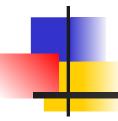
# Decision Support and Business Intelligence Systems



#### Chapter 1:

Decision Support Systems and Business Intelligence



#### Learning Objectives

- 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.

- 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

## Turban, Aronson, and Liang Decision Support Systems and Intelligent Systems, Seventh Edition



# Chapter 1 Management Support Systems: An Overview

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#### Levels of the Organization Explained

#### **Executive Level**

Strategic planning and responses to strategic issues occur here. Executive decisions are usually unstructured and are made using information consolidated internal and external information



#### Managerial Level

Monitoring and controlling of operational activities and executive information support occur here. Managerial decisions are usually semistructured and are made using procedures and ad hoc tools

#### **Operational Level**

Day-to-day business processes and interactions with customers occur here. Operational decisions are usually structured and are made using established policies and procedures



Figure 6.1 • Organizations are composed of levels, with each using information technology to automate activities or assist in decision making.

# TPSs are special class of information systems designed to process business events and transactions. Contoh: Payroll System

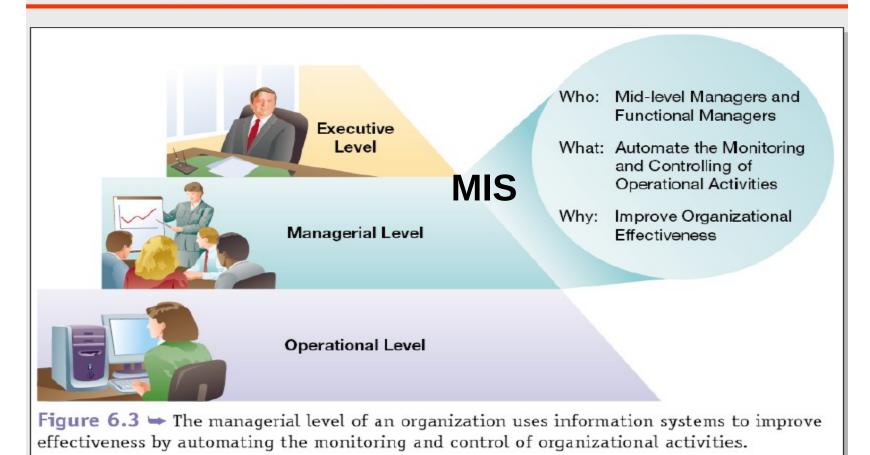
Who, What, Why: Organizational Level



Figure 6.2 The operational level of an organization uses information systems to improve efficiency by automating routine and repetitive activities.

# MISs are used by managerial employees to support recurring decision making in managing a function or the entire business

Who, What, Why: Managerial Level



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### EISs (=Executive Support Systems/ESS) are special purpose IS to support executive decision-making.

Who, What, Why: Executive Level



Who: Executive-level Managers

What: Aggregate Summaries of Past Organizational Data and Projections of the Future

Why: Improve Organizational Strategy and Planning

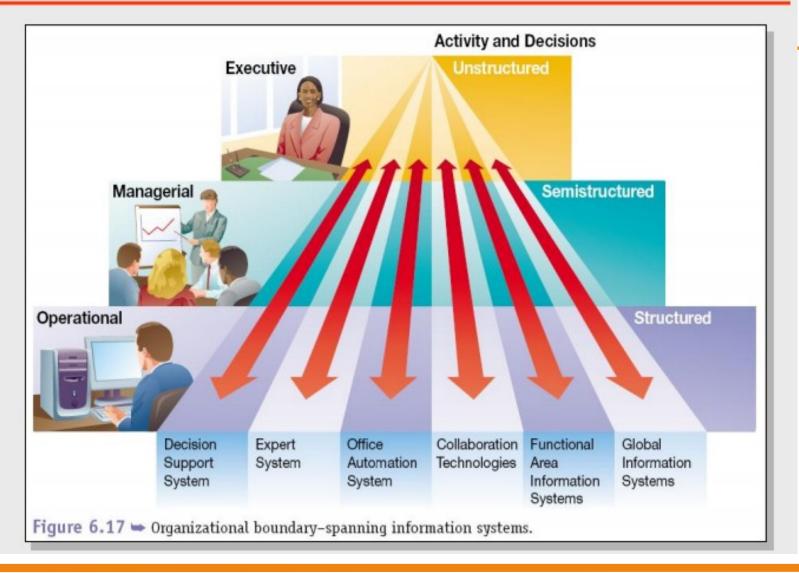


Operational Level

Figure 6.4 The executive level of an organization uses information systems to improve strategy and planning by providing summaries of past data and projections of the future.



#### Systems That Span Organizational Boundaries





#### **Opening Vignette:**

- "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

- 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

- 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**

<b>FACTOR</b>	<b>DESCRIPTION</b>			
Markets	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			
Consumer	Desire for customization			
demand	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			
Societal	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			
	Creater emphasis on sustainability			



#### Organizational Responses

- 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

- Improve customer service and relationships
- Move to electronic commerce (e-commerce)
- Move to make-to-order production and ondemand 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

 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

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



#### **Decision Making Process**

- Managers usually make decisions by following a four-step process (a.k.a. the scientific approach)
  - 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

- 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

- 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)

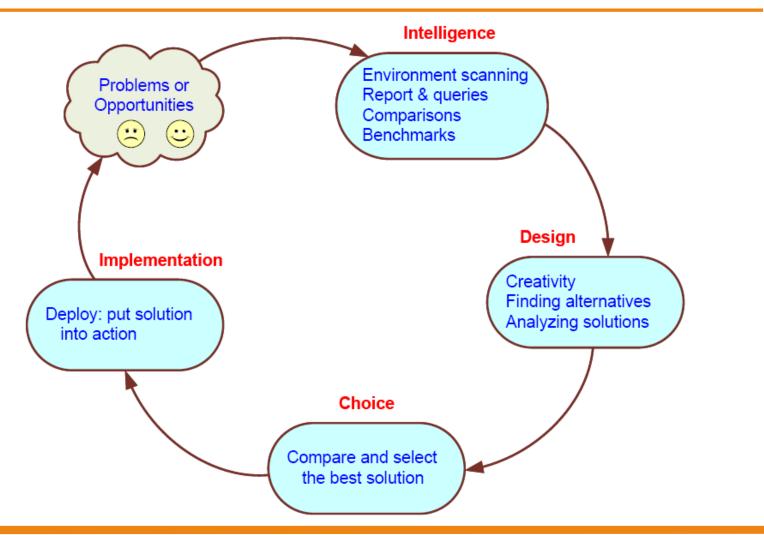
	Type of Control		
Type of Decision	Operational Control	Managerial Control	Strategic Planning
Structured	Accounts receivable Accounts payable Order entry	Budget analysis Short-term forecasting Personnel reports Make-or-buy	Financial management Investment portfolio Warehouse location Distribution systems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



# A Decision Support Framework – cont.

- 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

- 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



#### **Automated Decision Making**

- 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

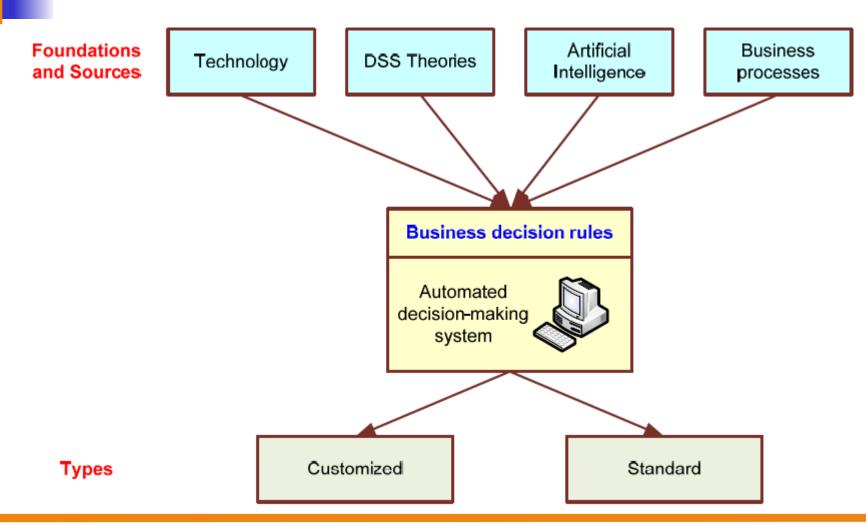
- Unstructured problems can be only partially supported by standard computerized quantitative methods
- They often require customized solutions
- They benefit from data and information
- Intuition and judgment may play a role
- Computerized communication and collaboration technologies along with knowledge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



#### Computer Support for Semi-structured Problems

- 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

#### 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

- 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.)

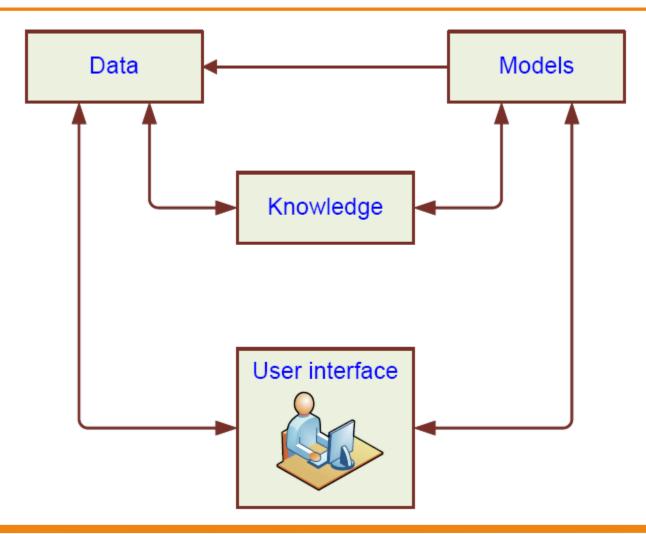


#### DSS as a Specific Application

- In a narrow sense DSS refers to a process for building customized applications for unstructured or semistructured 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

- 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)**

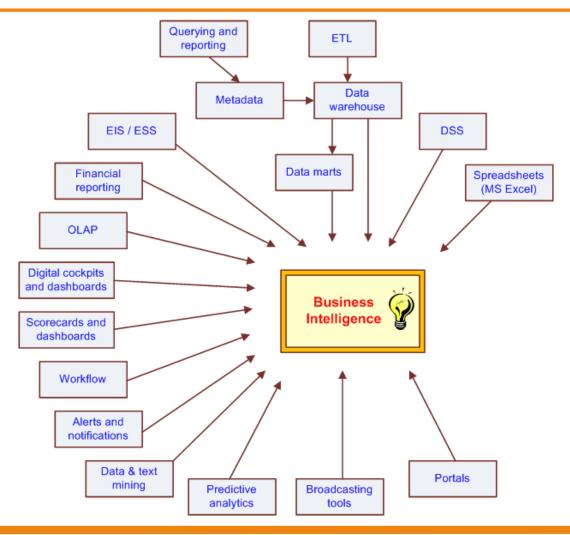
- BI is an umbrella term that combines architectures, tools, databases, analytical tools, applications, and methodologies
- Like DSS, BI a content-free expression, so it means different things to different people
- BI's major objective is to enable easy access to data (and models) to provide business 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

- 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, adhoc 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

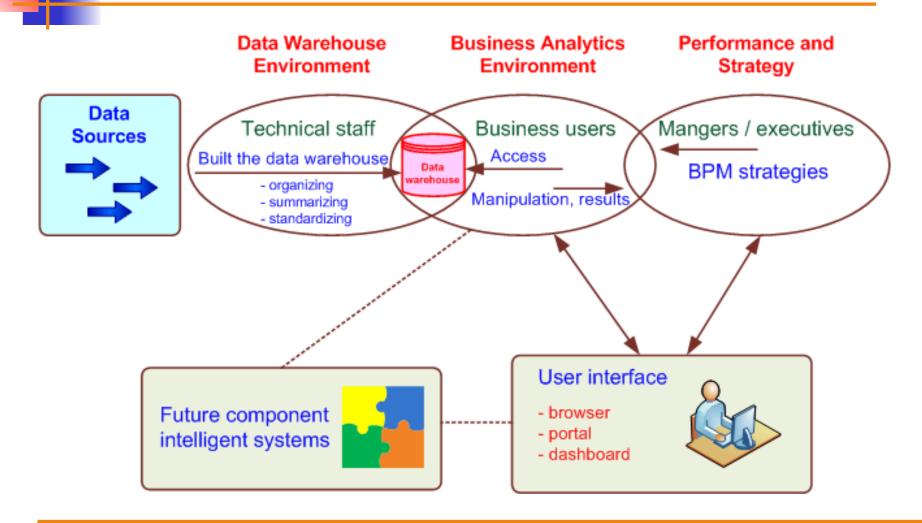




#### The Architecture of BI

- 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 Bl





# Components in a BI Architecture

- 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 Bl components



# Styles of BI

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



- 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

- 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.

- 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.

- 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

# Major Tool Categories for MSS

TOOL CATEGORY	TOOLS AND THEIR ACRONYMS
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	Business performance management (BPM)/
management	Corporate performance management (CPM)
	Business activity management (BAM)
	Dashboards and Scorecards
Communication and	Group decision support systems (GDSS)
collaboration	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)
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Source: Table



# Hybrid (Integrated) Support Systems

- 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

- 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

# Case on IDSS

#### **APPLICATION CASE 1.5**

United Sugars Corporation Optimizes Production, Distribution, and Inventory Capacity with Different Decision Support Tools

United Sugars Corporation, headquartered in Bloomington, Minnesota, is a grower-owned cooperative that sells and distributes sugar products for its member companies. United has a 25 percent U.S. market share and sales of more than \$1 billion annually. When the United States Sugar Corporation in southern Florida joined the cooperative, United Sugars decided to revise its marketing and distribution plans to gain access to new markets and serve existing ones more efficiently. Improvements in managing the supply chain and in the supply chain's design were in order.

A strategic model was developed to identify the minimum-cost solutions for packaging, inventory, and distribution. The company's enterprise resource planning (ERP) system (and a legacy database system) provided data for several mathematical models (see Chapter 4). This first model contained about 1 million decision variables and more than 250,000 relationships. A Web-based GIS graphically displays reports and optimal solutions. A map of the United States indicates the locations of plants, warehouses, and customers. Each one is a hotspot that links to additional information about the solutions.

This model is also used to schedule production and distribution. Results are uploaded into the ERP to support operational decisions. The results of the strategic model drive the generation of subsequent models for inventory analysis. These models simulate a variety of inventory situations, through what-if analyses, and help analysts reduce the overall inventory. Results are displayed in a variety of formats in a Web browser.

This hybrid decision support system consists of several optimization and simulation models, an ERP, and Web interfaces.

Sources: Compiled from M. D. Cohen, C. B. Charles, and A. L. Medaglia, "Decision Support with Web-Enabled Software," Interfaces, Vol. 31, No. 2, 2001, and "U.S. Sugar in the News," unitedsugars.com (accessed July 2006).



# Harrah's Makes a Great Bet Vignette

- Data Warehouse
- Data Mining
- Business Intelligence
- Transaction Processing System
- Customer Relationship Management
- Decision Support System



# **End of the Chapter**

• Questions / Comments...



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