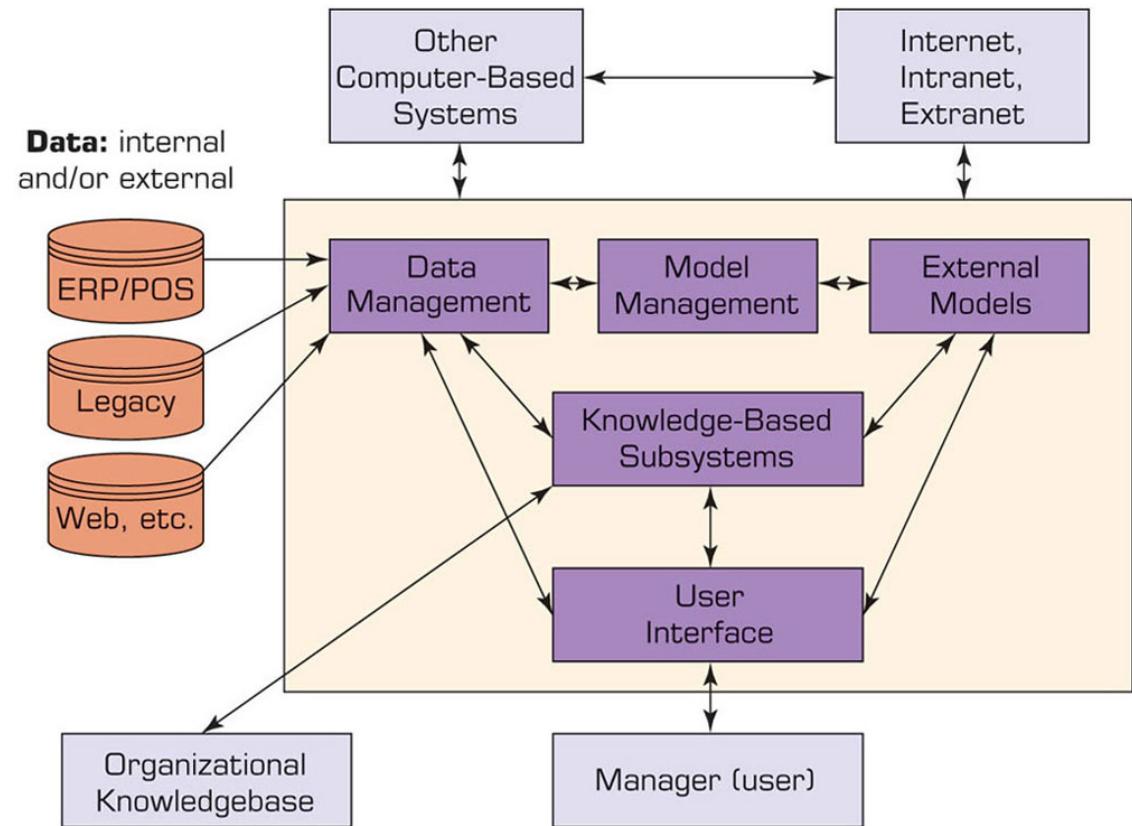


Key Characteristics and Capabilities of Decision Support System (DSS)



Components of a DSS (1 of 2)

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

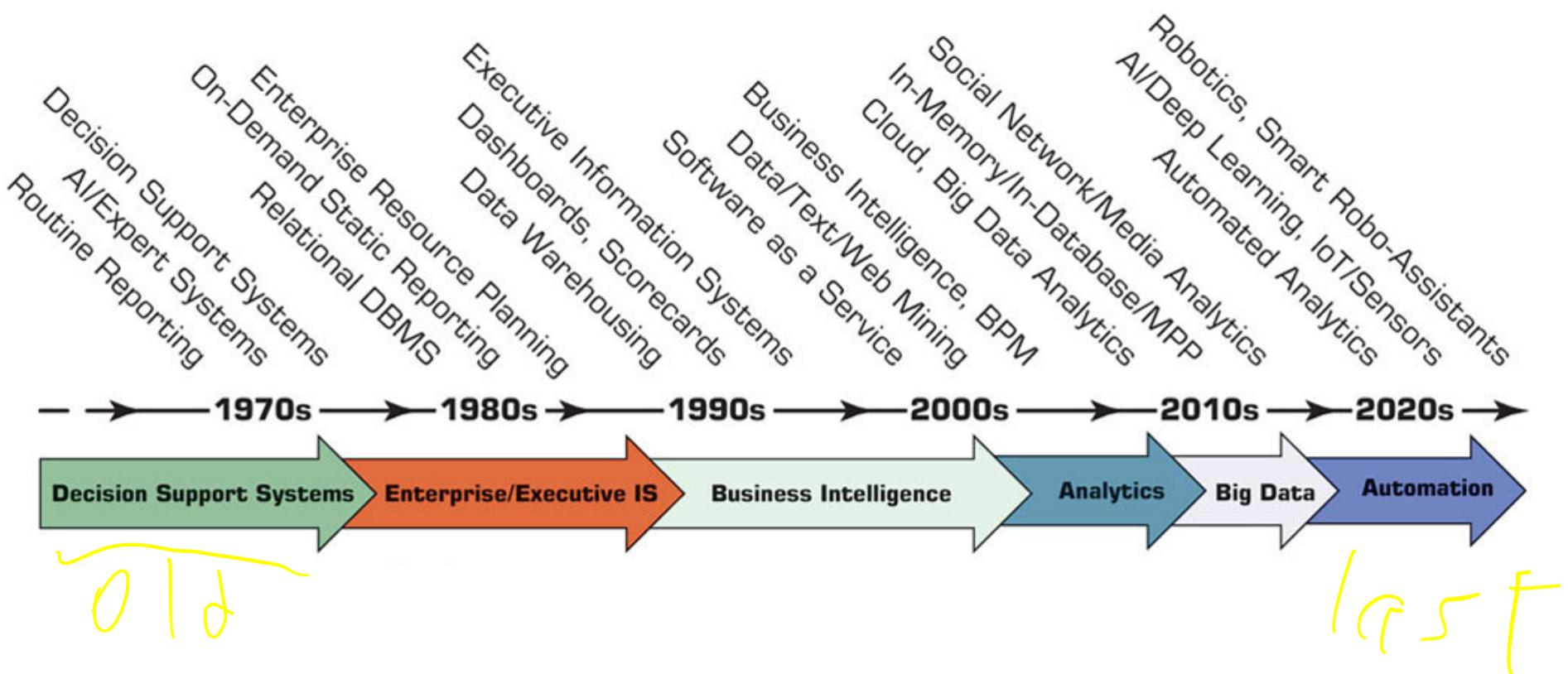


Components of a DSS (2 of 2)

- The Model Management Subsystem
 - Model base
 - MBMS
 - Modelling 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

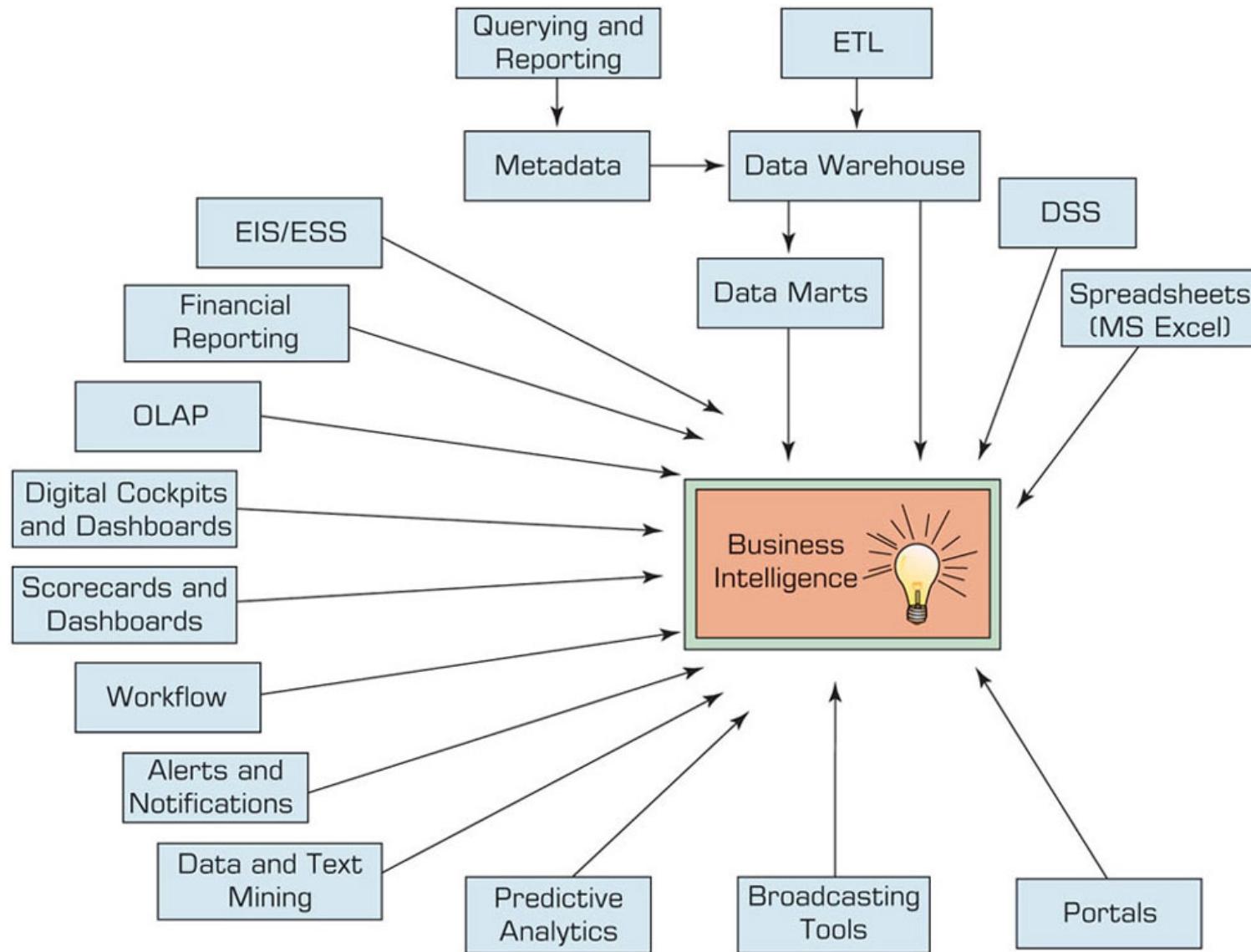
Figure 1.5 Evolution of Decision Support, Business Intelligence, Analytics, and AI.



A Framework for Business Intelligence

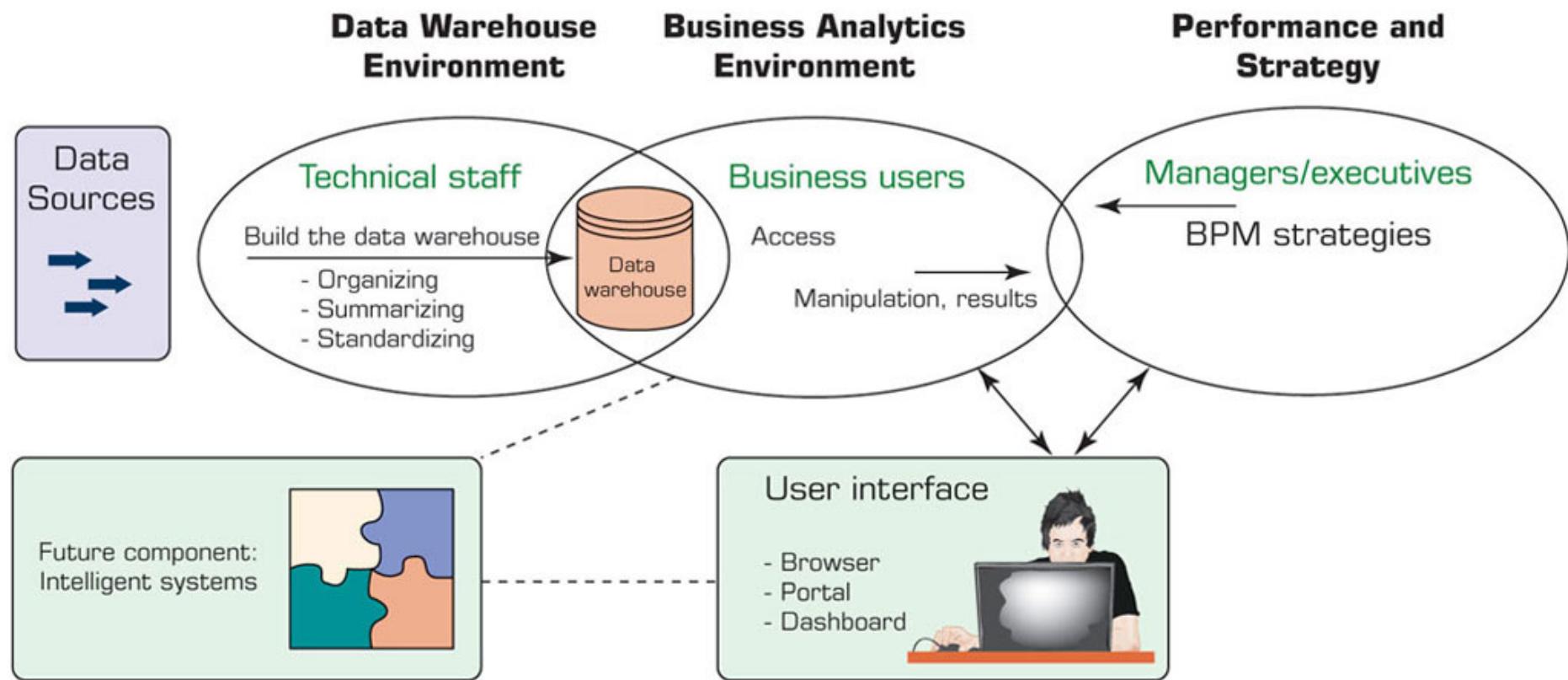
- Definitions of business intelligence (BI)
- A brief history of BI
- The architecture of BI
 - Data warehousing (DW) [as a foundation of BI]
 - Business performance management (BPM)
 - User interface (dashboard)
- Transaction processing versus analytics processing
- Appropriate planning and alignment of BI with the business strategy

Evolution of Business Intelligence (BI)



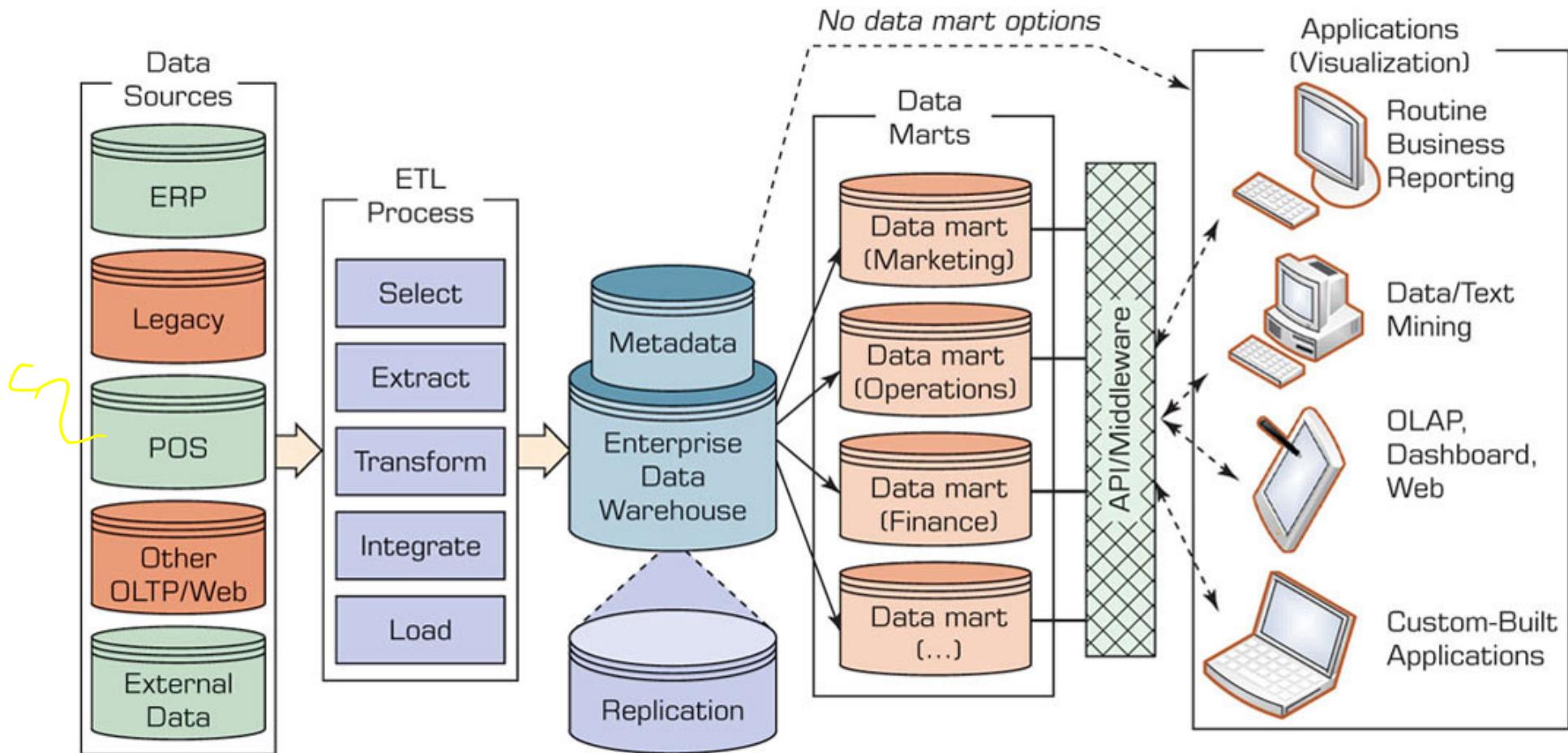
The Origins and Drivers of BI

Figure 1.7 A High-Level Architecture of BI.

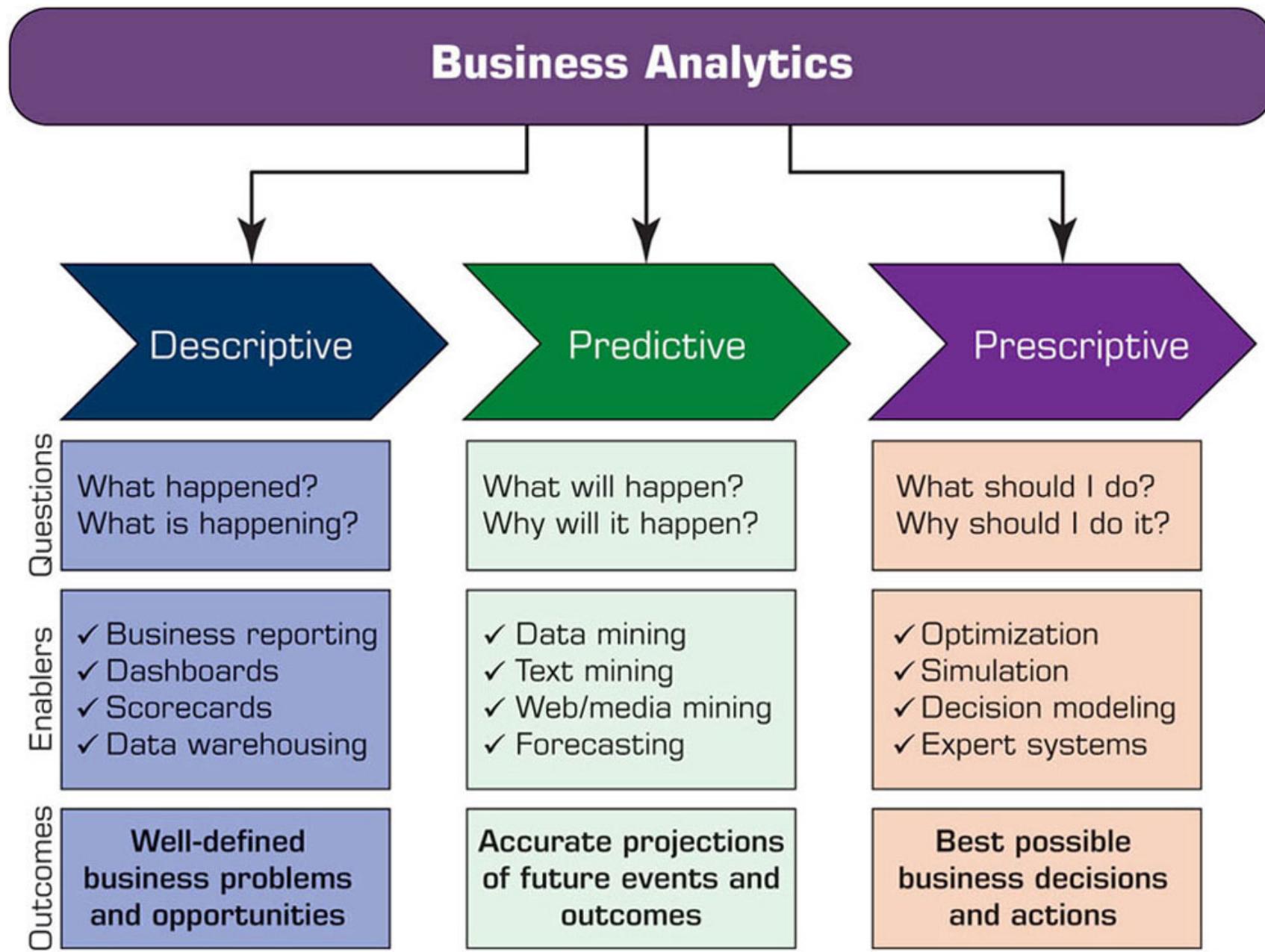


Source: Based on W. Eckerson. (2003). *Smart Companies in the 21st Century: The Secrets of Creating Successful Business Intelligent Solutions* Seattle, WA: The Data Warehousing Institute, p. 32, Illustration 5.

Data Warehouse Framework



Analytics Overview (1 of 2)



Analytics 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?
 - Structured and unstructured data from all types of different sources including IoT, sensors, log files, social media, streaming media, etc.
 - Important related developments:
 - ❑ Hadoop Distributed File System (HDFS)
 - ❑ MapReduce programming paradigm

Artificial Intelligence Overview

What Is artificial intelligence (A I)?

Artificial Intelligence Overview

- What Is artificial intelligence (AI)?
- AI studies the human thought processes while trying to duplicate those processes in machines.
 - Technology that can learn to do things better over time.
 - Technology that can understand human language.
 - Technology that can answer questions.

Artificial Intelligence Overview

- Major Goals of AI are to:
 - Create intelligent machines that can do tasks currently done by humans
 - Learn to do things better over time.
 - Understand human language.
 - Answer questions.

The Landscape of AI

1. Major technologies

- Machine learning, deep learning, intelligent agents.

2. Knowledge-based technologies

- Expert systems, recommendation engines, chatbots, virtual personal assistants, robo advisors.

3. Biometric related technologies

- Natural language processing, image recognition, voice recognition, biometric recognition.

The Landscape of AI

4. Support theories, tools, and platforms

- Theories: CS, cognitive science, linguistics, mathematics, psychology, statistics, etc.
- Tools: Sensors, augmented reality, logic, context awareness, data mining, etc.
- Platforms: IBM, Microsoft, Nvidia, etc.

5. AI applications

- Smart cities, smart homes, autonomous vehicles, automatic decisions, language translation, robotics, fraud detection, content screening, prediction, personalized services, etc.

Narrow (weak) versus general (strong) AI

- Weak AI focuses on one narrow field (domain).
 - ❑ Examples: expert systems in general (specific domain area), SIRI and Alexa (knowledge-based), automated call centers, computer vision, chess, medical diagnosis, equipment failure diagnosis, etc.
- Strong AI exhibit real intelligence, machines perform the full range of human cognitive capabilities.
 - ❑ Basically, ability to replicate humans.
 - ❑ Some applications exist, however, in very narrow domains like autonomous vehicles.

The three flavors of AI decisions

1. Assisted intelligence (weak AI)

- Work only in narrow domains.
- Requires clearly defined inputs and outputs.
- Examples: monitoring systems (like car alerts), virtual assistants (Alexa, Siri), healthcare diagnosis.

The three flavors of AI decisions

2. Autonomous AI

- Systems that are in the realm of strong AI but in very narrow domains.
- Machines will act as experts and have absolute decision making power.
- Examples: Autonomous vehicles, robo-advisors (complete automated investment services based on answered questions).

 <https://www.investopedia.com/terms/r/roboadvisor-roboadviser.asp>

The three flavors of AI decisions

3. Augmented Intelligence (Intelligence Augmentation)

- Between assisted and autonomous AI
- Technology focuses on augmenting computer abilities to extend human cognitive abilities.
- Excel in solving complex human or industry problems in specific domains.
- Provides insights and recommendations including explanations.
- Can offer new solutions by combining existing and discovered information.
- Most AI applications fall in this category.
- Examples: Cybercrime fighting, e-commerce decisions.

Convergence of Analytics and AI

- Based on a Gartner study, 70-80% of analytics initiatives will not meet enterprise objectives.
- High percentage as well for AI on its own.
- What are the major differences between analytics and AI?

Convergence of Analytics and AI

- Analytics is about:
 - ? Computation/Analysis of historical data
 - Big Data
 - Statistics
 - Management Science (mathematical modeling)
- AI is about:
 - ? Imitate the way people think, learn, reason ,make decisions, solve problems
 - Cognitive Computing
 - Knowledge
 - Intelligence

Convergence of Analytics and AI

- Issues (problems) with Analytics:
 - Results of analytics may be good for some applications but not for others
 - Models are as good as their input data and assumptions (garbage-in, garbage-out)
 - Incomplete data
 - Inaccurate data from people
 - Quickly changing environment factors
 - Quality of collected data
- Issues (problems) with AI:
 - Some similar issues as in analytics
 - Need for continuously updated knowledge (i.e., big data)

Convergence of Analytics and AI

- The combination of AI and analytics can help produce much better results.
- AI can process different situations very fast and produce lots of data that can be analyzed via Business Intelligence/Analytics

Example:

- https://www.youtube.com/watch?v=_t-ChKxXACw

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