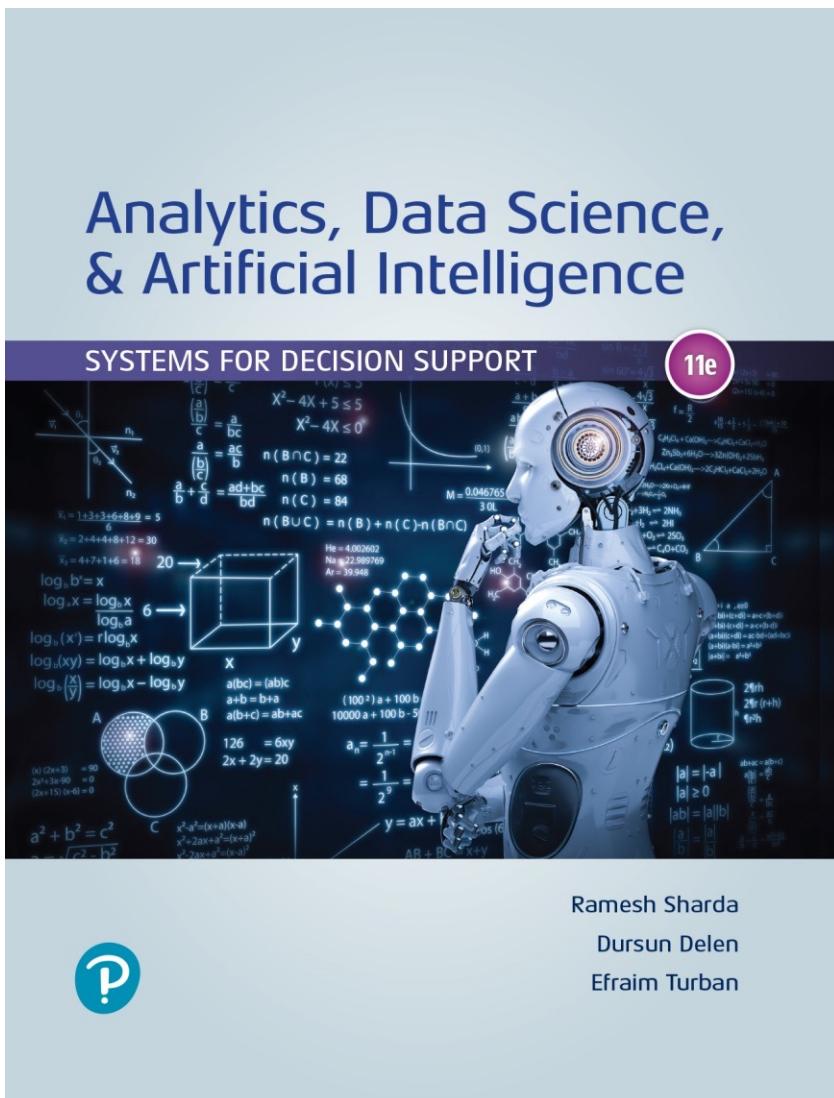


# Analytics, Data Science and AI: Systems for Decision Support

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.

Decision system is an automated system  
that support the decision maker  
to make decision

ERP system is  
Enterprise Resource Planning

# Changing Business Environments And Evolving Needs For Decision Support And Analytics

- Big-bet, high-risk decisions.

مُخاطر عالٍ لـ

- Cross-cutting decisions, which are repetitive but high risk that require group work.

المُتَبَعَّقُ اذن القرار يخْدِمُ الارشاد

- Ad hoc decisions that arise episodically.

ما يكون تجده من شخص وابد تجيء من شخص آخر وان القرار

- Delegated decisions to individuals or small groups.

اسناد القرار الى الاشخاص او المجموعات

Data warehouse

historical data

طاویل اذن اطلاعات

تعمد نسخة في اخبار اذن القرار



ازه الفرار نمی کنیم و می خواهیم  
نهایت این را بخواهیم

1 - understand the decision that you have  
to make

2 - gather the relevant information

3 - identify the options you have

4 - weigh the options

5 - make the decision

6 - monitor the results

# Decision Making Process

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

# Decision Making Process

The four step managerial process:

1. • Define the problem
2. • Construct a model
3. • Identify and evaluate possible solutions
4. • 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?

العوامل التي تؤثر في اتخاذ القرار

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

بعض العوامل التي تؤثر على اتخاذ القرارات  
وتحير في تغير القرارات والتأثير على تغيير القرارات

impact, effect + the decision

- 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,

عوامل الالال

1- المعايير  
2- الحكومة

3- الوسائل المتاحة

4- القيارات العددية التي تؤثر  
القوانين واللوائح والمتطلبات  
وأنفصال الناس عن العمل

أ- تغير القوى العاملة التي تؤثر  
ب- تغير توجهات العمل: كوفيد وروابط

أن الارتباط بالعمل يختلف باختلاف  
فراند ساندز اتفاقية

البيئات التي تتغير وتتغير

مثال  
؛ مثل براءات الاختراع وتوسيعها  
كانوا ووار في الجداول ويعملون  
ما وابحروا بالبطولة فقط

# 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

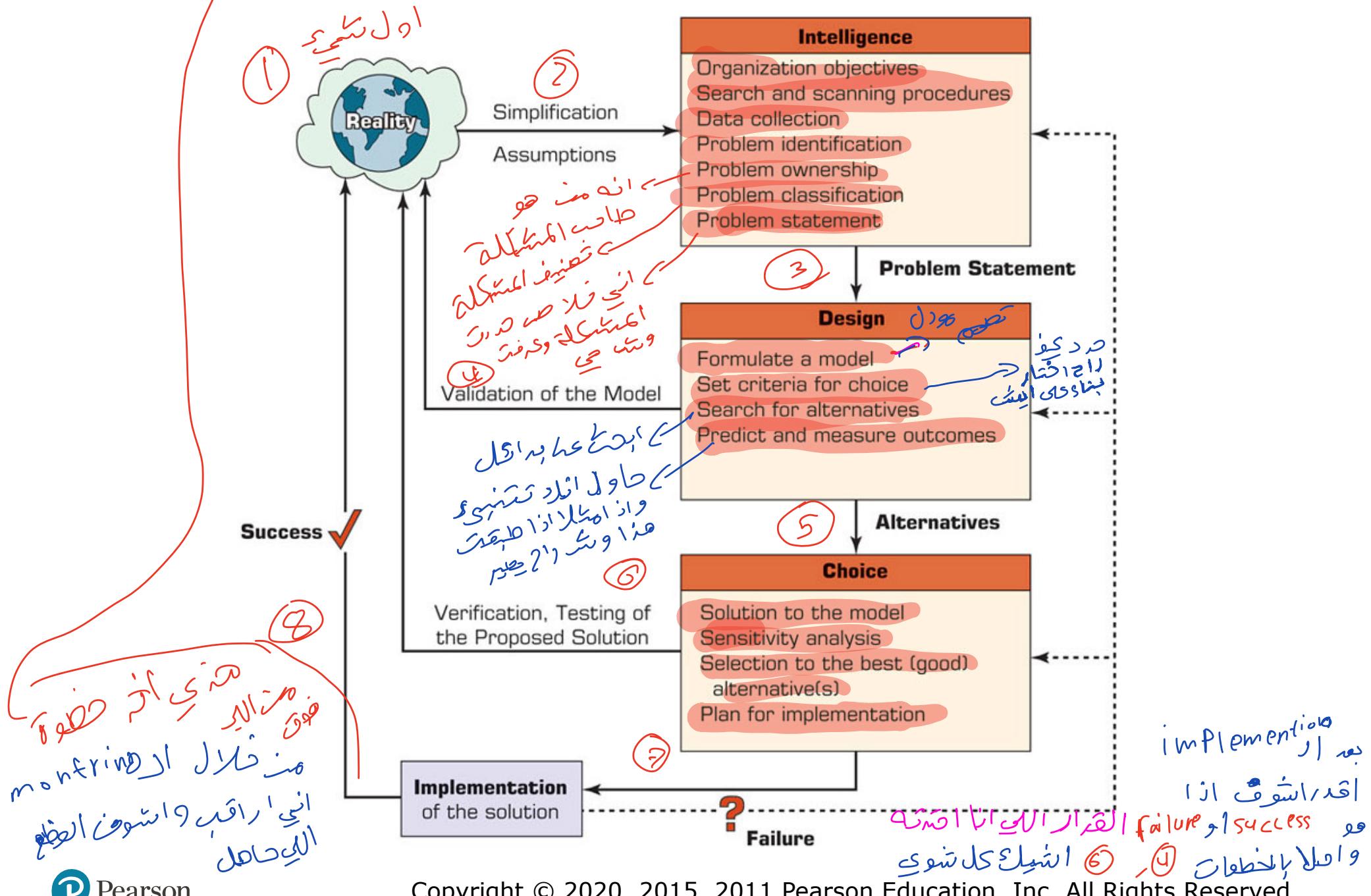
- 5. [+] Monitoring

لـ  
ازدیاد میزان نیاز  
softwave, hardware و نیاز  
licences و overhead  
SAS میکنند  
cost

و نیاز  
نهایت این افزایش نیاز  
نمیگیرد



# The Decision-Making Process



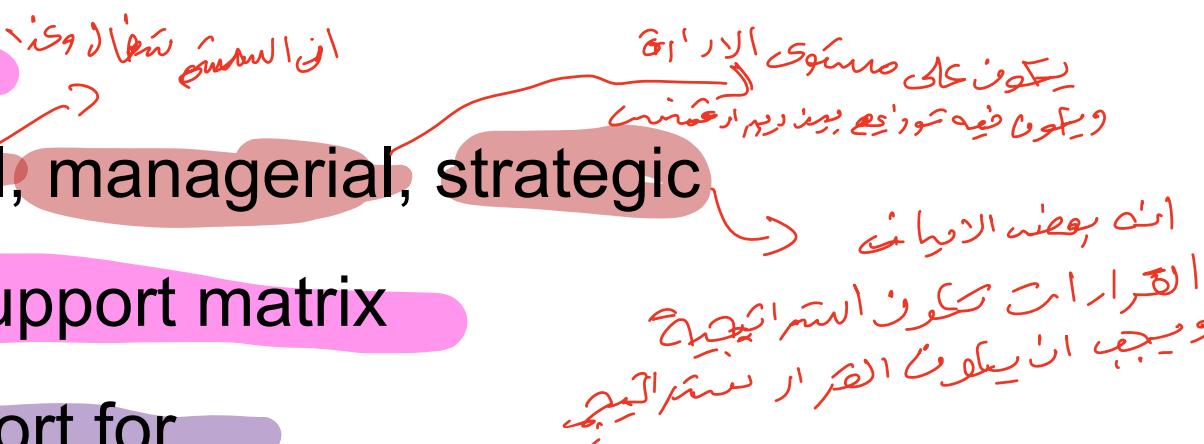
# The Classical Decision Support System

## Framework

3 types

کل مسائل  
دو لایه ای مدل های ساختاری

- 1- • Degree of structuredness
  - Structured, unstructured, semi-structured problems
- 2- • Type of control
  - Operational, managerial, strategic
- 3- • The decision Support matrix
- Computer support for ...
  - Structured decisions
  - Unstructured decisions
  - Semi-structured problems



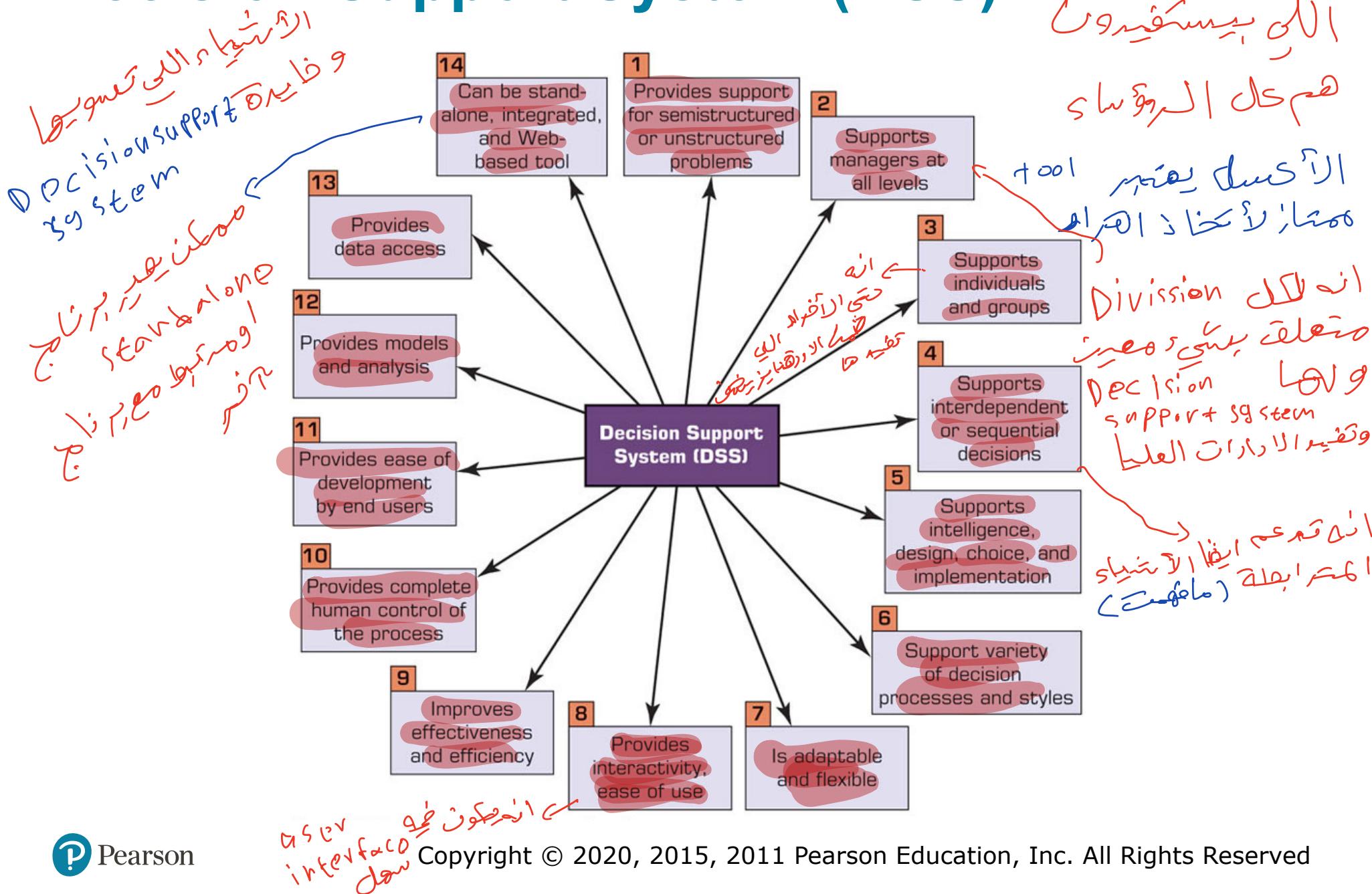
# Decision Support Framework

نحوه عملیاتی ادراکی

نحوه عملیاتی  
ادراکی

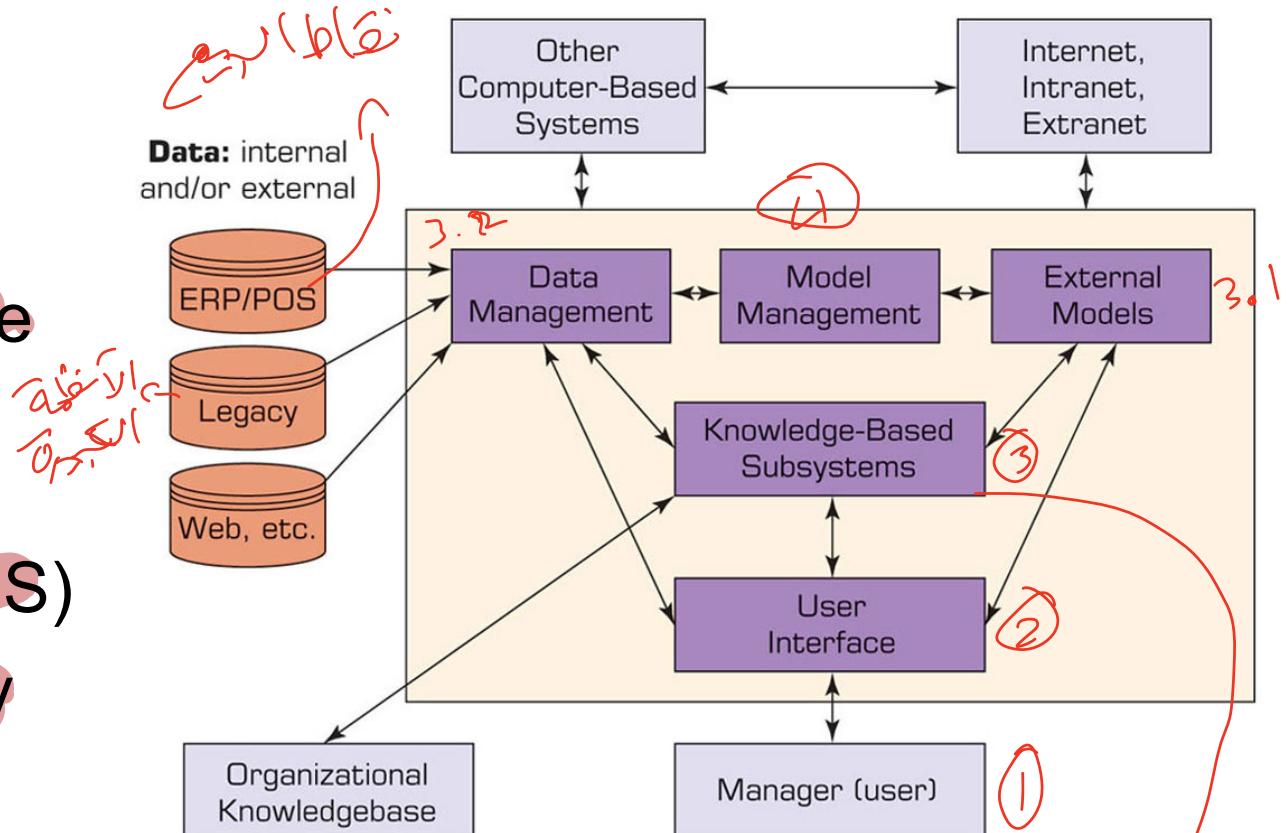
Type of Decision	Operational Control	Managerial Control	Strategic Planning
Structured	<p>Monitoring accounts receivable Monitoring accounts payable Placing order entries</p>	<p>Analyzing budget Forecasting short-term Reporting on personnel Making or buying</p>	<p>Managing finances Monitoring investment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

# 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



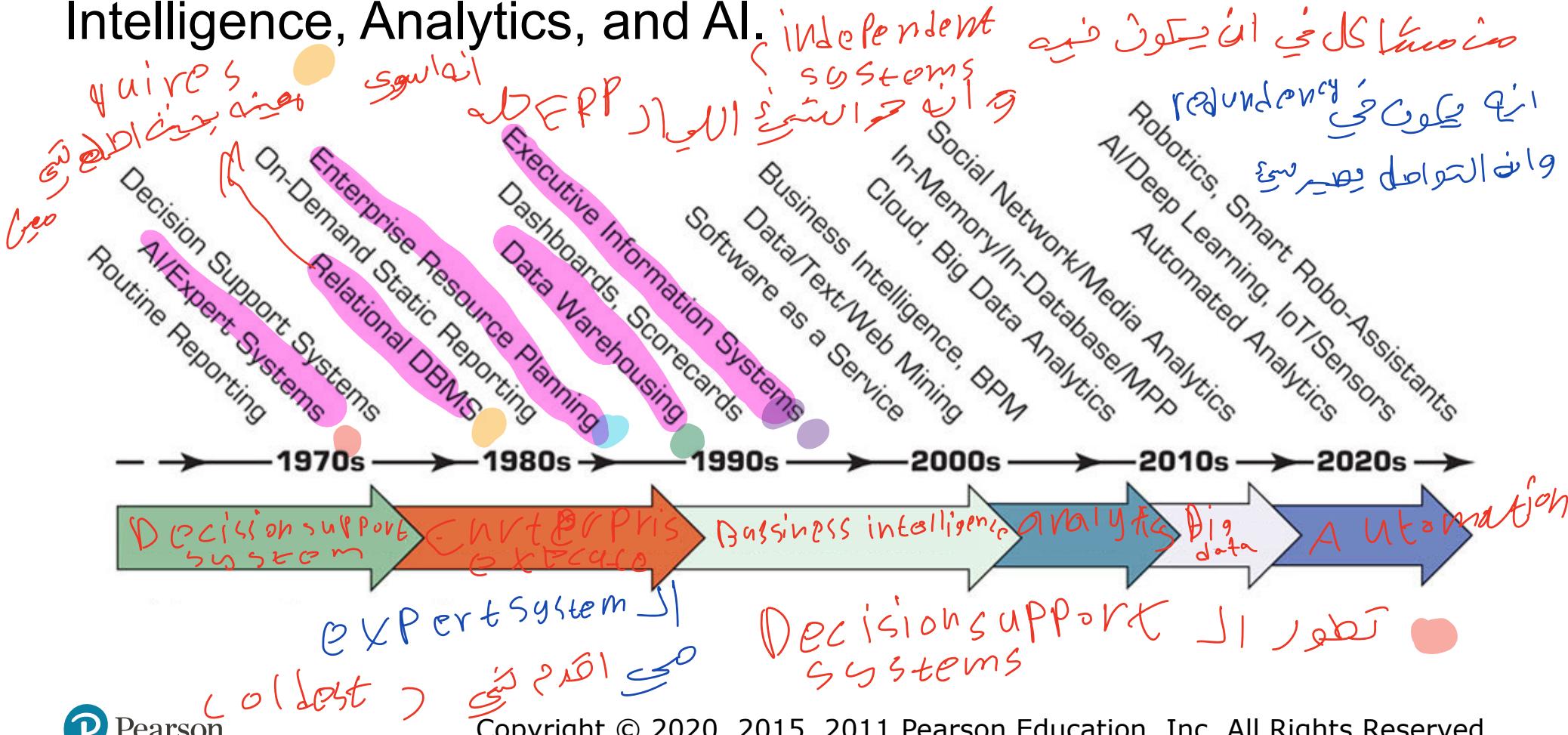
expert systems  
heuristics  
...if-then...

# Components of a DSS (2 of 2)

- The Model Management Subsystem
  - Model base
  - MBMS
  - Modelling language *لenguage modeling* →
  - 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.**



Executive information systems ; تكنولوجيا المعلومات التنفيذية  
upper management uses dashboards and graphs و يتكون خلاصات و جداول و رسومات  
لهم يرون سير العمل ويوضح لهم الاتجاه

Data warehouse : historical Data بيانات تاريخية و احصائية  
update at from time to time فتحل : اشغال العمل يتزايد و متغير

Datawarehouse excludes business Analytics تحليل  
cost preventive system

ERP : day by day transactions  
daily تكون يومياً

centralized single source  
one source of information

Data mining ; it mines for the data from data warehouse  
it can also predict by some algorithms

Massive Parallel Processing ; تحليل الضخم

export system :  
knowledge acquisition  
knowledge representation  
knowledge inference

Big data includes  
1 - social media و  
2 - Books, novels  
3 - IoT  
4 - Log files

log file : يسجل كل انتقالات المستخدم user مثل  
فتح المتصفح او زيارة المواقع

AI : predict the future based on the historical data

# A Framework for Business Intelligence

Decision support system

دستگاه پشتیبانی تصمیم گیری

## Definitions of business intelligence (BI)

Data warehouse داده های خرده رسانی

## A brief history of BI

Analytics

آنالیز

## The architecture of BI

کارخانه داده های آینده AI

- Data warehousing (DW) [as a foundation of BI]
- Business performance management (BPM)
- User interface (dashboard)

based on Data warehousing  
بنای داده های خرده رسانی

## Transaction processing versus analytics processing

POS و ERP

## Appropriate planning and alignment of BI with the business strategy

BI دستگاه پشتیبانی تصمیم گیری

BI اسکله داده های خرده رسانی

و نیز تراکنشی  
داده های خرده رسانی  
پردازشی

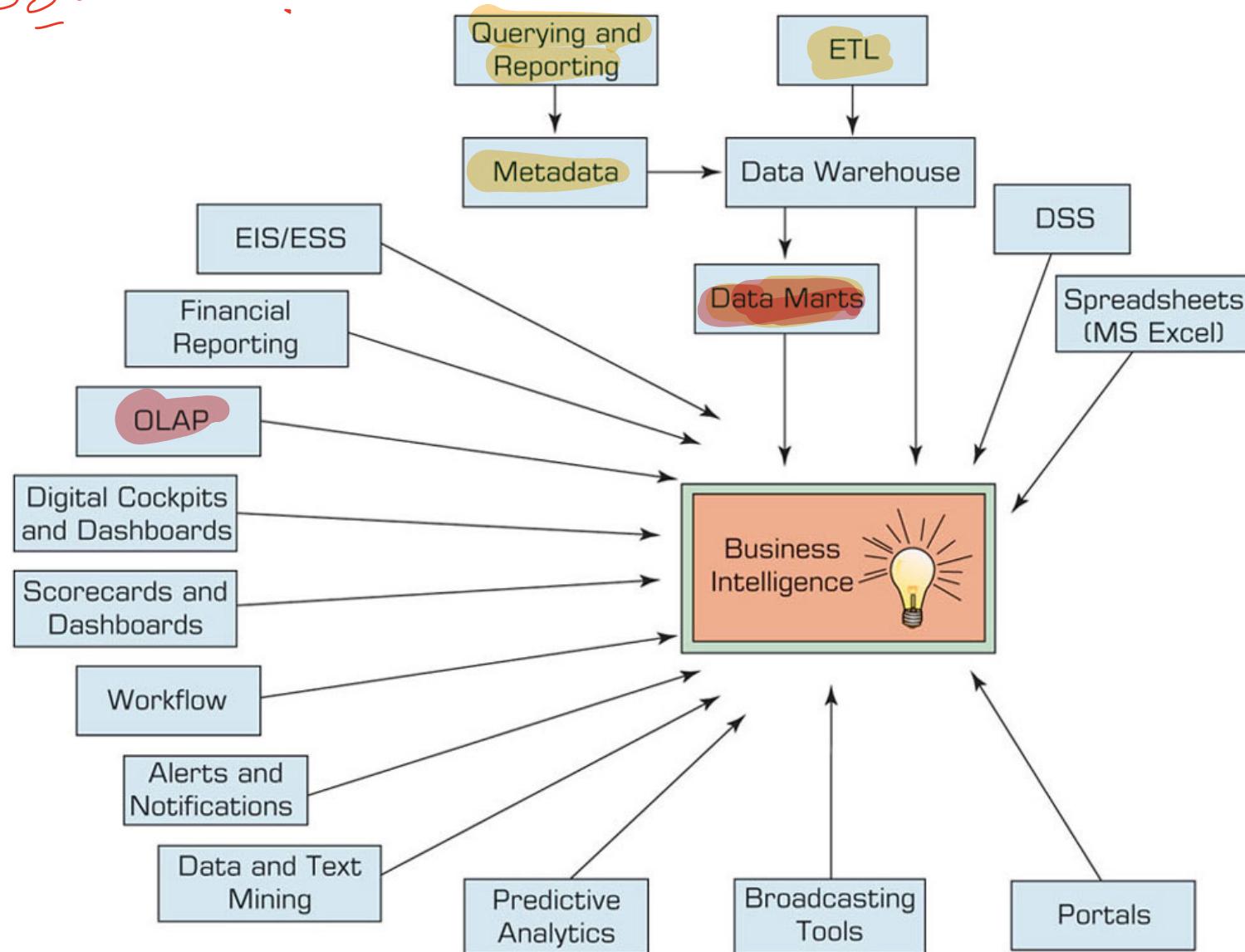


Pearson

آنالیز پردازشی

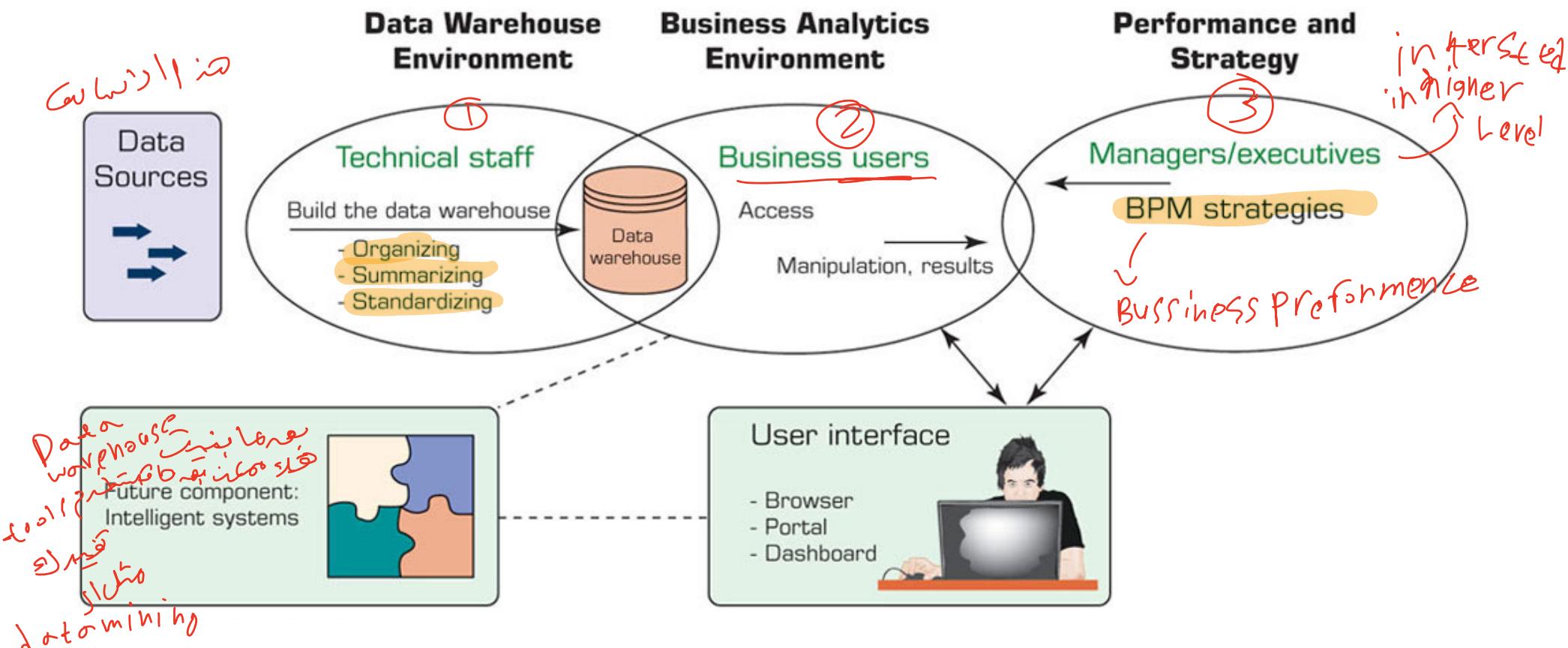
# Evolution of Business Intelligence (BI)

التطور والتغير في مجال تحليل الأعمال



# The Origins and Drivers of BI

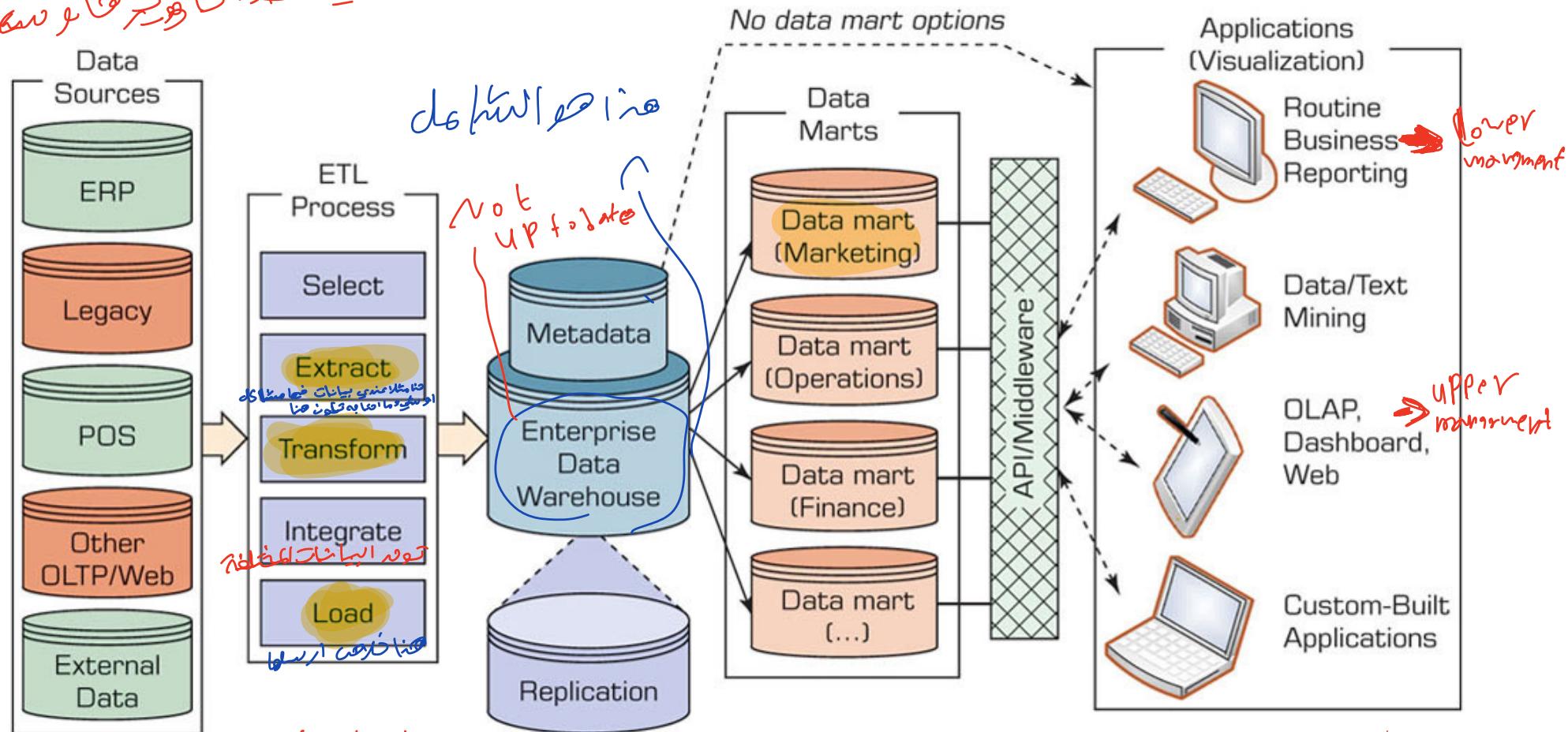
Figure 1.7 A High-Level Architecture of BI.



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

ازواع الـ DW من حيث المحتوى في البيانات



OLAP: multidimensional (Cube)

وأكبر سعى فيه إمكانية واحتياطيات متعددة  
وهو يحتوي على قواعد بيانات متعددة

OLTP: Database (البيانات)  
2 dimensional  
ويحاط بها قواعد بيانات متعددة

Extracted data  
والبيانات المتعددة

البيانات المتعددة  
extracted من البيانات في ODS  
وإدخالها في DW

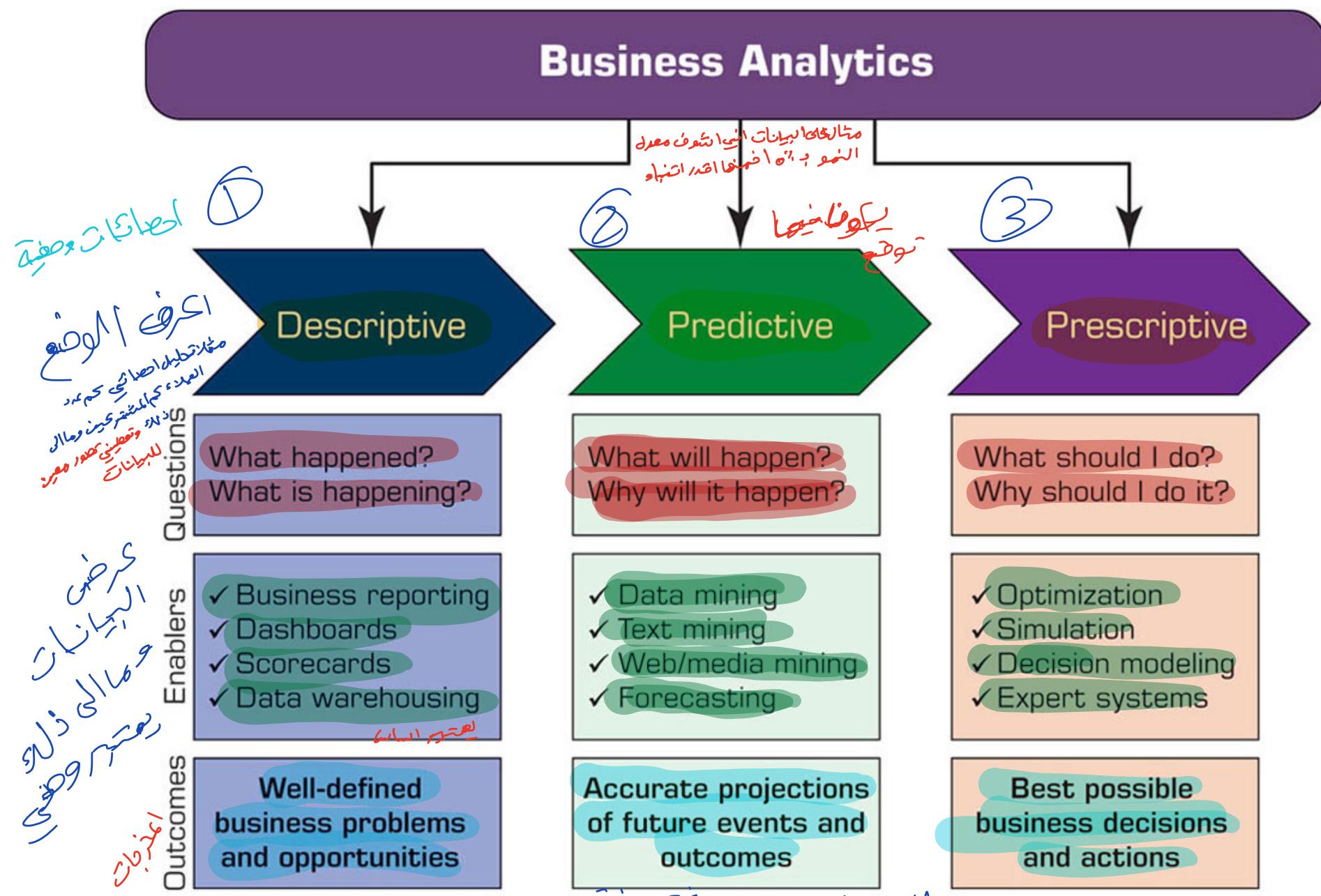
EDW ⇒ Staging area

Operational Data Store

3 types of Data warehouse:

- o DS joins
  - Datawarehouse www
  - Data mart ~~access~~   
 Datawarehouse ~~also~~   
 Department DE

# 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 (AI)?

# Artificial Intelligence Overview

machines AI is trying to mimic the human thought processes

- 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. *NLP*
  - Technology that can answer questions.

AI محاكاة العقول

Robotics AI

وتحريك الميكانيزمات

it also can detect text  
any thing transit

الذكاء الاصطناعي، وبنادق التنفيذ، اجهزة الرصد

natural language processing;

او لغة اولية لـ AI

NLP، text service

NLP ليس隻 voice recognition

# 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.

# Artificial Intelligence Overview

What are the major benefits of AI?

# Artificial Intelligence Overview

Links ↴

- 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, and competitive advantage.

# The Landscape of AI

1. Major technologies *(أمثلة على التكنولوجيات الرئيسية)*
  - Machine learning, deep learning, intelligent agents.
2. Knowledge-based technologies *(التطبيقات المبنية على المعرفة)*
  - Expert systems, recommendation engines, chatbots, virtual personal assistants, robo advisors.
3. Biometric related technologies *(تطبيقات المعرفة الحيوانية)*
  - Natural language processing, image recognition, voice recognition, biometric recognition.

# The Landscape of AI

21st week

## 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.

AI changes  
the world

ser  
yo

# 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.

Dashboard  
Siri  
Alexa  
Healthcare

# 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>

Smart  
Machines

Autonomous vehicles, robo-advisors

Smart Fool

Autonomous vehicles, robo-advisors

Robo-recommendations

# The three flavors of AI decisions

intelligence AI decisions  
agents

## 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.

Augmented AI decisions involve intelligent agents  
involving decision-making, learning, and problem-solving

# Convergence of Analytics and AI

جهاز اقتصادي لـ AI 80٪

- 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

الاندماج بين التحليل والذكاء الاصطناعي

- 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

بيانات غير مكتملة  
بيانات غير دقيقة

عوامل بيئية متغيرة  
جودة البيانات

- 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.  
*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>

# Copyright



**This work is protected by United States copyright laws and is provided solely for the use of instructors in teaching their courses and assessing student learning. Dissemination or sale of any part of this work (including on the World Wide Web) will destroy the integrity of the work and is not permitted. The work and materials from it should never be made available to students except by instructors using the accompanying text in their classes. All recipients of this work are expected to abide by these restrictions and to honor the intended pedagogical purposes and the needs of other instructors who rely on these materials.**