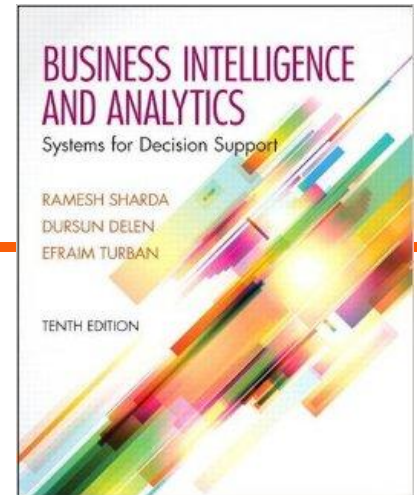


Business Intelligence and Analytics: Systems for Decision Support (10th Edition)



Chapter 2: Foundations and Technologies for Decision Making



Learning Objectives

- Understand the conceptual foundations of decision making
- Understand Simon's four phases of decision making: intelligence, design, choice, and implementation
- Understand the essential definition of decision support systems (DSS)
- Understand different types of DSS classifications

(Continued...)



Learning Objectives

- Learn the capabilities and limitations of DSS in supporting managerial decisions
- Learn how DSS support for decision making can be provided in practice
- Understand DSS components and how they integrate



Opening Vignette

Decision Modeling at HP Using Spreadsheets

- Background
- Problem description
- Proposed solution
- Results
- Answer & discuss the case questions...



Questions for the Opening Vignette

1. What are some of the key questions to be asked in supporting decision making through DSS?
2. What guidelines can be learned from this vignette about developing DSS?
3. What lessons should be kept in mind for successful model implementation?



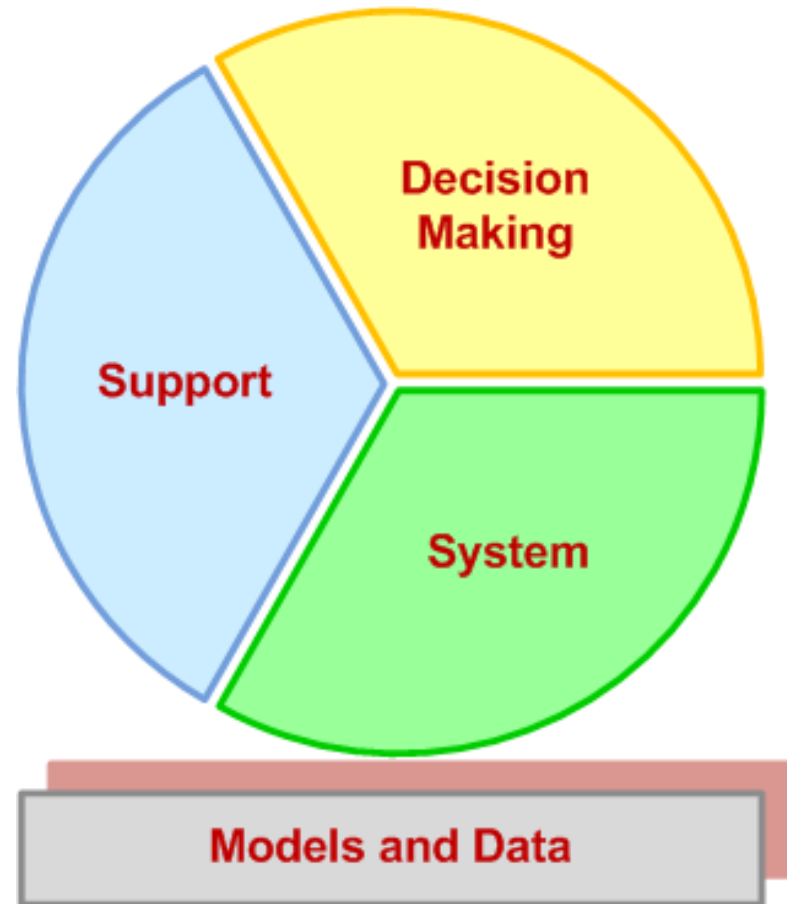
Characteristics of Decision Making

- Groupthink
- Evaluating what-if scenarios
- Experimentation with a real system!
- Changes in the decision-making environment may occur continuously
- Time pressure on the decision maker
- Analyzing a problem takes time/money
- Insufficient or too much information

Characteristics of Decision Making Decision Support Systems (DSS)

Dissecting DSS
into its main
concepts →

Building successful
DSS requires a
thorough
understanding of
these concepts





Decision Making

- A process of choosing among two or more alternative courses of action for the purpose of attaining a goal(s)
- Managerial decision making is synonymous with the entire management process - *Simon (1977)*
- Example: Planning
 - What should be done? When? Where? Why? How? By whom?



Decision-Making Disciplines

- **Behavioral:** anthropology, law, philosophy, political science, psychology, social psychology, and sociology
- **Scientific:** computer science, decision analysis, economics, engineering, the hard sciences (e.g., biology, chemistry, physics), management science/operations research, mathematics, and statistics
- Each discipline has its own set of assumptions and each contributes a unique, valid view of how people make decisions



Decision-Making Disciplines

- Better decisions
 - Tradeoff: **accuracy** versus **speed**
- Fast decision may be detrimental
- Many areas suffer from fast decisions
- Effectiveness versus Efficiency
- Effectiveness → “goodness” “accuracy”
- Efficiency → “speed” “less resources”
- A fine balance is what is needed!



Decision Style

- The manner by which decision makers think and react to problems
 - perceive a problem
 - cognitive response
 - values and beliefs
- When making decisions, people...
 - follow different steps/sequence
 - give different emphasis, time allotment, and priority to each step



Decision Style

- Personality temperament tests are often used to determine decision styles
- There are many such tests
 - Meyers/Briggs,
 - True Colors (Birkman),
 - Keirsey Temperament Theory, ...
- Various tests measure somewhat different aspects of personality
 - They cannot be equated!



Decision Style

- Decision-making styles
 - Heuristic versus Analytic
 - Autocratic versus Democratic
 - Consultative (with individuals or groups)
- A successful computerized system should fit the decision style and the decision situation
 - Should be flexible and adaptable to different users (individuals vs. groups)



Decision Makers

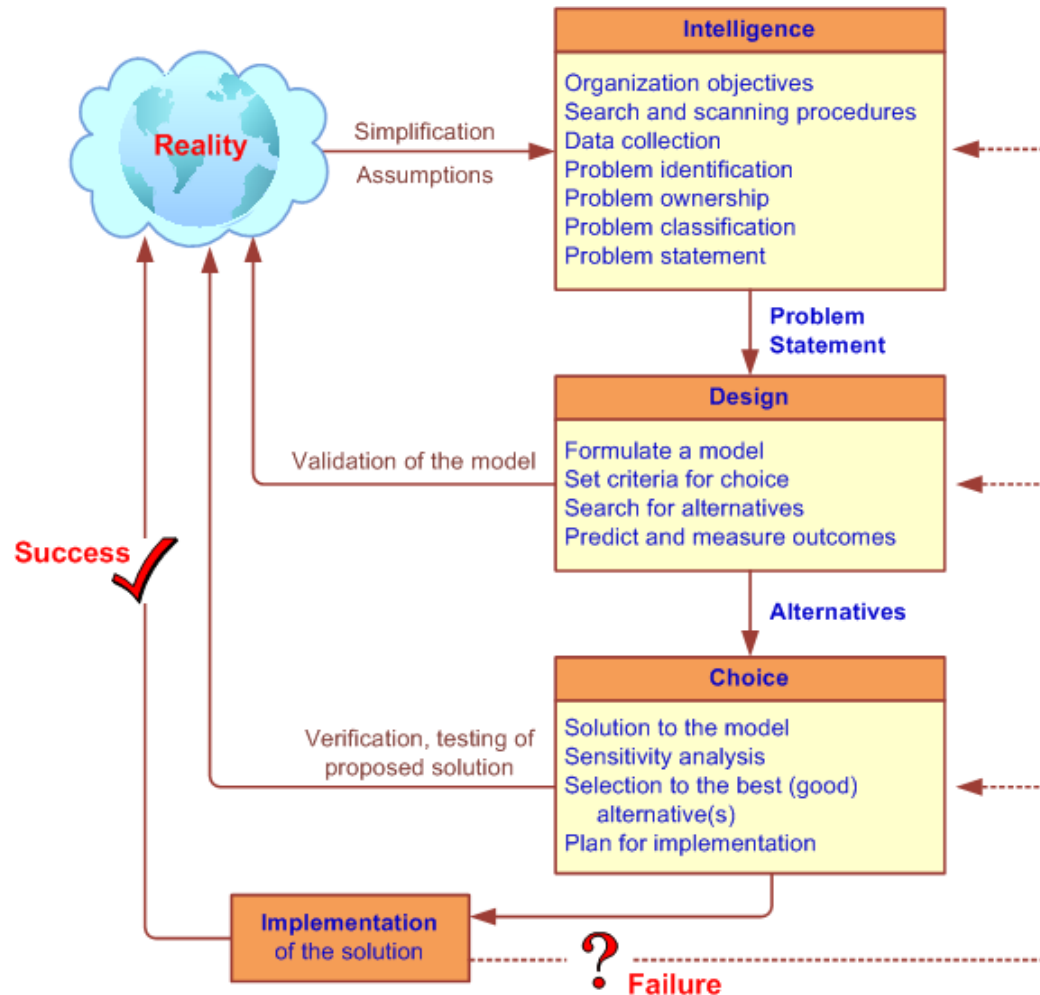
- Small organizations
 - Individuals
 - Conflicting objectives
- Medium-to-large organizations
 - Groups
 - Different styles, backgrounds, expectations
 - Conflicting objectives
 - Consensus is often difficult to reach
 - Help: Computer support, GSS, ...



Phases of Decision-Making Process

- Humans consciously or subconsciously follow a systematic decision-making process - Simon (1977)
 - 1) Intelligence
 - 2) Design
 - 3) Choice
 - 4) Implementation
 - 5) (?) Monitoring (a part of intelligence?)

Simon's Decision-Making Process





Decision Making: Intelligence Phase

- Scan the environment, either intermittently or continuously
- Identify problem situations or opportunities
- Monitor the results of the implementation
- **Problem** is the difference between what people desire (or expect) and what is actually occurring
 - Symptom versus Problem
- Timely identification of opportunities is as important as identification of problems



Decision Making: Intelligence Phase

- Potential issues in data/information collection and estimation
 - Lack of data
 - Cost of data collection
 - Inaccurate and/or imprecise data
 - Data estimation is often subjective
 - Data may be insecure
 - Key data may be qualitative
 - Data change over time (time-dependence)



Application Case 2.1

Making Elevators Go Faster!

- Background
- Problem description
- Proposed solution
- Results



Decision Making: Intelligence Phase

- Problem Classification
 - Classification of problems according to the degree of structuredness
- Problem Decomposition
 - Often solving the simpler subproblems may help in solving a complex problem.
 - Information/data can improve the structuredness of a problem situation
- Problem Ownership
- Outcome of intelligence phase → A Formal Problem Statement

Web and the Decision -Making Process

TABLE 2.1 Simon's Four Phases of Decision Making and the Web

Phase	Web Impacts	Impacts on the Web
Intelligence	<p>Access to information to identify problems and opportunities from internal and external data sources</p> <p>Access to analytics methods to identify opportunities</p> <p>Collaboration through group support systems (GSS) and knowledge management systems (KMS)</p>	<p>Identification of opportunities for e-commerce, Web infrastructure, hardware and software tools, etc.</p> <p>Intelligent agents, which reduce the burden of information overload</p> <p>Smart search engines</p>
Design	<p>Access to data, models, and solution methods</p> <p>Use of online analytical processing (OLAP), data mining, and data warehouses</p> <p>Collaboration through GSS and KMS</p> <p>Similar solutions available from KMS</p>	<p>Brainstorming methods (e.g., GSS) to collaborate in Web infrastructure design</p> <p>Models and solutions of Web infrastructure issues</p>
Choice	<p>Access to methods to evaluate the impacts of proposed solutions</p>	<p>Decision support system (DSS) tools, which examine and establish criteria from models to determine Web, intranet, and extranet infrastructure</p> <p>DSS tools, which determine how to route messages</p>
Implementation	<p>Web-based collaboration tools (e.g., GSS) and KMS, which can assist in implementing decisions</p> <p>Tools, which monitor the performance of e-commerce and other sites, including intranets, extranets, and the Internet</p>	<p>Decisions implemented on browser and server design and access, which ultimately determined how to set up the various components that have evolved into the Internet</p>



Decision Making: The Design Phase

- Finding/developing and analyzing possible courses of actions
- A model of the decision-making problem is constructed, tested, and validated
- Modeling: conceptualizing a problem and abstracting it into a quantitative and/or qualitative form (i.e., using symbols/variables)
 - Abstraction: making assumptions for simplification
 - Tradeoff (cost/benefit): more or less abstraction
 - Modeling: both an art and a science



Decision Making: The Design Phase

- Selection of a Principle of Choice
 - It is a **criterion** that describes the acceptability of a solution approach
 - Reflection of decision-making objective(s)
 - In a model, it is the result variable
 - Choosing and validating against
 - High-risk versus low-risk
 - Optimize versus satisfice
 - **Criterion is not a constraint!**
 - See Technology Insight 2.1



Decision Making: The Design Phase

- Normative models (= optimization)
 - the chosen alternative is demonstrably the best of all possible alternatives
 - Assumptions of rational decision makers
 - Humans are economic beings whose objective is to maximize the attainment of goals
 - For a decision-making situation, all alternative courses of action and consequences are known
 - Decision makers have an order or preference that enables them to rank the desirability of all consequences



Decision Making: The Design Phase

- Heuristic models (= suboptimization)
 - The chosen alternative is the best of only a subset of possible alternatives
 - Often, it is not feasible to optimize realistic (size/complexity) problems
 - Suboptimization may also help relax unrealistic assumptions in models
 - Help reach a good enough solution faster



Decision Making: The Design Phase

- Descriptive models
 - Describe things as they are or as they are believed to be (mathematically based)
 - They do not provide a solution but information that may lead to a solution
 - **Simulation** - most common descriptive modeling method (mathematical depiction of systems in a computer environment)
 - Allows experimentation with the descriptive model of a system



Decision Making: The Design Phase

- Good Enough, or Satisficing
 - “something less than the best”
 - A form of suboptimization
 - Seeking to achieve a desired level of performance as opposed to the “best”
 - Benefit: time saving
 - Simon’s idea of **bounded rationality**



Decision Making: The Design Phase

- Developing (Generating) Alternatives
 - In optimization models (such as linear programming), the alternatives may be generated automatically
 - In most MSS situations, however, it is necessary to generate alternatives manually
 - Use of GSS helps generate alternatives
- Measuring/ranking the outcomes
 - Using the principle of choice



Decision Making: The Design Phase

- Risk

- Lack of precise knowledge (uncertainty)
- Risk can be measured with probability

- Scenario (what-if case)

- A statement of assumptions about the operating environment (variables) of a particular system at a given time
- Possible scenarios: best, worst, most likely, average (and custom intervals)



Decision Making: The Choice Phase

- The actual decision and the commitment to follow a certain course of action are made here
- The boundary between the design and choice is often unclear (partially overlapping phases)
 - Generate alternatives while performing evaluations
- Includes the **search**, **evaluation**, and **recommendation** of an appropriate solution to the model
- Solving the model versus solving the problem!



Decision Making: The Choice Phase

- Search approaches
 - Analytic techniques (solving with a formula)
 - Algorithms (step-by-step procedures)
 - Heuristics (rule of thumb)
 - Blind search (truly random search)
- Additional activities
 - Sensitivity analysis
 - What-if analysis
 - Goal seeking



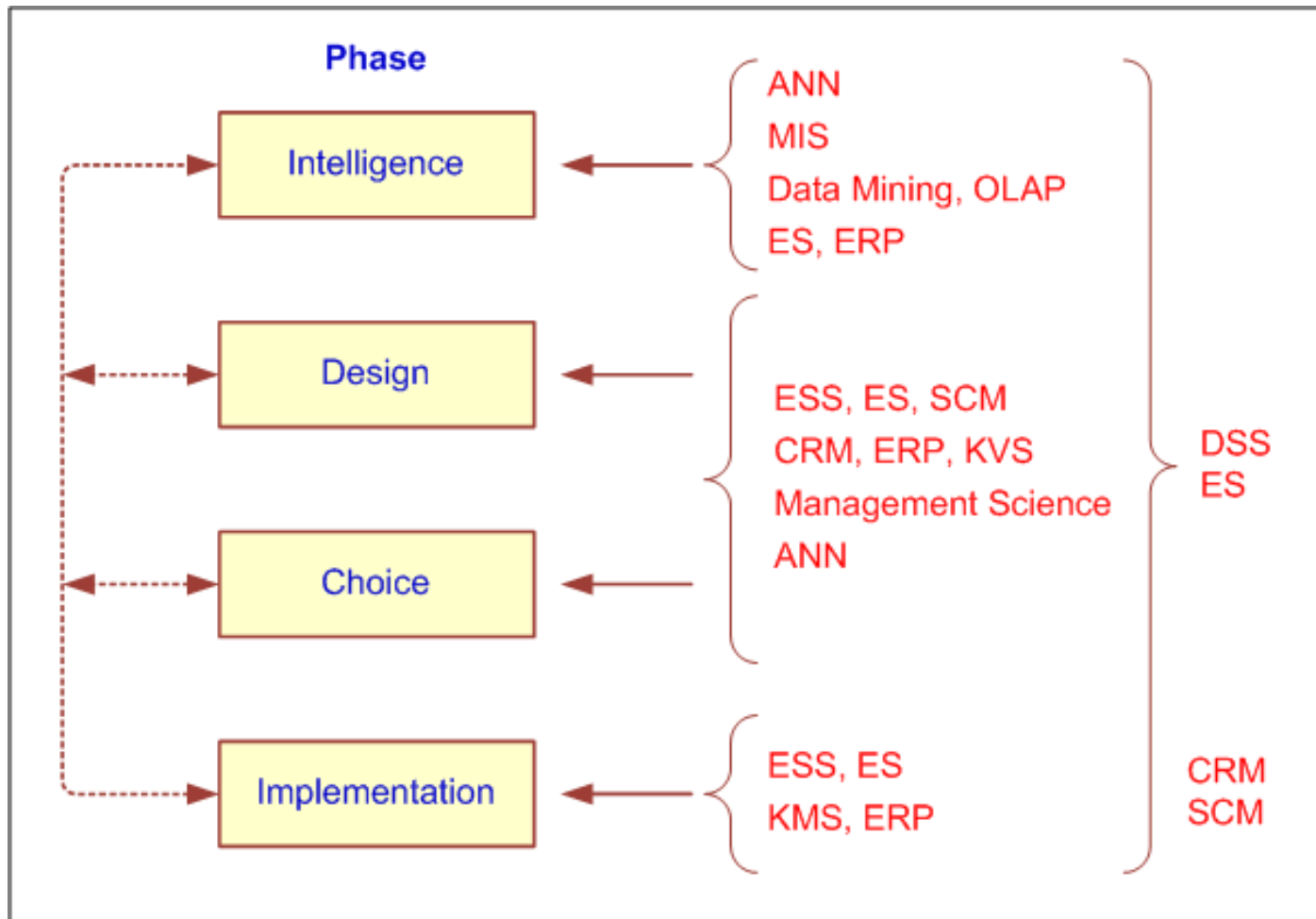
Decision Making: The Implementation Phase

“Nothing more difficult to carry out, nor more doubtful of success, nor more dangerous to handle, than to initiate a new order of things.”

- *The Prince, Machiavelli 1500s*

- Solution to a problem → **Change**
- Change management ?..
- Implementation: putting a recommended solution to work

How Decisions are Supported





How Decisions are Supported

- **Support for the Intelligence Phase**
 - Enabling continuous scanning of external and internal information sources to identify problems and/or opportunities
 - Resources/technologies: Web; ES, OLAP, data warehousing, data/text/Web mining, EIS/Dashboards, KMS, GSS, GIS,...
 - Business activity monitoring (BAM)
 - Business process management (BPM)
 - Product life-cycle management (PLM)



How Decisions are Supported

- Support for the Design Phase
 - Enabling generating alternative courses of action, determining the criteria for choice
 - Generating alternatives
 - Structured/simple problems: standard and/or special models
 - Unstructured/complex problems: human experts, ES, KMS, brainstorming/GSS, OLAP, data/text mining
- A good “criteria for choice” is critical!



How Decisions are Supported

- Support for the Choice Phase
 - Enabling selection of the best alternative given a complex constraint structure
 - Use sensitivity analyses, what-if analyses, goal seeking
 - Resources
 - KMS
 - CRM, ERP, and SCM
 - Simulation and other descriptive models



How Decisions are Supported

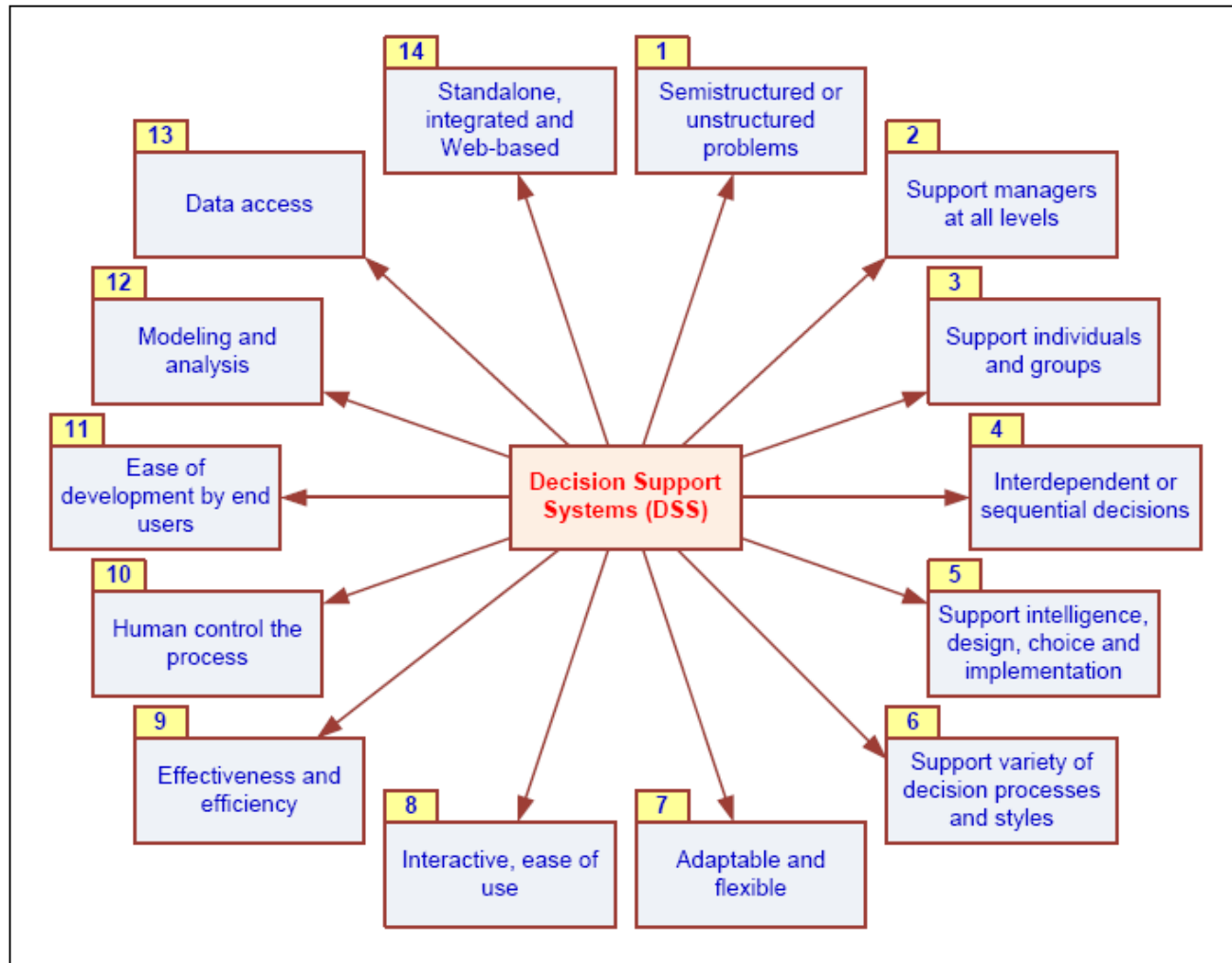
- Support for the Implementation Phase
 - Enabling implementation/deployment of the selected solution to the system
 - Decision communication, explanation and justification to reduce resistance to change
 - Resources
 - Corporate portals, Web 2.0/Wikis
 - Brainstorming/GSS
 - KMS, ES



DSS Capabilities

- DSS early definition: it is a system intended to support managerial decisions in semistructured and unstructured decision situations
- DSS were meant to be adjuncts to decision makers → extending their capabilities
- They are computer based and would operate interactively online, and preferably would have graphical output capabilities
- Nowadays, simplified via Web browsers and mobile devices

DSS Capabilities





DSS Classifications

- AIS SIGDSS Classification
 1. Communication-driven and group DSS
 2. Data-driven DSS
 3. Document-driven DSS
 4. Knowledge-driven DSS
 5. Model-driven DSS

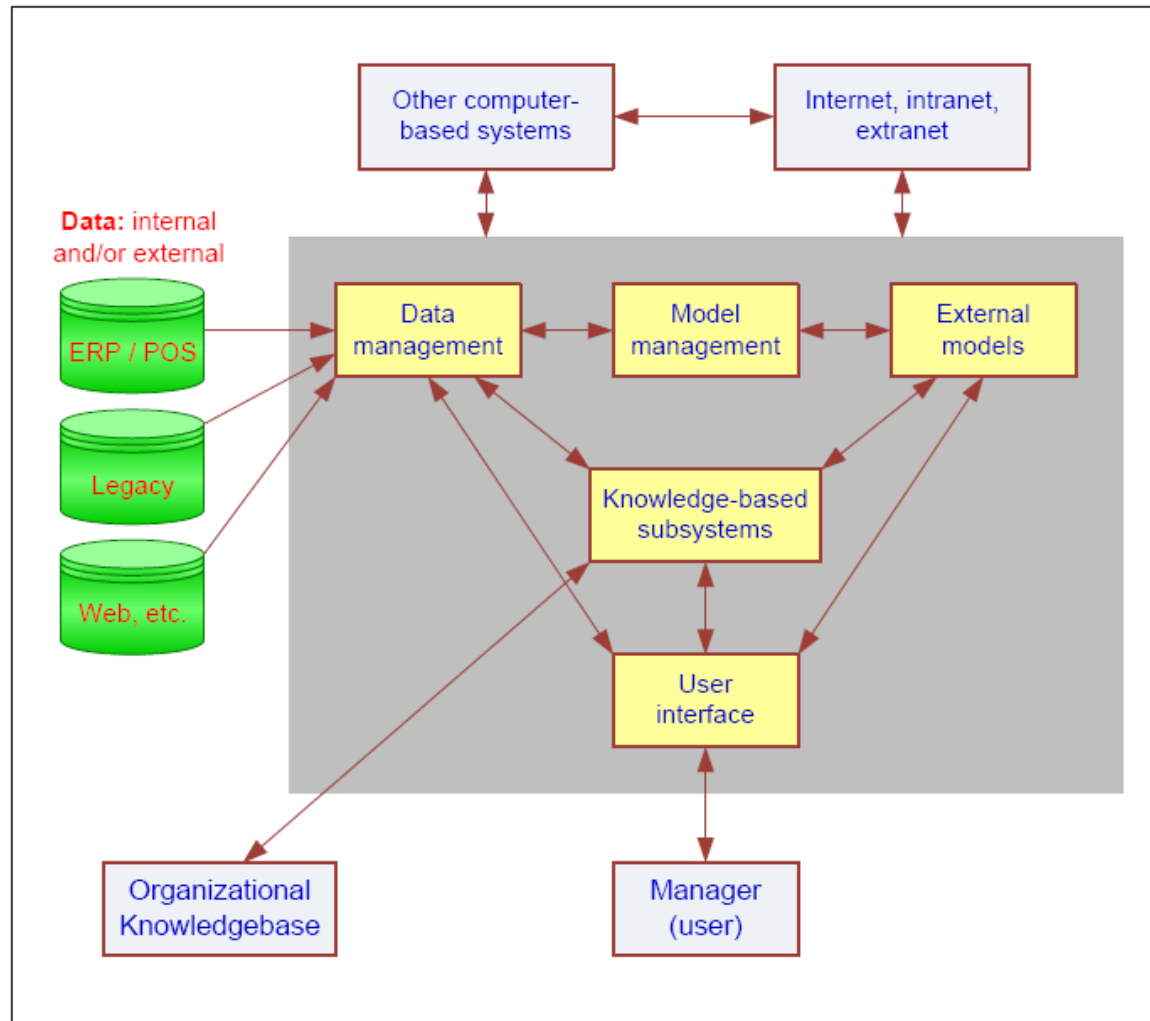
- Often DSS is a hybrid of many classes



DSS Classifications

- Other DSS Categories
 - Institutional and ad-hoc DSS
 - Custom-made systems versus ready-made systems
 - Personal, group, and organizational support
 - Individual support system versus group support system (GSS)...

Components of DSS





Components of DSS

1. Data Management Subsystem

- Includes the database that contains the data
- Database management system (DBMS)
- Can be connected to a data warehouse

2. Model Management Subsystem

- Model base management system (MBMS)

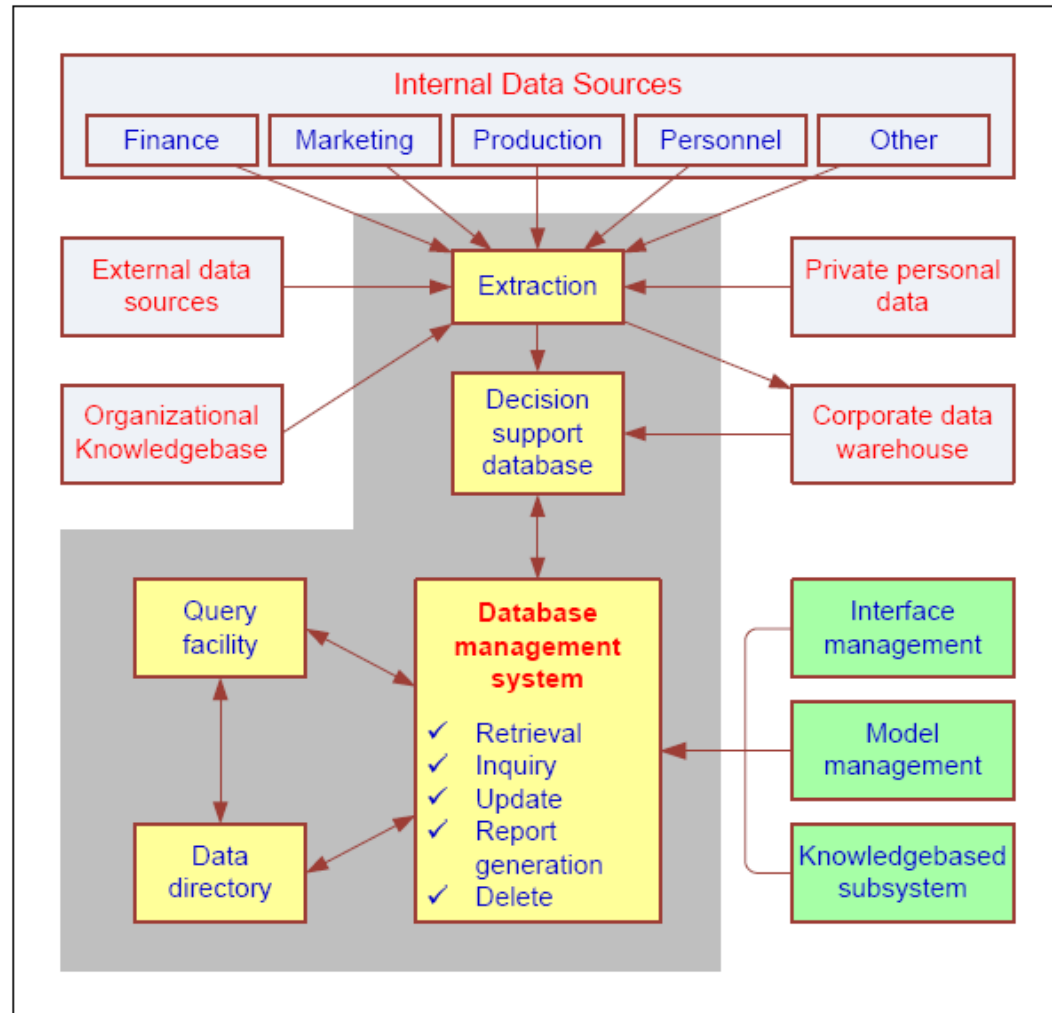
3. User Interface Subsystem

4. Knowledgebase Management Subsystem

- Organizational knowledge base

DSS Components: Data Management Subsystem

- DSS database
- DBMS
- Data directory
- Query facility





Application Case 2.2

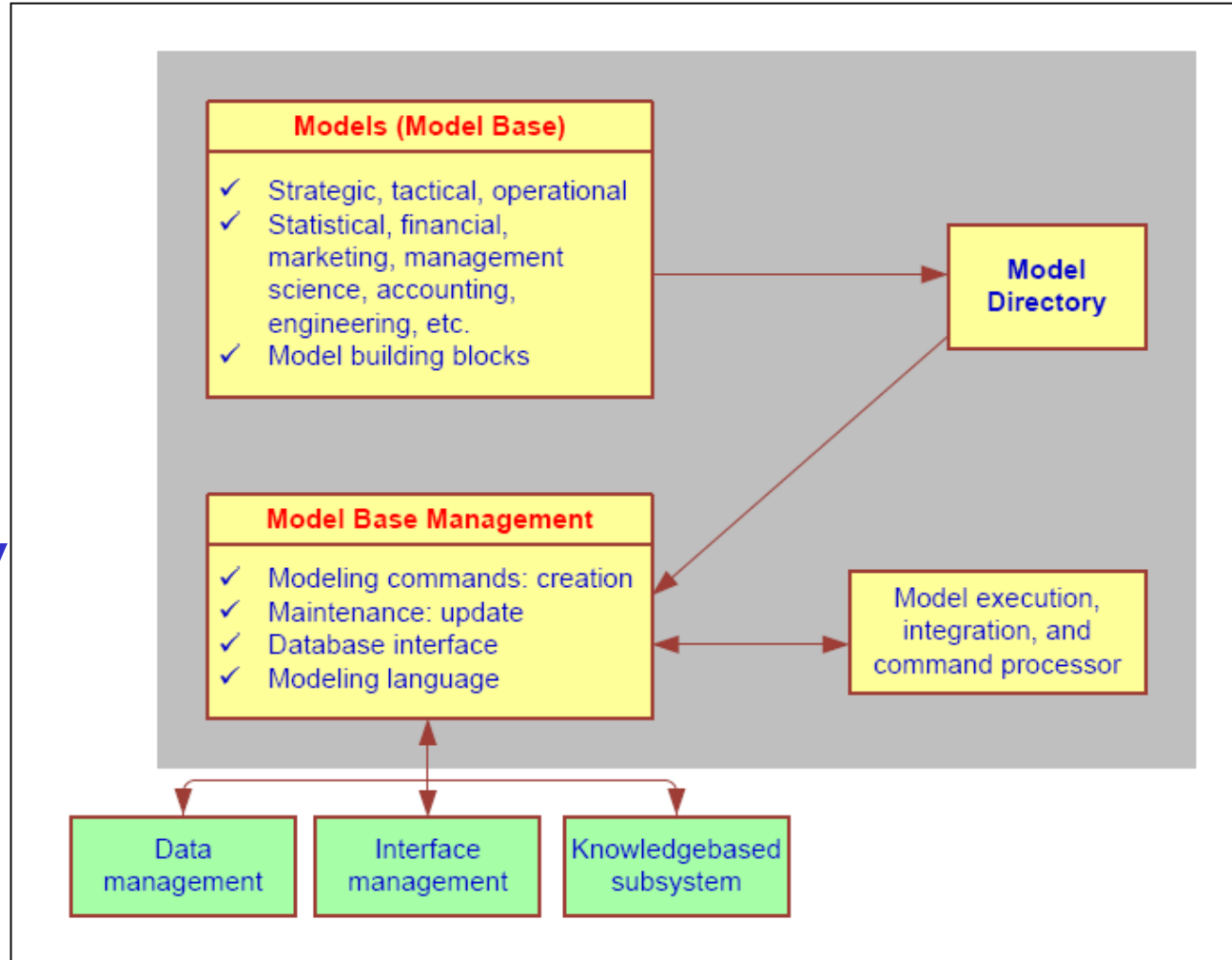
Station Casinos Wins by Building Customer Relationships Using Its Data

Questions for Discussion

1. Why is this decision support system classified as a data-focused DSS?
2. What were some of the benefits from implementing this solution?

DSS Components: Model Management Subsystem

- Model base
- MBMS
- Modeling language
- Model directory
- Model execution, integration, and command processor





Application Case 2.3

SNAP DSS Helps OneNet Make Telecommunications Rate Decisions

- Background
- Problem description
- Proposed solution
- Results

DSS Components: User Interface Subsystem

■ Interface

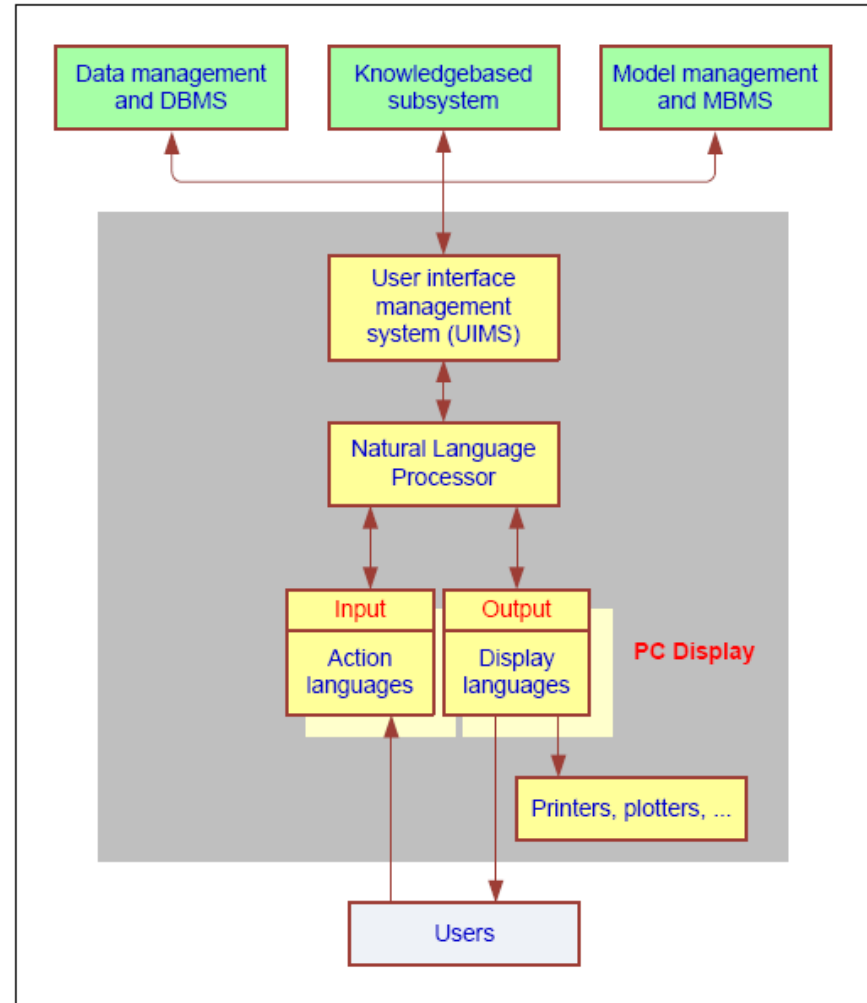
- Application interface
- User Interface (GUI?)

■ DSS User Interface

- Portal
- Graphical icons
 - Dashboard
- Color coding

■ Interfacing with PDAs, cell phones, etc.

- See Technology Insight 2.2 for next gen devices





End of the Chapter

- Questions, comments



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