

DECISION SUPPORT SYSTEMS



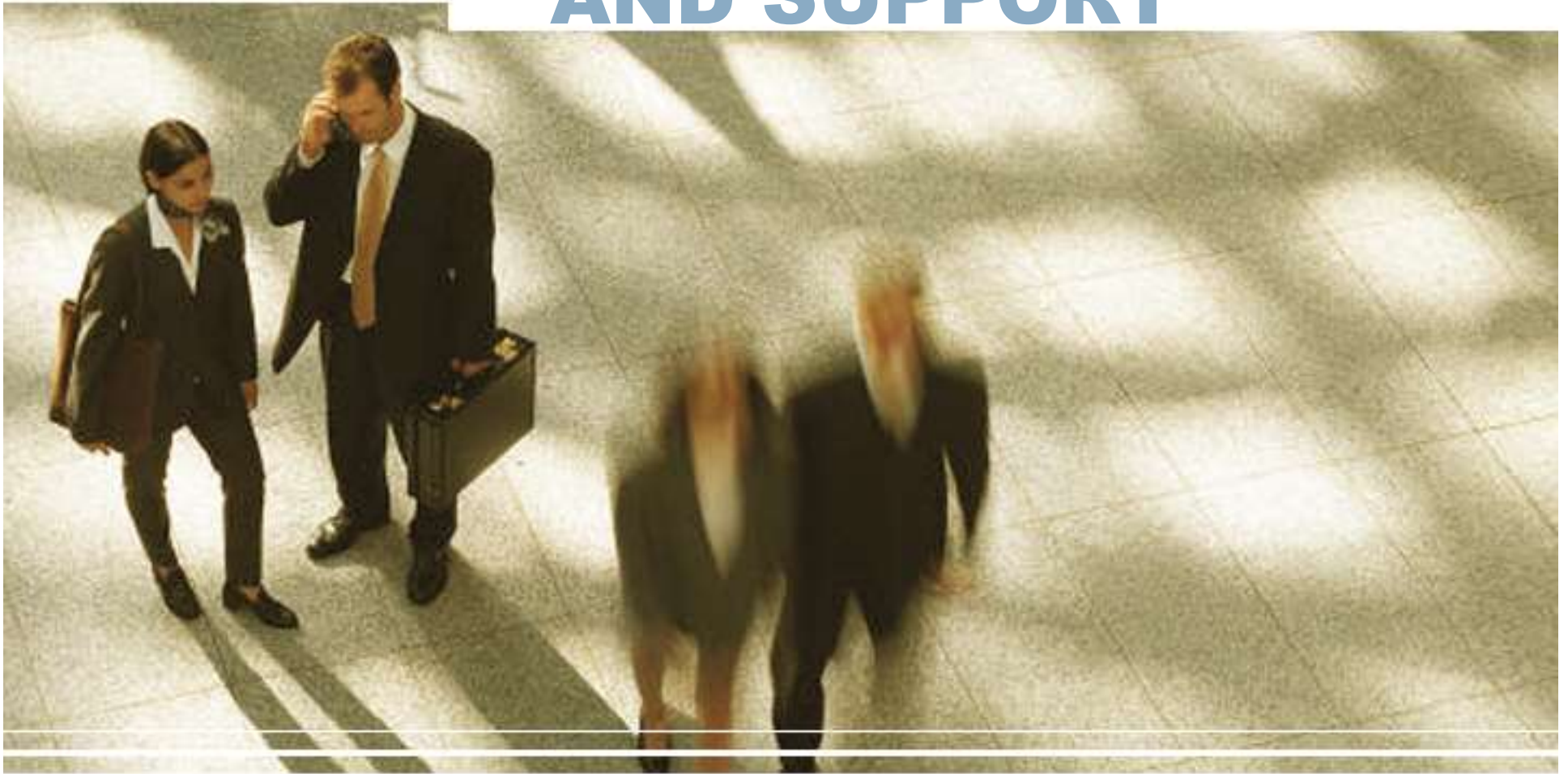
**CENTRAL
UNIVERSITY**

FAITH • INTEGRITY • EXCELLENCE

Presented by
Dr. K. Kissi Mireku

Chapter 2

DECISION MAKING, SYSTEMS, MODELING, AND SUPPORT



Learning Objectives

- Understand the conceptual foundations of decision making
- Understand Simon's four phases of decision making: intelligence, design, choice, and implementation
- Recognize the concepts of rationality and bounded rationality, and how they relate to decision making
- Differentiate between the concepts of making a choice and establishing a principle of choice
- Learn how DSS support for decision making can be provided in practice
- Understand the systems approach



Decision Making: Introduction and Definitions

Characteristics of decision making

- *Groupthink*
- *Decision makers are interested in evaluating what-if scenarios*
- *Experimentation with the real system may result in failure*
- *Experimentation with the real system is possible only for one set of conditions at a time and can be disastrous*
- *Changes in the decision making environment may occur continuously, leading to invalidating assumptions about the situation*



Decision Making: Introduction and Definitions

Characteristics of decision making

- *Changes in the decision making environment may affect decision quality by imposing time pressure on the decision maker*
- *Collecting information and analyzing a problem takes time and can be expensive. It is difficult to determine when to stop and make a decision*
- *There may not be sufficient information to make an intelligent decision*
- *Information overload*



Decision Making: Introduction and Definitions

Phases of the decision process

1. *Intelligence*
2. *Design*
3. *Choice*
4. *Implementation*



Problem solving

A process in which one starts from an initial state and proceeds to search through a problem space to identify a desired goal.

It includes the 4th phase of the decision process

Phases of the Decision-Making Process

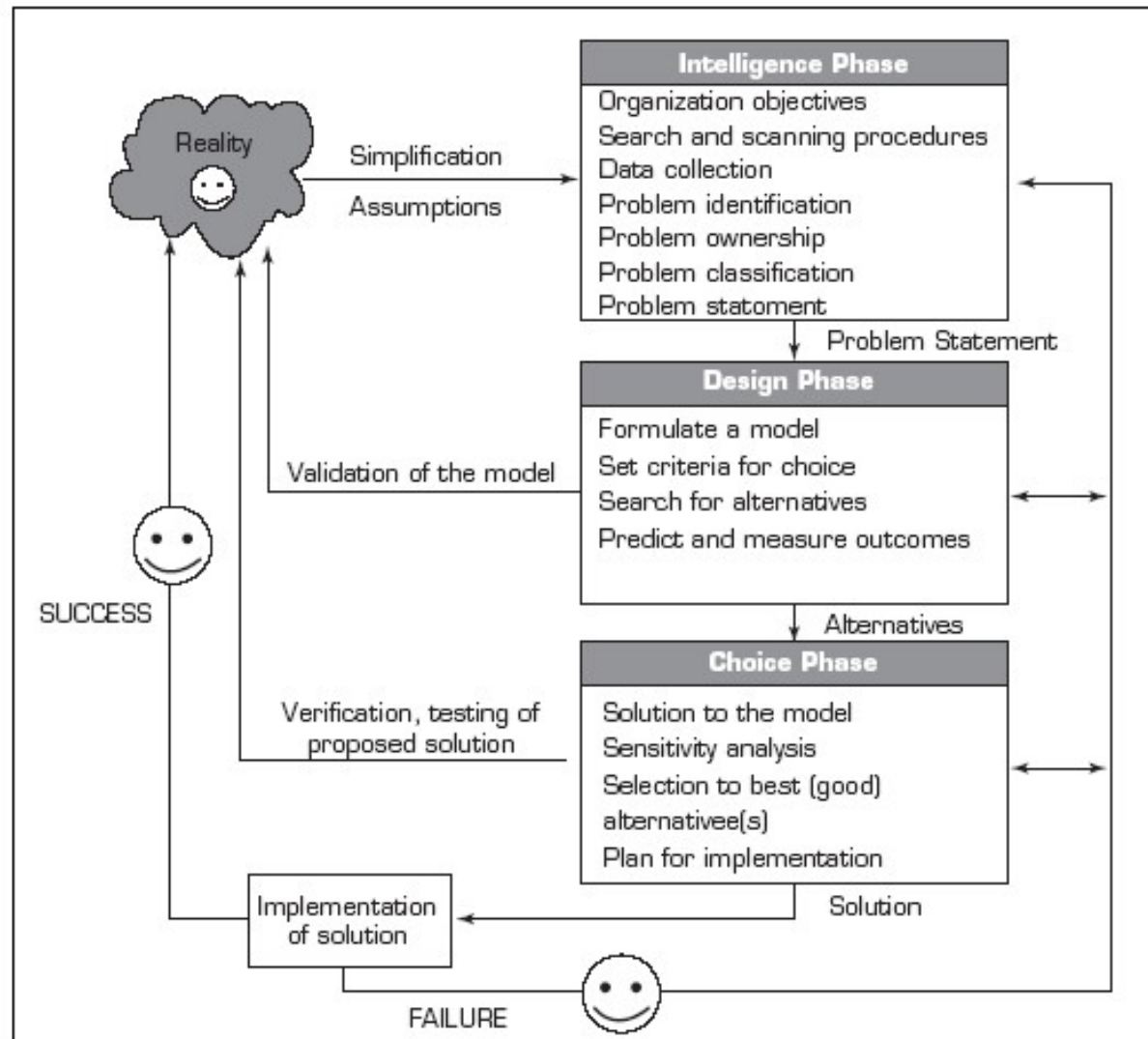


FIGURE 2.1 The Decision Making/Modeling Process

Phases of the Decision-Making Process

- **Intelligence phase**

The initial phase of problem definition in decision making

- **Design phase**

The second decision-making phase, which involves finding possible alternatives in decision making and assessing their contributions

- **Choice phase**

The third phase in decision making, in which an alternative is selected

- **Implementation phase**

The fourth decision-making phase, involving actually putting a recommended solution to work



Decision Making: The Intelligence Phase

Problem (or opportunity) identification: some issues that may arise during data collection

- *Data are not available*
- *Obtaining data may be expensive*
- *Data may not be accurate or precise enough*
- *Data estimation is often subjective*
- *Data may be insecure*
- *Important data that influence the results may*



Decision Making: The Intelligence Phase

Problem (or opportunity) identification: some issues that may arise during data collection

- *Information overload*
- *Outcomes (or results) may occur over an extended period*
- *If future data is not consistent with historical data, the nature of the change has to be predicted and included in the analysis*



Decision Making: The Intelligence Phase

- **Problem classification**

The conceptualization of a problem in an attempt to place it in a definable category, possibly leading to a standard solution approach

- **Problem decomposition**

Dividing complex problems into simpler sub-problems may help in solving the complex problem

- **Problem ownership**

The jurisdiction (authority) to solve a problem



Decision Making: The Design Phase

- ❑ The design phase involves finding or developing and analyzing possible courses of action
 - *Understanding the problem*
 - *Testing solutions for feasibility*
 - *A model of the decision-making problem is constructed, tested, and validated*
- ❑ Modelling involves conceptualizing a problem and abstracting it to quantitative and/or qualitative form
- ❑ Models have:
 - *Decision variables*
 - *Principle of choice*



Decision Making: The Design Phase

- **Decision variables**

A variable in a model that can be changed and manipulated by the decision maker. Decision variables correspond to the decisions to be made, such as quantity to produce, amounts of resources to allocate, and so on

- **Principle of choice**

The criterion for making a choice among alternatives

- **Normative models**

Models in which the chosen alternative is demonstrably the best of all possible alternatives

- **Optimization**

The process of examining all the alternatives and proving that the one selected is the best

- **Suboptimization**

An optimization-based procedure that does not consider all the alternatives for or impacts on an organization



Decision Making: The Design Phase

- **Descriptive model**

A model that describes things as they are

- ***Simulation***

An imitation of reality

- ***Narrative is a story that helps a decision maker uncover the important aspects of the situation and leads to better understanding and framing***

- **Good enough or satisficing**

- ***Satisficing***

A process by which one seeks a solution that will satisfy a set of constraints. In contrast to optimization, which seeks the best possible solution, satisficing simply seeks a solution that will work well enough



Decision Making: The Design Phase

❑ Good enough or satisficing

▪ *Reasons for satisficing:*

- Time pressures
- Ability to achieve optimization
- Recognition that the marginal benefit of a better solution is not worth the marginal cost to obtain it

❑ Developing (generating) alternatives

- *In optimization models the alternatives may be generated automatically by the model*
- *In most MSS situations it is necessary to generate alternatives manually (a lengthy, costly process); issues such as when to stop generating alternatives are very important*
- *The search for alternatives usually occurs after the criteria for evaluating the alternatives are determined*
- *The outcome of every proposed alternative must be established*



Decision Making: The Design Phase

☐ Measuring outcomes

- *The value of an alternative is evaluated in terms of goal attainment*

☐ Risk

- *One important task of a decision maker is to attribute a level of risk to the outcome associated with each potential alternative being considered*

☐ Scenario

A statement of assumptions about the operating environment of a particular system at a given time; a narrative description of the decision-situation setting

- *Scenarios are especially helpful in simulations and what-if analyses*



Decision Making: The Design Phase

❑ Scenarios play an important role in MSS because they:

- Help identify opportunities and problem areas
- Provide flexibility in planning
- Identify the leading edges of changes that management should monitor
- Help validate major modelling assumptions
- Allow the decision maker to explore the behaviour of a system through a model
- Help to check the sensitivity of proposed solutions to changes in the environment



Decision Making: The Design Phase

❑ Possible scenarios

- *The worst possible scenario*
- *The best possible scenario*
- *The most likely scenario*
- *The average scenario*

❑ Errors in decision making

- *The model is a critical component in the decision-making process*
- *A decision maker may make a number of errors in its development and use*
- *Validating the model before it is used is critical*
- *Gathering the right amount of information, with the right level of precision and accuracy is also critical*



Decision Making: The Choice Phase

❑ Solving a decision-making model involves searching for an appropriate course of action



- *Analytical techniques (solving a formula)*
- *Algorithms (step-by-step procedures)*
- *Heuristics (rules of thumb)*
- *Blind searches*

Decision Making: The Choice Phase

- **Analytical techniques**

Methods that use mathematical formulas to derive an optimal solution directly or to predict a certain result, mainly in solving structured problems

- **Algorithm**

A step-by-step search in which improvement is made at every step until the best solution is found

- **Heuristics**

Informal, judgmental knowledge of an application area that constitutes the rules of good judgment in the field. Heuristics also encompasses the knowledge of how to solve problems efficiently and effectively, how to plan steps in solving a complex problem, how to improve performance, and so forth



Decision Making: The Choice Phase

- **Sensitivity analysis**

A study of the effect of a change in one or more input variables on a proposed solution

- **What-if analysis**

A process that involves asking a computer what the effect of changing some of the input data or parameters would be



Decision Making: The Implementation Phase

Generic implementation issues important in dealing with MSS include:

- *Resistance to change*
- *Degree of support of top management*
- *User training*

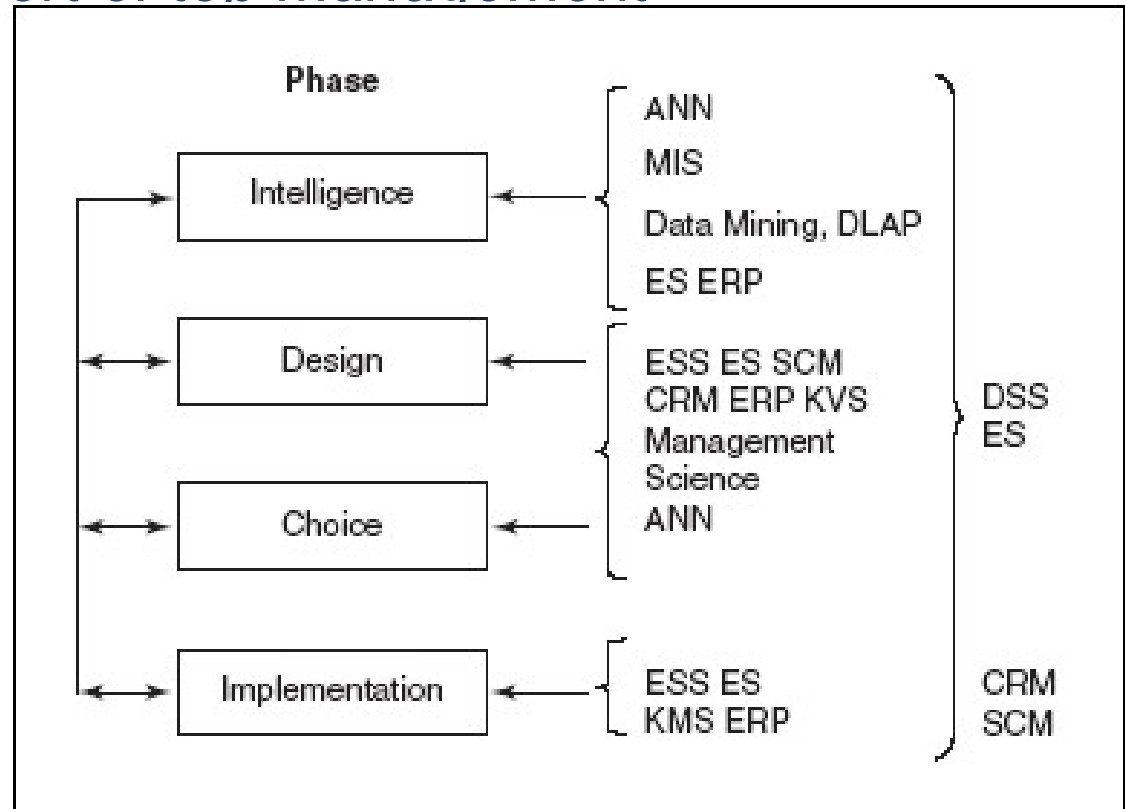


FIGURE 2.2 DSS Support

How Decisions Are Supported

❖ Support for the intelligence phase

- *The ability to scan external and internal information sources for opportunities and problems and to interpret what the scanning discovers*
 - Web tools and sources are extremely useful for environmental scanning
 - Web browsers provide useful front ends for a variety of tools (OLAP, data mining, data warehouses)
 - Internal data sources may be accessible via a corporate intranet
 - External sources are many and varied



How Decisions Are Supported

❖ Support for the design phase

- *The generation of alternatives for complex problems requires expertise that can be provided only by a*
 - human
 - brainstorming software,
 - or an Executive System



How Decisions Are Supported

❖ Support for the choice phase

- *DSS can support the choice phase through what-if and goal-seeking analyses*
- *Different scenarios can be tested for the selected option to reinforce the final decision*
- *KMS helps identify similar past experiences*
- *CRM, ERP, and SCM systems are used to test the impacts of decisions in establishing their value, leading to an intelligent choice*
- *An ES can be used to assess the desirability of certain solutions and to recommend an appropriate solution*
- *A GSS can provide support to lead to consensus in a group*



How Decisions Are Supported

❖ Support for the implementation phase

- *DSS can be used in implementation activities such as decision communication, explanation, and justification*
- *DSS benefits are partly due to the vividness and detail of analyses and reports*



How Decisions Are Supported

- New technology support for decision making
 - *Mobile commerce (m-commerce)*
 - *Personal devices*
 - Personal digital assistants [PDAs]
 - Cell phones
 - Tablet computers
 - Laptop computers



Decision Making

- Decision making disciplines
 - *Behavioral*
 - *Scientific*
- Successful decision
 - ***Effectiveness***
The degree of goal attainment. Doing the right things
 - ***Efficiency***
The ratio of output to input. Appropriate use of resources. Doing the things right



Decision Making: Introduction and Definitions

Decision style and decision makers

□ Decision style

The manner in which a decision maker thinks and reacts to problems. It includes perceptions, cognitive responses, values, and beliefs

- Autocratic
- Democratic
- Consultative
- *Different decision styles require different types of support*
 - *Individual decision makers need access to data and to experts who can provide advice*
 - *Groups need collaboration tools*





Models

- **Iconic model**

A scaled physical replica

- **Analog model**

An abstract, symbolic model of a system that behaves like the system but looks different

Mental model

The mechanisms or images through which a human mind performs sense-making in decision making

- **Mathematical (quantitative) model**

A system of symbols and expressions that represent a real situation

Models - benefits of models

- ☐ Model manipulation is much easier than manipulating a real system
- ☐ *Models enable the compression of time*
- ☐ *The cost of modelling analysis is much lower*
- ☐ *The cost of making mistakes during a trial-and-error experiment is much lower when models are used than with real systems*
- ☐ *With modelling, a manager can estimate the risks resulting from specific actions within the uncertainty of the business environment*
- ☐ *Mathematical models enable the analysis of a very large number of possible solutions*
- ☐ *Models enhance and reinforce learning and training*
- ☐ *Models and solution methods are readily available on the Web*

