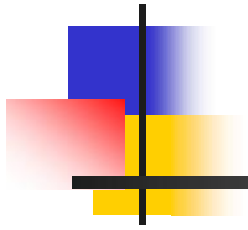


# Decision Support and Business Intelligence Systems



## Chapter 1:

### Decision Support Systems and Business Intelligence



# Learning Objectives

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- Understand today's turbulent business environment and describe how organizations survive and even excel in such an environment (solving problems and exploiting opportunities)
- Understand the need for computerized support of managerial decision making
- Understand an early framework for managerial decision making
- Learn the conceptual foundations of the decision support systems (DSS)



## Learning Objectives – cont.

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- Describe the business intelligence (BI) methodology and concepts and relate them to DSS
- Describe the concept of work systems and its relationship to decision support
- List the major tools of computerized decision support
- Understand the major issues in implementing computerized support systems



## Opening Vignette:

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### “Norfolk Southern Uses BI for Decision Support to Reach Success”

- Company background
- Problem
- Proposed solution
- Results
- Answer and discuss the case questions

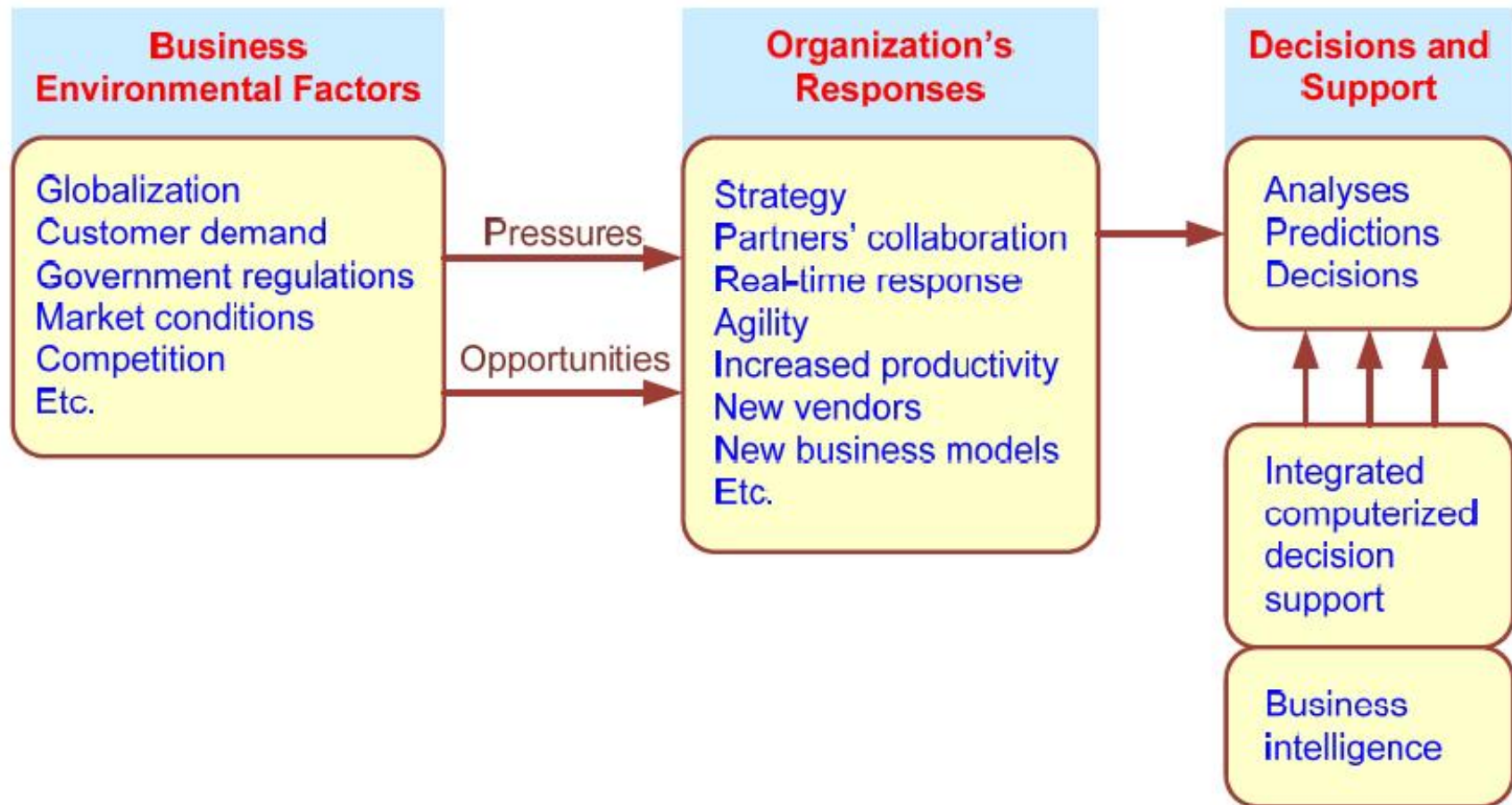


# Changing Business Environment

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- Companies are moving aggressively to computerized support of their operations => Business Intelligence
- Business Pressures–Responses–Support Model
  - **Business pressures** result of today's competitive business climate
  - **Responses** to counter the pressures
  - **Support** to better facilitate the process

# Business Pressures–Responses– Support Model





# The Business Environment

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- The environment in which organizations operate today is becoming more and more complex, creating:
  - opportunities, and
  - problems
  - Example: globalization
- Business environment factors:
  - markets, consumer demands, technology, and societal...



# Business Environment Factors

<u>FACTOR</u>	<u>DESCRIPTION</u>
<b>Markets</b>	Strong competition Expanding global markets Blooming electronic markets on the Internet Innovative marketing methods Opportunities for outsourcing with IT support Need for real-time, on-demand transactions
<b>Consumer demand</b>	Desire for customization Desire for quality, diversity of products, and speed of delivery Customers getting powerful and less loyal
<b>Technology</b>	More innovations, new products, and new services Increasing obsolescence rate Increasing information overload Social networking, Web 2.0 and beyond
<b>Societal</b>	Growing government regulations and deregulation Workforce more diversified, older, and composed of more women Prime concerns of homeland security and terrorist attacks Necessity of Sarbanes-Oxley Act and other reporting-related legislation Increasing social responsibility of companies Greater emphasis on sustainability





# Organizational Responses

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- Be Reactive, Anticipative, Adaptive, and Proactive
- Managers may take actions, such as
  - Employ strategic planning
  - Use new and innovative business models
  - Restructure business processes
  - Participate in business alliances
  - Improve corporate information systems
  - Improve partnership relationships
  - Encourage innovation and creativity ...cont...>



# Managers actions, continued

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- Improve customer service and relationships
- Move to electronic commerce (e-commerce)
- Move to make-to-order production and on-demand manufacturing and services
- Use new IT to improve communication, data access (discovery of information), and collaboration
- Respond quickly to competitors' actions (e.g., in pricing, promotions, new products and services)
- Automate many tasks of white-collar employees
- Automate certain decision processes
- Improve decision making by employing analytics



# Closing the Strategy Gap

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- One of the major objectives of computerized decision support is to facilitate closing the gap between the current performance of an organization and its desired performance, as expressed in its mission, objectives, and goals, and the strategy to achieve them



# Managerial Decision Making

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- Management is a process by which organizational goals are achieved by using resources
  - **Inputs:** resources
  - **Output:** attainment of goals
  - **Measure of success:** outputs / inputs
- Management Q Decision Making
- Decision making: selecting the best solution from two or more alternatives



# Mintzberg's 10 Managerial Roles

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## **Interpersonal**

1. Figurehead
2. Leader
3. Liaison

## **Informational**

4. Monitor
5. Disseminator
6. Spokesperson

## **Decisional**

7. Entrepreneur
8. Disturbance handler
9. Resource allocator
10. Negotiator



# Decision Making Process

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- Managers usually make decisions by following a four-step process (a.k.a. the scientific approach)
  1. Define the problem (or opportunity)
  2. Construct a model that describes the real-world problem
  3. Identify possible solutions to the modeled problem and evaluate the solutions
  4. Compare, choose, and recommend a potential solution to the problem



# Decision making is difficult, because

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- Technology, information systems, advanced search engines, and globalization result in more and more alternatives from which to choose
- Government regulations and the need for compliance, political instability and terrorism, competition, and changing consumer demands produce more uncertainty, making it more difficult to predict consequences and the future
- Other factors are the need to make rapid decisions, the frequent and unpredictable changes that make trial-and-error learning difficult, and the potential costs of making mistakes



# Why Use Computerized DSS

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- Computerized DSS can facilitate decision via:
  - Speedy computations
  - Improved communication and collaboration
  - Increased productivity of group members
  - Improved data management
  - Overcoming cognitive limits
  - Quality support; agility support
  - Using Web; anywhere, anytime support



# A Decision Support Framework

(by Gory and Scott-Morten, 1971)

Type of Decision	Type of Control		
	Operational Control	Managerial Control	Strategic Planning
<b>Structured</b>	Accounts receivable <b>1</b> Accounts payable Order entry	Budget analysis <b>2</b> Short-term forecasting Personnel reports Make-or-buy	Financial management <b>3</b> Investment portfolio Warehouse location Distribution systems
<b>Semistructured</b>	Production scheduling <b>4</b> Inventory control	Credit evaluation <b>5</b> Budget preparation Plant layout Project scheduling Reward system design Inventory categorization	Building a new plant <b>6</b> Mergers & acquisitions New product planning Compensation planning Quality assurance HR policies Inventory planning
<b>Unstructured</b>	Buying software <b>7</b> Approving loans Operating a help desk Selecting a cover for a magazine	Negotiating <b>8</b> Recruiting an executive Buying hardware Lobbying	R & D planning <b>9</b> New tech. development Social responsibility planning

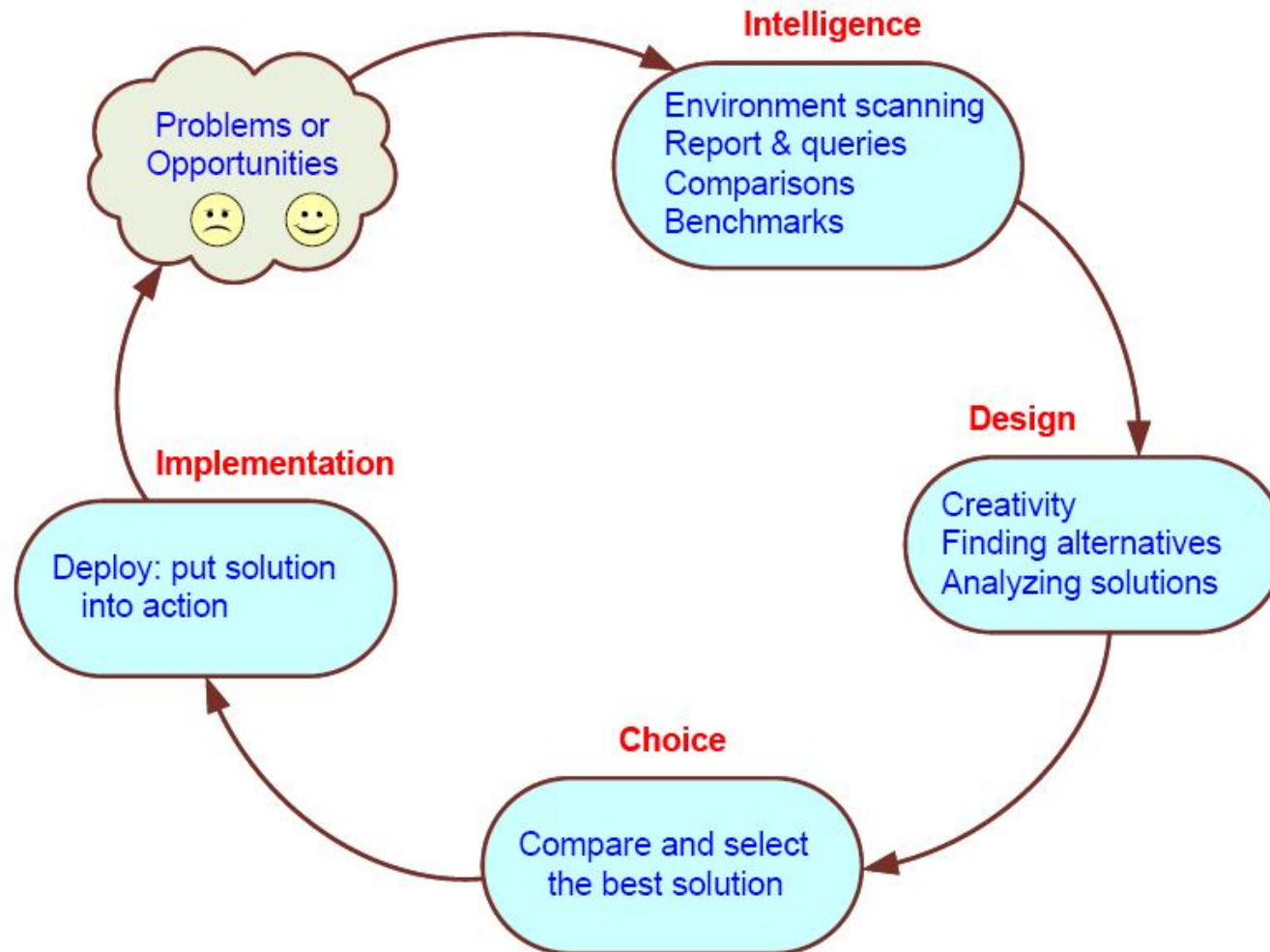


## A Decision Support Framework – cont.

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- Degree of Structuredness (Simon, 1977)
  - Decision are classified as
    - Highly structured (a.k.a. programmed)
    - Semi-structured
    - Highly unstructured (i.e., non-programmed)
- Types of Control (Anthony, 1965)
  - Strategic planning (top-level, long-range)
  - Management control (tactical planning)
  - Operational control

# Simon's Decision-Making Process





# Computer Support for Structured Decisions

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- Structured problems: encountered repeatedly, have a high level of structure
- It is possible to abstract, analyze, and classify them into specific categories
  - e.g., make-or-buy decisions, capital budgeting, resource allocation, distribution, procurement, and inventory control
- For each category a solution approach is developed => Management Science



# Management Science Approach

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- Also referred to as Operation Research
- In solving problems, managers should follow the five-step MS approach
  1. Define the problem
  2. Classify the problem into a standard category (\*)
  3. Construct a model that describes the real-world problem
  4. Identify possible solutions to the modeled problem and evaluate the solutions
  5. Compare, choose, and recommend a potential solution to the problem



# Automated Decision Making

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- A relatively new approach to supporting decision making
- Applies to highly structures decisions
- Automated decision systems (ADS)  
(or decision automation systems)
- An ADS is a rule-based system that provides a solution to a repetitive managerial problem in a specific area
  - e.g., simple-loan approval system



# Automated Decision Making

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- ADS initially appeared in the airline industry called revenue (or yield) management (or revenue optimization) systems
  - dynamically price tickets based on actual demand
- Today, many service industries use similar pricing models
- ADS are driven by business rules!



# Computer Support for Unstructured Decisions

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- Unstructured problems can be only partially supported by standard computerized quantitative methods
- They often require customized solutions
- They benefit from data and information
- Intuition and judgment may play a role
- Computerized communication and collaboration technologies along with knowledge management is often used



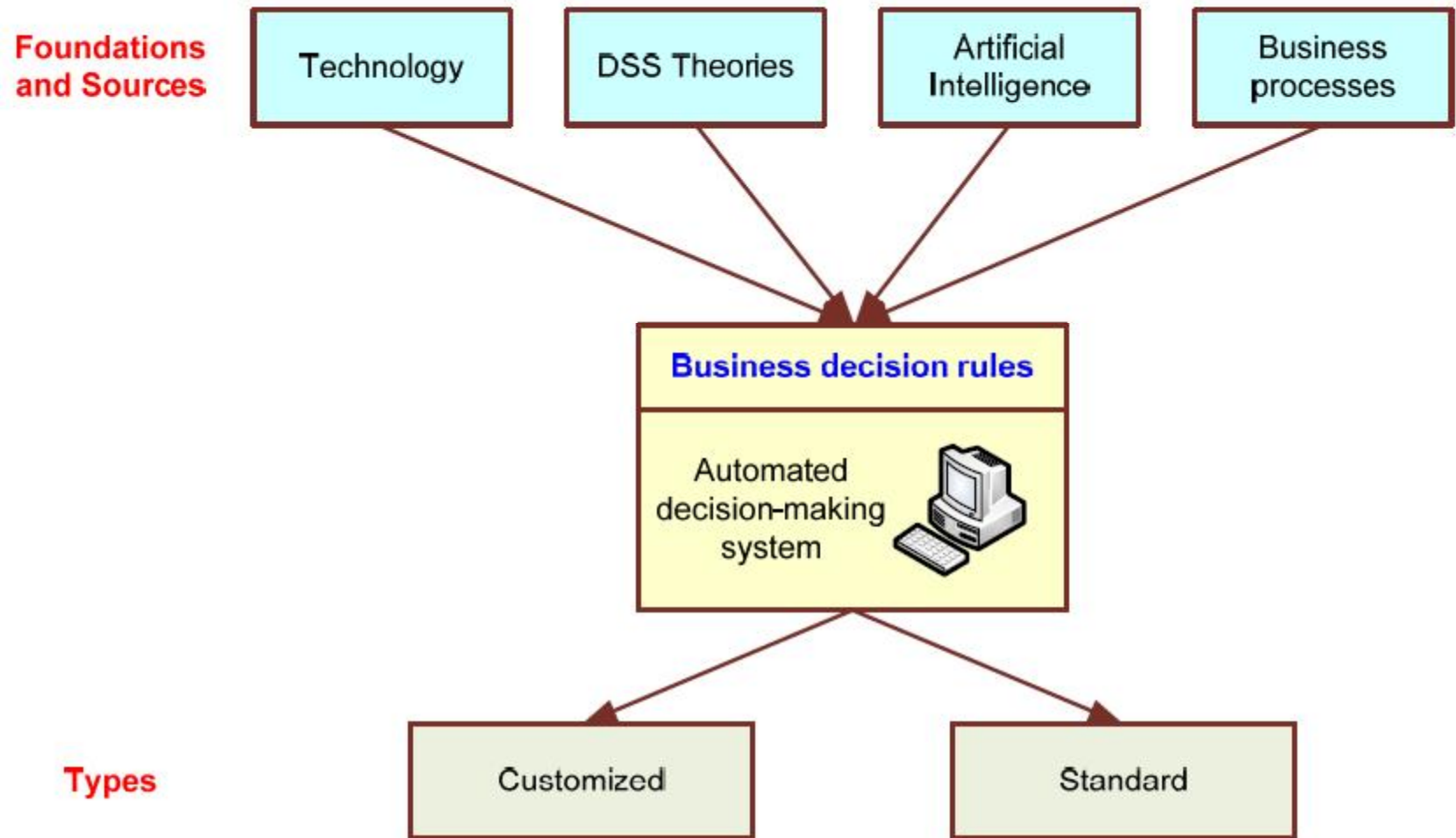


# Computer Support for Semi-structured Problems

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- Solving semi-structured problems may involve a combination of standard solution procedures and human judgment
- MS handles the structured parts while DSS deals with the unstructured parts
- With proper data and information, a range of alternative solutions, along with their potential impacts

# Automated Decision-Making Framework





# Concept of Decision Support Systems

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## Classical Definitions of DSS

- Interactive computer-based systems, which help decision makers utilize data and models to solve unstructured problems" - Gorry and Scott-Morton, 1971
- Decision support systems couple the intellectual resources of individuals with the capabilities of the computer to improve the quality of decisions. It is a computer-based support system for management decision makers who deal with semistructured problems - Keen and Scott-Morton, 1978



## DSS as an Umbrella Term

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- The term DSS can be used as an umbrella term to describe any computerized system that supports decision making in an organization
  - E.g., an organization wide knowledge management system; a decision support system specific to an organizational function (marketing, finance, accounting, manufacturing, planning, SCM, etc.)

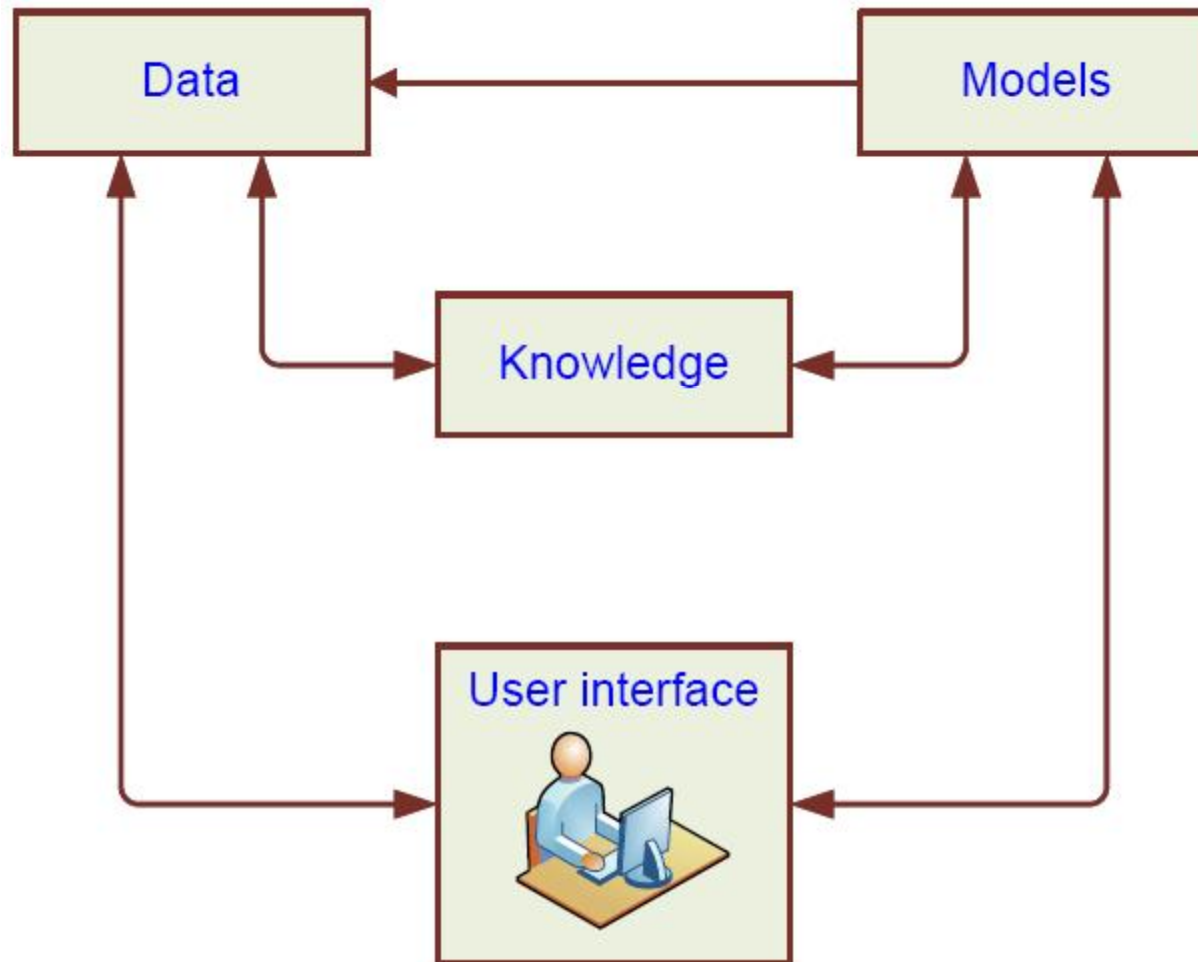


# DSS as a Specific Application

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- In a narrow sense DSS refers to a process for building customized applications for unstructured or semi-structured problems
- Components of the **DSS Architecture**
  - Data, Model, Knowledge/Intelligence, User, Interface (API and/or user interface)
  - DSS often is created by putting together loosely coupled instances of these components

# High-Level Architecture of a DSS





# Types of DSS

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- Two major types:
  - Model-oriented DSS
  - Data-oriented DSS
- Evolution of DSS into Business Intelligence
  - Use of DSS moved from specialist to managers, and then whomever, whenever, wherever
  - Enabling tools like OLAP, data warehousing, data mining, intelligent systems, delivered via Web technology have collectively led to the term “business intelligence” (BI) and “business analytics”



# Business Intelligence (BI)

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- BI is an umbrella term that combines architectures, tools, databases, analytical tools, applications, and methodologies
- Like DSS, BI a content-free expression, so it means different things to different people
- BI's major objective is to enable easy access to data (and models) to provide business managers with the ability to conduct analysis
- BI helps transform data, to information (and knowledge), to decisions and finally to action



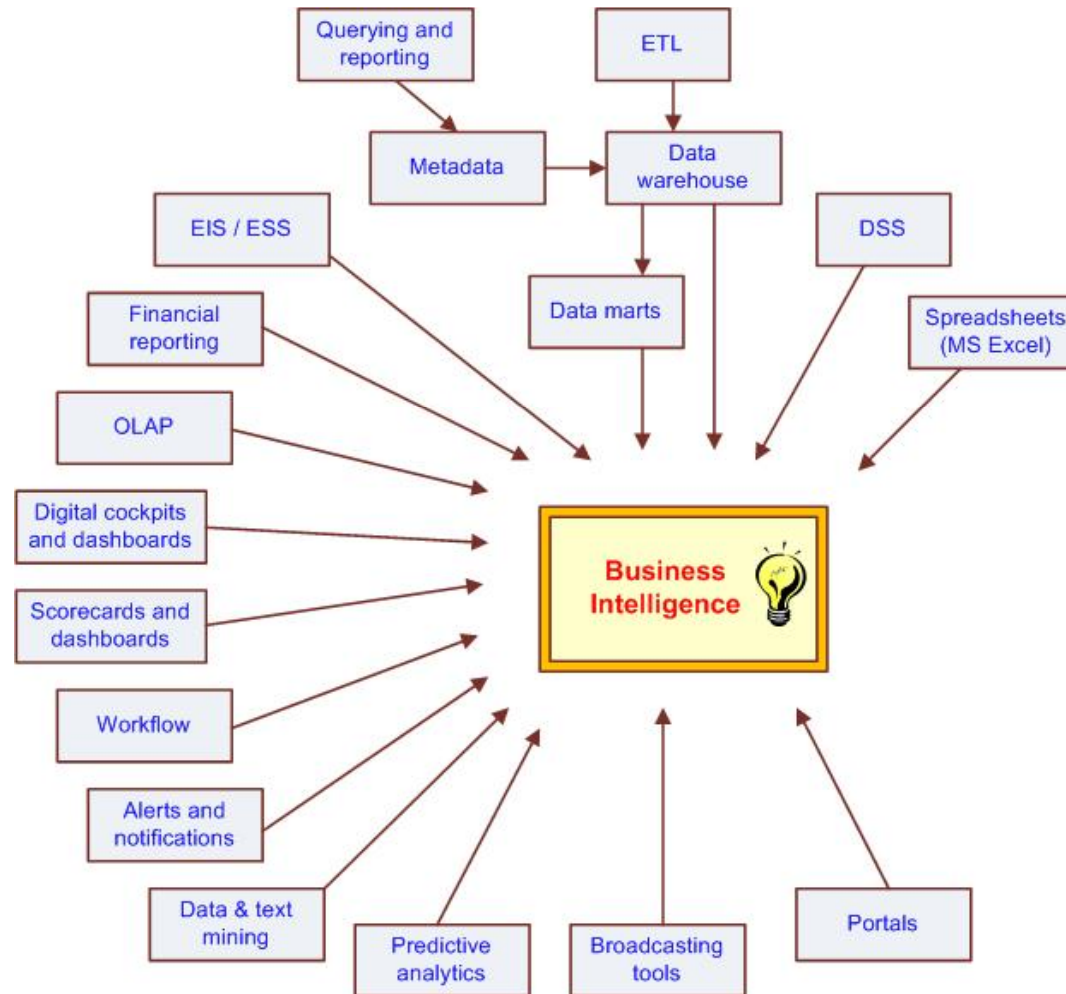


# A Brief History of BI

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- The term BI was coined by the Gartner Group in the mid-1990s
- However, the concept is much older
  - 1970s - MIS reporting - static/periodic reports
  - 1980s - Executive Information Systems (EIS)
  - 1990s - OLAP, dynamic, multidimensional, ad-hoc reporting -> coining of the term "BI"
  - 2005+ Inclusion of AI and Data/Text Mining capabilities; Web-based Portals/Dashboards
  - 2010s - yet to be seen

# The Evolution of BI Capabilities



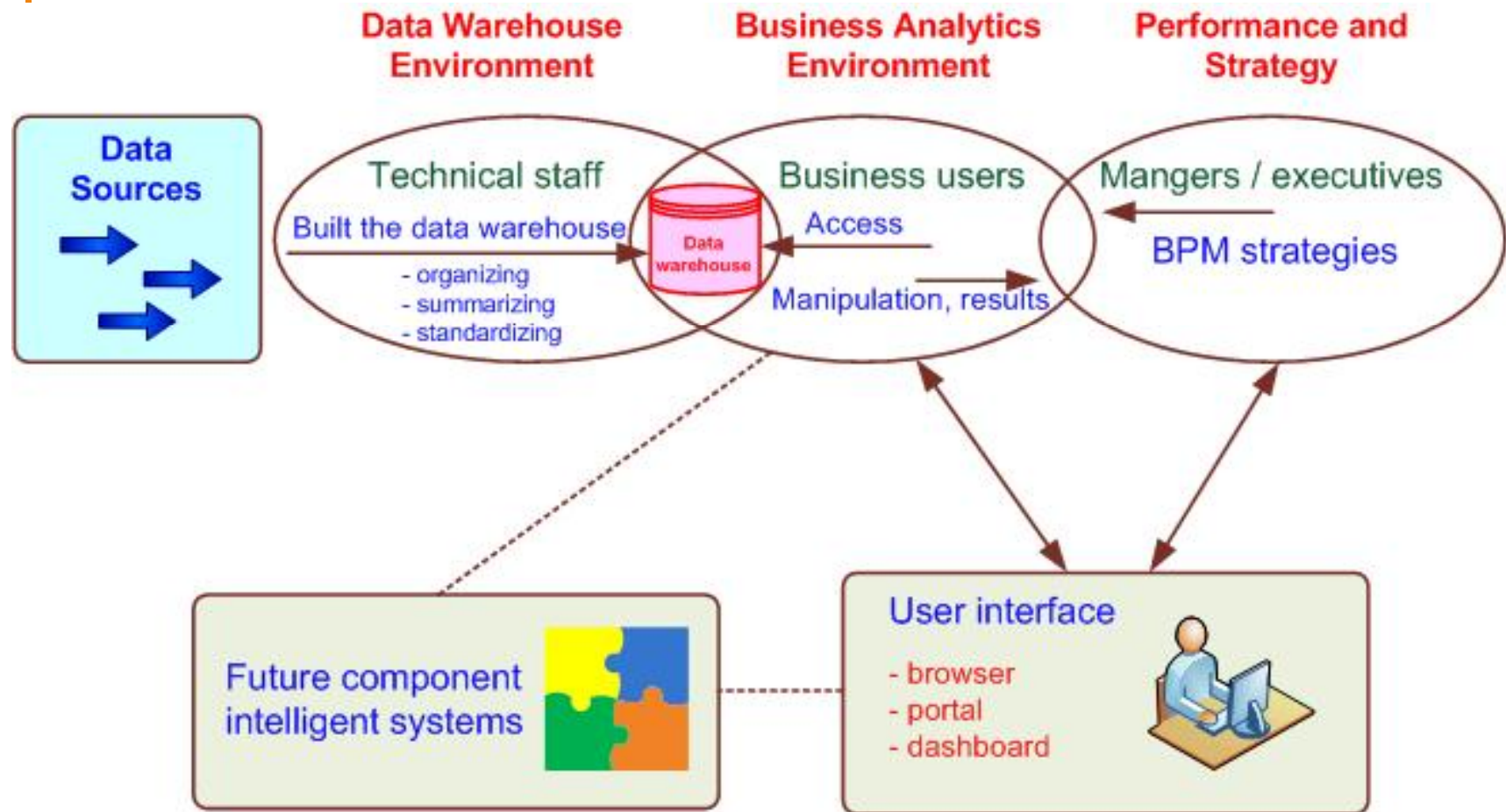


# The Architecture of BI

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- A BI system has four major components
  - a data warehouse, with its source data
  - business analytics, a collection of tools for manipulating, mining, and analyzing the data in the data warehouse;
  - business performance management (BPM) for monitoring and analyzing performance
  - a user interface (e.g., dashboard)

# A High-Level Architecture of BI





# Components in a BI Architecture

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- The **data warehouse** is a large repository of well-organized historical data
- **Business analytics** are the tools that allow transformation of data into information and knowledge
- **Business performance management (BPM)** allows monitoring, measuring, and comparing key performance indicators
- **User interface** (e.g., dashboards) allows access and easy manipulation of other BI components



# Styles of BI

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- MicroStrategy, Corp. distinguishes five styles of BI and offers tools for each
  1. report delivery and alerting
  2. enterprise reporting (using dashboards and scorecards)
  3. cube analysis (also known as slice-and-dice analysis)
  4. ad-hoc queries
  5. statistics and data mining



# The Benefits of BI

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- The ability to provide accurate information when needed, including a real-time view of the corporate performance and its parts
- A survey by Thompson (2004)
  - Faster, more accurate reporting (81%)
  - Improved decision making (78%)
  - Improved customer service (56%)
  - Increased revenue (49%)
- See Table 1.3 for a list of **BI analytic applications**, the **business questions** they answer and the **business value** they bring



# The DSS–BI Connection

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- First, their architectures are very similar because BI evolved from DSS
- Second, DSS directly support specific decision making, while BI provides accurate and timely information, and indirectly support decision making
- Third, BI has an executive and strategy orientation, especially in its BPM and dashboard components, while DSS, in contrast, is oriented toward analysts





## The DSS–BI Connection – cont.

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- Fourth, most BI systems are constructed with commercially available tools and components, while DSS is often built from scratch
- Fifth, DSS methodologies and even some tools were developed mostly in the academic world, while BI methodologies and tools were developed mostly by software companies
- Sixth, many of the tools that BI uses are also considered DSS tools (e.g., data mining and predictive analysis are core tools in both)



## The DSS–BI Connection – cont.

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- Although some people equate DSS with BI, these systems are not, at present, the same
  - some people believe that DSS is a part of BI—one of its analytical tools
  - others think that BI is a special case of DSS that deals mostly with reporting, communication, and collaboration (a form of data-oriented DSS)
  - BI is a result of a continuous revolution and, as such, DSS is one of BI's original elements
  - In this book, we separate DSS from BI
- MSS = BI and/or DSS



# A Work System View of Decision Support (Alter, 2004)

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- drop the word “systems” from DSS
- focus on “decision support”

“use of any plausible computerized or noncomputerized means for improving decision making in a particular repetitive or nonrepetitive business situation in a particular organization”
- **Work system:** a system in which human participants and/or machines perform a business process, using information, technology, and other resources, to produce products and/or services for internal or external customers



# Elements of a Work System

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1. **Business process.** Variations in the process rationale, sequence of steps, or methods used for performing particular steps
2. **Participants.** Better training, better skills, higher levels of commitment, or better real-time or delayed feedback
3. **Information.** Better information quality, information availability, or information presentation
4. **Technology.** Better data storage and retrieval, models, algorithms, statistical or graphical capabilities, or computer interaction

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## Elements of a Work System – cont.

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5. **Product and services.** Better ways to evaluate potential decisions
6. **Customers.** Better ways to involve customers in the decision process and to obtain greater clarity about their needs
7. **Infrastructure.** More effective use of shared infrastructure, which might lead to improvements
8. **Environment.** Better methods for incorporating concerns from the surrounding environment
9. **Strategy.** A fundamentally different operational strategy for the work system



# Major Tool Categories for MSS

<b>TOOL CATEGORY</b>	<b>TOOLS AND THEIR ACRONYMS</b>
Data management	Databases and database management system (DBMS) Extraction, transformation, and load (ETL) systems Data warehouses (DW), real-time DW, and data marts
Reporting status tracking	Online analytical processing (OLAP) Executive information systems (EIS)
Visualization	Geographical information systems (GIS) Dashboards, Information portals Multidimensional presentations
Business analytics	Optimization, Web analytics Data mining, Web mining, and text mining
Strategy and performance management	Business performance management (BPM)/ Corporate performance management (CPM) Business activity management (BAM) Dashboards and Scorecards
Communication and collaboration	Group decision support systems (GDSS) Group support systems (GSS) Collaborative information portals and systems
Social networking	Web 2.0, Expert locating systems
Knowledge management	Knowledge management systems (KMS)
Intelligent systems	Expert systems (ES) Artificial neural networks (ANN) Fuzzy logic, Genetic algorithms, Intelligent agents
Enterprise systems	Enterprise resource planning (ERP), Customer Relationship Management (CRM), and Supply-Chain Management (SCM)

Source: Table 1.4



# Hybrid (Integrated) Support Systems

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- The objective of computerized decision support, regardless of its name or nature, is to assist management in solving managerial or organizational problems (and assess opportunities and strategies) faster and better than possible without computers
- Every type of tool has certain capabilities and limitations. By integrating several tools, we can improve decision support because one tool can provide advantages where another is weak
- The trend is therefore towards developing **hybrid (integrated) support system**



# Hybrid (Integrated) Support Systems

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- Type of integration
  - Use each tool independently to solve different aspects of the problem
  - Use several loosely integrated tools. This mainly involves transferring data from one tool to another for further processing
  - Use several tightly integrated tools. From the user's standpoint, the tool appears as a unified system
- In addition to performing different tasks in the problem-solving process, tools can support each other

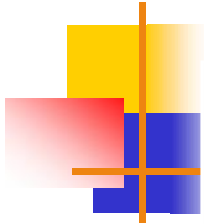




# End of the Chapter

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- Questions / Comments...



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