

Chapter 2:

Foundations and Technologies for Decision Making

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
- 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-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

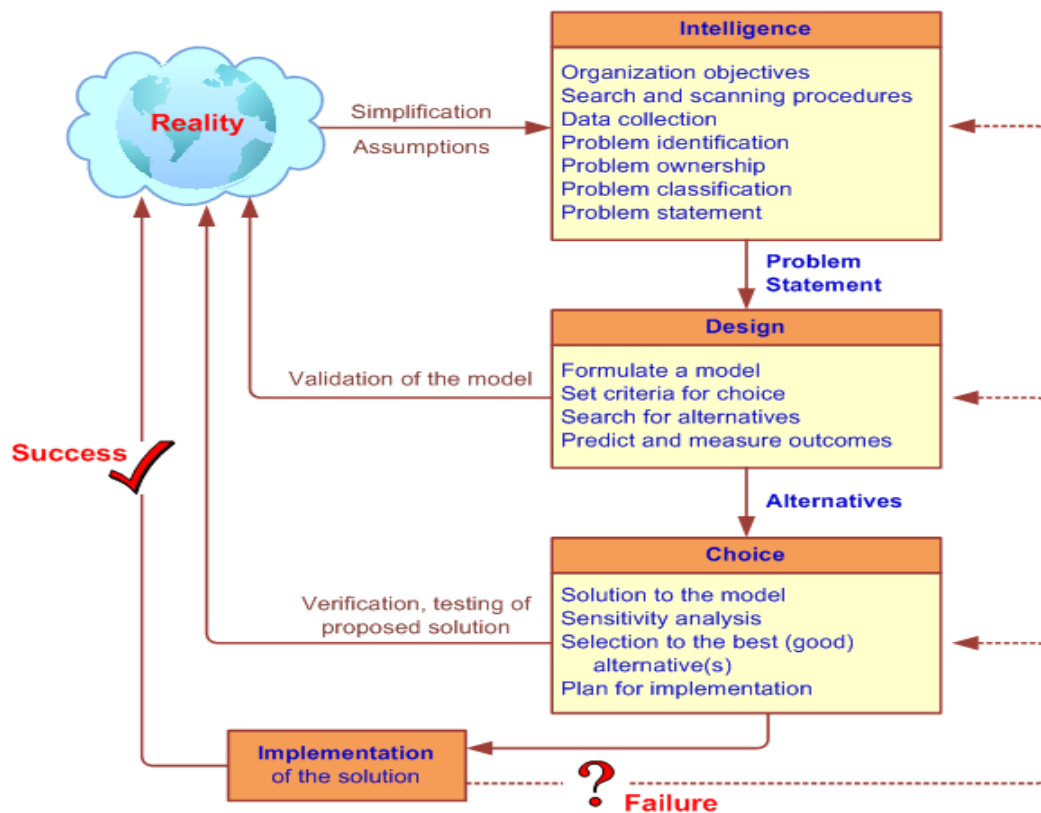
- Small organizations
 - Individuals
 - Conflicting objectives
- Medium-to-large organizations
 - Groups
 - Different styles, backgrounds, expectations
 - Conflicting objectives
 - Consensus is often difficult to reach

- 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)

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
- 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!**

- 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
- 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
- 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
- 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**
 - 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
- 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

DSS

- 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!
- 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

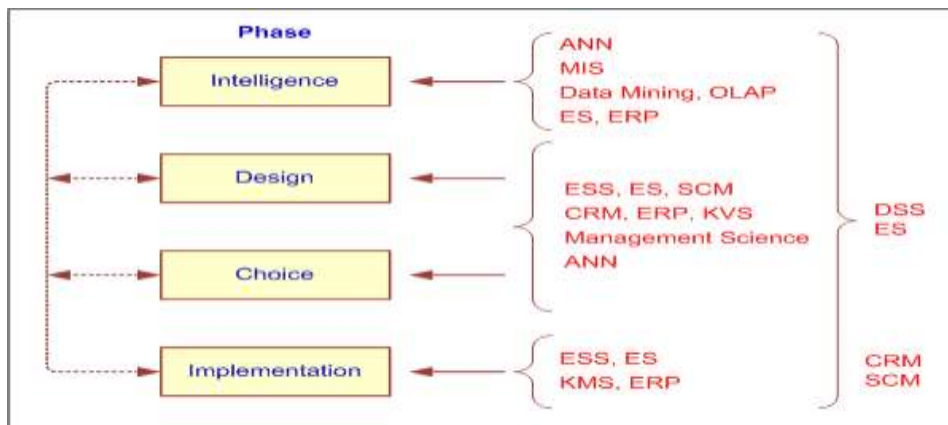
Decision Making: The Implementation Phase

“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**

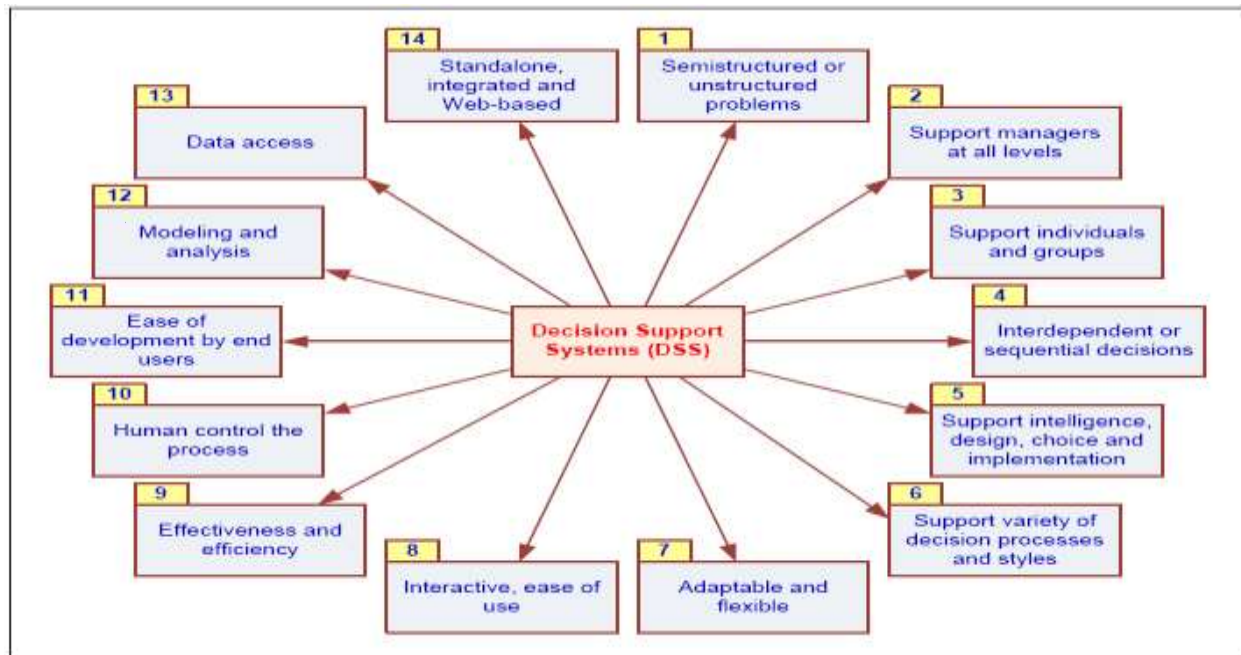
- Enabling continuous scanning of external and internal information sources to identify problems and/or opportunities
- Resources/technologies: Web; ES, OLAP, data warehousing, data/text/Web mining, EIS/Dashboards, KMS, GSS, GIS,...
- Business activity monitoring (BAM)
- Business process management (BPM)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

■ AIS SIGDSS Classification

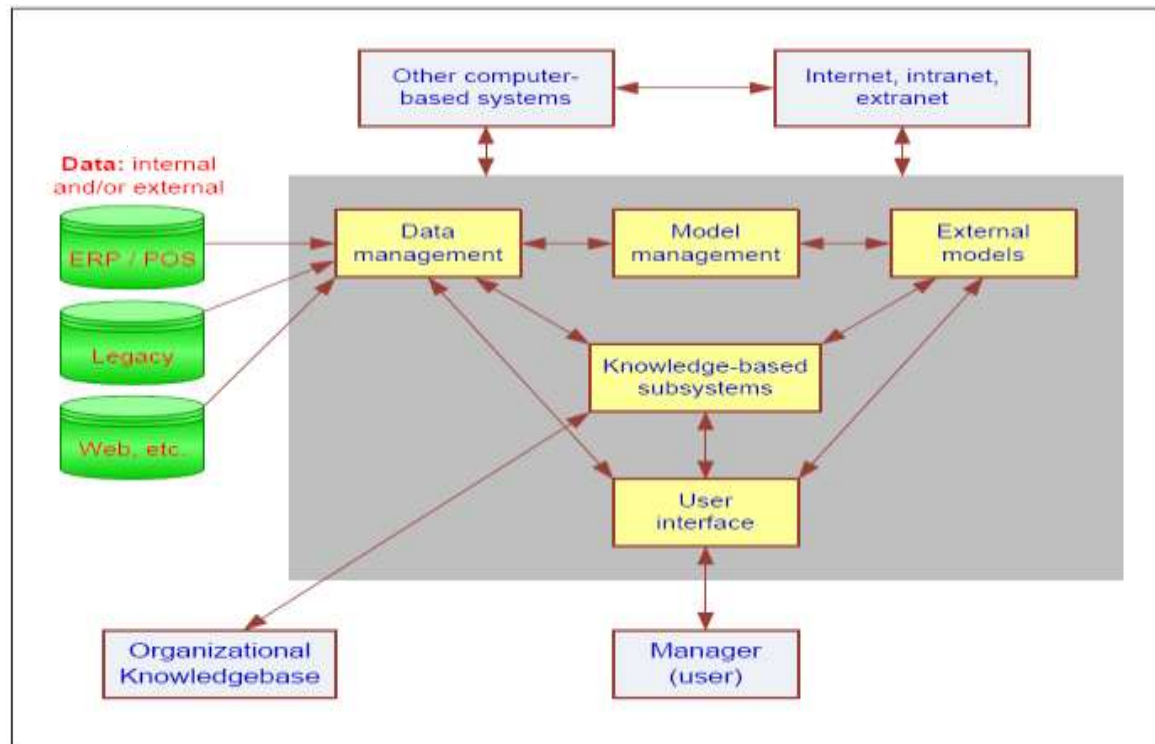
1. Communication-driven and group DSS
2. Data-driven DSS
3. Document-driven DSS
4. Knowledge-driven DSS
5. Model-driven DSS

■ Often DSS is a hybrid of many classes

■ 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



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

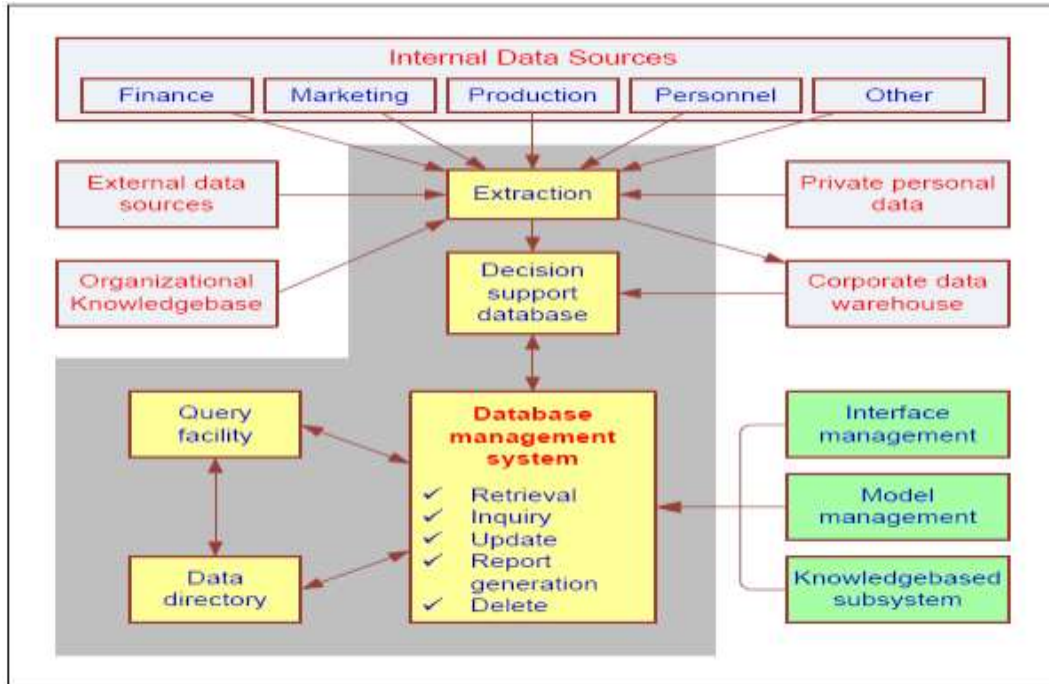
4. Knowledgebase Management Subsystem

- Organizational knowledge base

DSS Components:

Data Management Subsystem

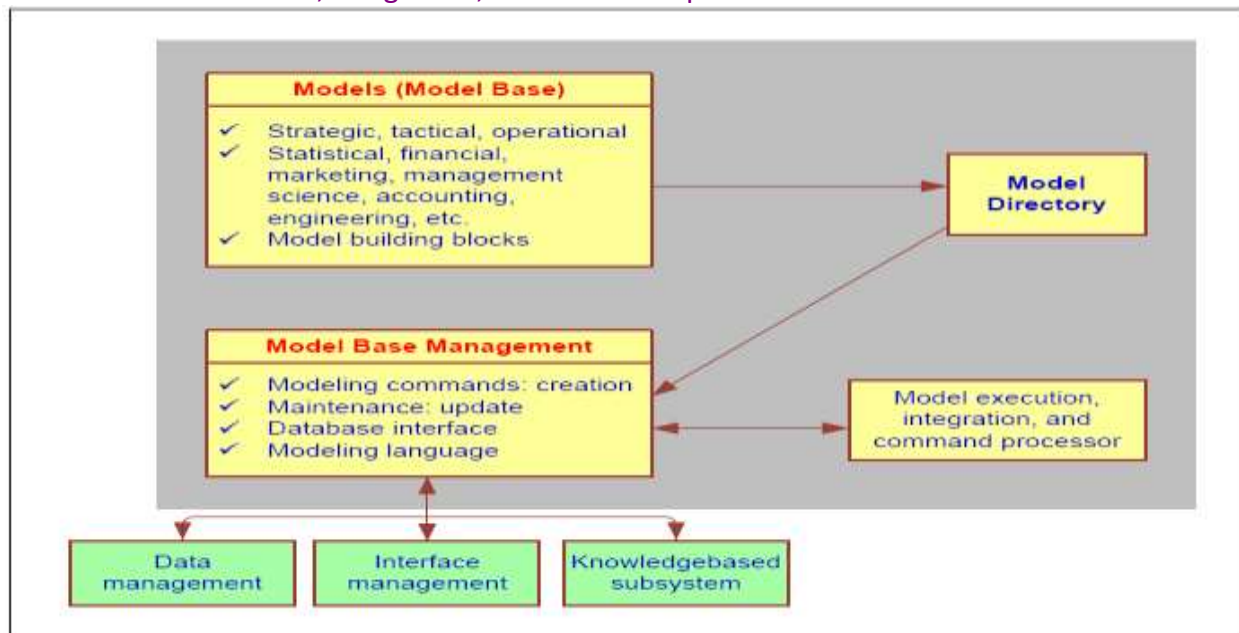
- DSS database
- DBMS
- Data directory
- Query facility



DSS Components:

Model Management Subsystem

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



DSS Components: User Interface Subsystem

