Chapter 2:
Decision Making, Systems, Modeling, and Support

Learning Objectives for Part II

1. Understand the conceptual foundations of decision making
2. Understand Simon’s four phases of decision making: intelligence, design, choice, and implementation
3. Understand the concept of rationality and its impact on decision making
4. Understand the foundations, definitions, and capabilities of decision support systems (DSS) and business intelligence (BI)
5. Describe DSS components and technology levels
6. Describe the various types of DSS and explain their use
7. Explain the importance of databases and database management
8. Explain the importance of models and model management

In Part II, we concentrate on decision making, the decision support methodology, technology components, and development. Throughout, we highlight the major impacts of the Internet on DSS. Chapter 2 contains an overview of the conceptual foundations of decision making, the reason that all DSS are developed. Chapter 3 provides an overview of DSS: its characteristics, structure, uses, and types. Some of the major components of DSS are presented in Chapter 4.

Learning Objectives for Chapter 2

1. Understand the conceptual foundations of decision making
2. Understand Simon’s four phases of decision making: intelligence, design, choice, and implementation
3. Recognize the concepts of rationality and bounded rationality and how they relate to decision making
4. Differentiate between the concepts of making a choice and establishing a principle of choice
5. Learn how DSS support for decision making can be provided in practice
6. Understand the systems approach
CHAPTER OVERVIEW

Our major focus in this book is the support of decision making through computer-based information systems. The purpose of this chapter is to describe the conceptual foundations of decision making and how support is provided. This chapter includes the following sections:

CHAPTER OUTLINE

2.1 OPENING VIGNETTE: DECISION MODELING AT HP USING SPREADSHEETS
   A. WHAT WE CAN LEARN FROM THIS VIGNETTE

2.2 DECISION MAKING: INTRODUCTION AND DEFINITIONS
   A. CHARACTERISTICS OF DECISION MAKING
   B. A WORKING DEFINITION OF DECISION MAKING
   C. DECISION MAKING AND PROBLEM SOLVING
   D. DECISION-MAKING DISCIPLINES
   E. DECISION STYLE AND DECISION MAKERS
      1. Decision Style
      2. Decision Makers
         ▶ Section 2.2 Review Questions

2.3 MODELS
   A. ICONIC (SCALE) MODELS
   B. ANALOG MODELS
   C. MENTAL MODELS
   D. MATHEMATICAL (QUANTITATIVE) MODELS
   E. THE BENEFITS OF MODELS
      ▶ Section 2.3 Review Questions

2.4 PHASES OF THE DECISION-MAKING PROCESS
   ▶ Section 2.4 Review Questions

2.5 DECISION MAKING: THE INTELLIGENCE PHASE
   A. PROBLEM (OR OPPORTUNITY) IDENTIFICATION
      ▶ Application Case 2.1: Making Elevators go Faster!
   B. PROBLEM CLASSIFICATION
   C. PROBLEM DECOMPOSITION
   D. PROBLEM OWNERSHIP
      ▶ Section 2.5 Review Questions

2.6 DECISION MAKING: THE DESIGN PHASE
   A. SELECTION OF A PRINCIPLE OF CHOICE
B. NORMATIVE MODELS
   ♦ Technology Insights 2.1: The Difference Between a Criterion and a Constraint
   ♦ Technology Insights 2.2: Are Decision Makers Really Rational?
C. SUBOPTIMIZATION
D. DESCRIPTIVE MODELS
E. GOOD ENOUGH OR SATISFICING
F. DEVELOPING (GENERATING) ALTERNATIVES
G. MEASURING OUTCOMES
H. RISK
I. SCENARIOS
J. POSSIBLE SCENARIOS
K. ERRORS IN DECISION MAKING
   ‣ Section 2.6 Review Questions

2.7 DECISION MAKING: THE CHOICE PHASE
   ‣ Section 2.7 Review Questions

2.8 DECISION MAKING: THE IMPLEMENTATION PHASE
   ‣ Section 2.8 Review Questions

2.9 HOW DECISIONS ARE SUPPORTED
A. SUPPORT FOR THE INTELLIGENCE PHASE
B. SUPPORT FOR THE DESIGN PHASE
   ‣ Technology Insights 2.3: Decision Making in the Digital Age
C. SUPPORT FOR THE CHOICE PHASE
D. SUPPORT FOR THE IMPLEMENTATION PHASE
E. NEW TECHNOLOGY SUPPORT FOR DECISION MAKING
   ‣ Application Case 2.2: Advanced Technology for Museums: RFID Makes Art Come Alive
   ‣ Section 2.9 Review Questions

2.10 RESOURCES, LINKS AND THE TERADATA UNIVERSITY NETWORK CONNECTION
A. RESOURCES AND LINKS
B. CASES
C. VENDORS, PRODUCTS AND DEMOS
D. PERIODICALS
E. THE TERADATA UNIVERSITY CONNECTION

Chapter Highlights
Key Terms
Questions for Discussion
Exercises
This chapter has two major themes: (a) how decisions are made, and (b) how the decision-making process (and hence the people who make them) can be supported. Decision making is the subject of Section 2.2 and Sections 2.4 through 2.8. Support is covered in Sections 2.3 and 2.9. (Section 2.1, the introductory vignette, and Section 2.10, resources and links, apply equally to both.) Some instructors will find the order in the text best, since it covers the types of models used in DSS/BI in Section 2.3 before they come up in the sections that follow. Others will find the intuitive understanding most students have of models sufficient for Sections 2.4–2.8 and will prefer to cover decision making first, support for it second. Either approach can work well.

It is important to stress the relevance of decision-making methods to DSS/BI in covering this chapter. The key reason is in the word “support” in the term DSS. We are discussing systems that support people who make decisions, not systems that make decisions on their own. People who make business decisions are often high enough in the organization to have choices as to how they make their decisions, so it is important to support decision-making methods and styles that they are willing to use.

One way to view this area, which ties into the discussion of systems in Online File W2.2 on systems, is to consider the decision-making system as a whole as consisting of human and automated subsystems. Inputs to the overall system are external and internal (as seen by the organization) data sources and decision requirements. Output is a decision. Internally, the two subsystems communicate in a manner determined by the designers and developers of the automated subsystem. If this is not a suitable interface for the human subsystem, the overall decision-making system will not work well. DSS/BI system designers must see themselves as subsystem designers, where they have limited control over the other major subsystem in the system they are working on, and where they must not suboptimize the automated subsystem at the expense of the overall system. (Suboptimization is covered in this chapter too, in Section 2.6.)

Understanding the phases of decision making is important in developing automated support, as the kind of support needed depends on the decision phase. Teachers should recognize that this subject is taught in several places in the typical business school curriculum, not always from the same point of view. Some instructors draw a strong distinction between decision making and problem solving, whereas this book considers them nearly equivalent. Some instructors consider monitoring to be a fifth phase of the process, whereas this book considers it as the intelligence phase of the next decision. It is not necessary to be dogmatic about one version of the phases versus
another. It can help, however, to determine where else these concepts are taught at your institution and how they are approached there.

In Section 2.3, this book groups simulation models and other types of mathematical models, such as linear programming, as “mathematical (quantitative) models.” Students may have been taught a distinction between the two in other courses such as operations management. You may want to recognize this as being beyond the level of breakdown needed for the purpose of this chapter, but at the same time as valid when a finer classification of models is required.

Section 2.9, “How Decisions Are Supported,” gives a wide range of support possibilities for each phase. In teaching this section, which is critical to students’ careers because it tells them what to look for in specific situations, it can help to add perspective to the lists in each subsection by indicating which of the listed tools are more important in each phase, which are less so. For example, expert systems are listed as being able to support all four of the decision phases. Although this is correct, you can add perspective by pointing out (in this case) that they are most useful in the choice phase, secondarily in design and implementation, and relatively less useful in the intelligence stage of a decision.

Finally, students may have to be reminded (or told for the first time!) that “criterion” is a singular noun whose plural is “criteria.” Saying “The single most important decision criteria is …” is incorrect. Since managers may obtain subconscious clues to a junior staff member’s or job applicant’s competence from his or her ability to use business terms correctly, it’s important for them to learn correct usage when this term comes up in Section 2.4.

ANSWERS TO END OF SECTION REVIEW QUESTIONS

Section 2.1 Review Questions

1. What are some of the key questions to be asked in supporting decision making through DSS?
   - What are the root issues underlying the decision situation? Do we understand the problem sufficiently to support it?
   - How structured is the decision? Is it unstructured, semi-structured, or structured?
   - Does the decision involve judgment? To what extent?
   - What data is needed to solve the problem?
   - Can an existing tool be leveraged or reused?
   - Is a tool needed?
   - What is the implementation plan?

2. What guidelines can be learned from this vignette about developing DSS?
   - Before building a model, decision makers should develop a good understanding of the problem that needs to be addressed.
• Coming up with nonmodeling solutions is important because if the problem is due to conflicting priorities, or the misalignment of incentives or unclear lines of authority or plans, then no DSS can help support the decision.
• A model many not be necessary to address the problem.
• Before developing a new tool, decision makers should explore reuse of existing tools.
• The goal of model building is to gain better insight into the problem, not just to generate more numbers.

3. What lessons should be kept in mind for successful model implementation?
• Implementation plans should be developed along with the model. Successful implementation results in solving the real problem.
• Including the end users in the development process enhances the decision makers’ analytical knowledge and capabilities. And by working together, their knowledge and skills complement each other in the final solution and the success of the implementation.

Section 2.2 Review Questions

1. What are the various aspects of decision making?
   Aspects of decision making that are important to understand if we are to develop effective computer support include the following:
   ▪ characteristics of decision making, such as groupthink, experimentation, and information overload.
   ▪ decision styles of the decision makers
   ▪ objectives of the decision makers
   ▪ supporting disciplines, styles and how they relate to the personal characteristics of the decision maker, and the nature of group involvement in the decision (if any).
   ▪ rationality of the decision maker. A decision maker should not simply apply IT tools blindly. Rather, the decision maker gets support through a rational approach that simplifies reality and provides a relatively quick and inexpensive means of considering various alternative courses of action to arrive at the best or a good solution to the problem.

2. Why is decision making so complex in today’s business environment?
   Today’s business environment is extremely dynamic. While the decision is being made, changes may be occurring in the decision-making environment. Those changes may invalidate the assumptions upon which the decision is based. There is time pressure from these same changes in the decision-making environment may affect decision quality by imposing time pressure on the decision maker. The fast-changing business environment often requires faster decisions, which may actually be detrimental to decision quality. The cost and expense of collecting information and analyzing a problem, with the difficulty of
determining when to stop and make a decision; possible lack of sufficient information to make an intelligent decision; and conversely the possible availability of too much information (information overload).

3. Identify similarities and differences between individual versus group decision making.
   - Individual decision makers need access to data and to experts who can provide advice, while groups additionally need collaboration tools.
   - There are often conflicting objectives in a group decision-making setting, but not in an individual setting.
   - Groups can be of variable size and may include people from different departments or from different organizations. Collaborating individuals may therefore have different cognitive styles, personality types, and decision styles. Some clash, whereas others are mutually enhancing.
   - Consensus can be a difficult political problem in group decision making which is not a problem in individual decision making.

For these and similar reasons, group decision making can be more complicated than individual decision making.

4. Compare decision making versus problem solving. Determine whether or not it makes sense to distinguish the two from one another.

They are quite similar activities. Some people consider decision making as the first three steps in problem solving. Others use the terms interchangeably. Those who distinguish between them consider decision making to be the process of making a recommendation, whereas problem solving includes the implementation of the recommendation (and perhaps monitoring its effects to determine whether or not the problem has been solved).

As experts on the subject disagree on whether or not it makes sense to distinguish between the two concepts, there is no single correct answer to the second part of this question.

5. Define decision style and describe why it is important to consider in the decision-making process.

Decision style is the manner in which a decision maker thinks and reacts to problems. It is important to consider it because different decision styles require different types of support.

Section 2.3 Review Questions

1. Describe the different categories of models.

Categories of models that can be useful in business include iconic (scale, physical) models, analog models, mental models, and mathematical (quantitative) models. Other types of models, such as fashion models or data models as used in system analysis and design, are not relevant to this context but share the
underlying concept of representing some aspect of a real system, having advantages over it for a specific purpose and lacking features that would permit them to replace it. (See also the note on types of models in the “Teaching Tips” section above.)

2. How can mathematical models provide the benefits listed in the section?

The benefits listed in this section, with the applicability of mathematical models to each, are:

- Model manipulation (changing decision variables or the environment) is much easier than manipulating the real system. Experimentation is easier and does not interfere with the daily operation of the organization. **Mathematical models describe their parameters in the form of numbers on paper or data in a computer, which can be changed easily without affecting the operation of the real system.**

- Models enable the compression of time. Years of operations can be simulated in minutes or seconds of computer time. The second part of this statement is specifically about mathematical models. However, other types of models enable the compression of time as well. For example, a mental model of which says “if I eat this food, I’ll get an allergic reaction” leads to the decision to avoid it far more quickly, as well as less painfully, than tasting it would.

- The cost of modeling analysis is much less than the cost of a similar experiment conducted on a real system. **This is because a model is typically less expensive than a real system, the compression of time reduces time-related costs such as personnel, and the business does not run the risk of impaired operations while alternatives are investigated in the model.**

- The cost of making mistakes during a trial-and-error experiment is much less when models are used rather than real systems. **This is because mistakes affect only the model, not the real system.**

- The business environment involves considerable uncertainty. With modeling, a manager can estimate the risks resulting from specific actions. **Mathematical models allow a decision maker to vary parameters (such as inflation rates, oil prices or demand growth) over a wide range as desired to reflect all future scenarios of interest.**

- Mathematical models enable the analysis of a very large, sometimes infinite, number of possible solutions. Even in simple problems, managers often have a large number of alternatives from which to choose. **This benefit is explicitly about mathematical models.**

- Models enhance and reinforce learning and training. **The operation of a mathematical model can be observed and reviewed, variables changed to see the effects of the change, and mistakes deliberately made to learn how to recover from them.**

- Models and solution methods are readily available over the Web. **Most models available over the Web are mathematical models.**
There are many Java applets (and other Web programs) that readily solve models. *This is true of mathematical models, but generally not of other types.*

3. How can mental models be utilized in decision making involving many qualitative factors?

Mental models, which are typically used when a decision involves mostly qualitative factors, can help frame the decision-making situation and can work through scenarios to consider the risks and benefits of alternative decisions.

4. How can modern IT tools help synthesize qualitative and quantitative factors in decision making?

Modern information technology tools can present qualitative factors along with its analysis of quantitative factors, so decision makers can consider both together and use the qualitative information to guide them to the most useful quantitative analyses.

### Section 2.4 Review Questions

1. List and briefly describe Simon’s four phases of decision making.

Simon’s four phases of decision making are intelligence, design, choice, and implementation.

*Intelligence* consists of gathering information by examining reality, then identifying and defining the problem. In this phase problem ownership should also be established.

*Design* consists of determining alternatives and evaluating them. If the evaluation will require construction of a model, that is done in this phase as well.

The *choice* phase consists of selecting a tentative solution and testing its validity.

*Implementation* of the decision consists of putting the selected solution into effect. See Figure 2.1.

2. Why is a fifth phase, evaluation, not necessary?

The authors of this book view monitoring as a manifestation of the intelligence phase, applied to the implementation of a decision. Like any other intelligence phase, it may lead to a future decision. See Figure 2.1.

In evaluating responses to this question, graders should be aware that students may have learned to treat evaluation, or monitoring, as a separate phase in other courses or from other sources.
3. What can cause a problem to exist in decision making?

A problem is a negative discrepancy between what is and what a decision maker feels should be. This can result from a change in the decision maker’s expectations or from a change in the situation. Expectations can be raised, creating such a discrepancy, by (for example) seeing how competitors have improved their operations. The situation can change in many ways: higher costs, lower market share, etc. See the MMS running case in the Online File W2.1.

Section 2.5 Review Questions

1. What is the difference between a problem and its symptoms?

Problems arise out of dissatisfaction with the way things are going. It is the result of a difference or gap between what we desire and what is or is not happening. A symptom is how a problem manifests itself.

A familiar personal example is a high temperature (symptom) and an illness (problem). It is necessary to diagnose and treat the underlying illness. Attempting to relieve the temperature works if the illness is one which the body’s defenses can cure, but, can be disastrous in other situations.

A business example: high prices (problem) and high unsold inventory level (symptom). Another is quality variance in a product (symptom) and poorly calibrated or worn-out manufacturing equipment (problem).

2. Why is it important to classify a problem?

Classifying a problem enables decision makers to use tools that have been developed to deal with problems in that category, perhaps even including a standard solution approach.

3. What is meant by problem decomposition?

Problem decomposition means dividing a complex problem into subproblems. This helps solve the problem because the smaller subproblems may be simpler to solve; some of the smaller problems may be structured, facilitating their solution, even though the overall problem as a whole is not; solving the easy subproblems enables decision makers to focus their attention on the remaining difficult parts; and decomposition may facilitate communication among decision makers.

4. Why is establishing problem ownership so important in the decision-making process?

Problem ownership means having the authority, and taking the responsibility, of solving it. Lack of problem ownership means either that someone is not doing his or her job, or that the problem at hand has yet to be identified as belonging to anyone. In either case, it cannot be solved until someone owns it.
Section 2.6 Review Questions

1. Define optimization and contrast it with suboptimization.

Optimization refers to the “best.” (There is no such thing as “more” optimal!) To achieve it, all alternatives must be considered, and the optimal one must be the best. Suboptimization is the optimization of a subsystem, without considering its impacts on other parts of the overall system. What is optimal for a part of a system (or organization) may not be for the entire system (or organization).

For example, a student spending all 24 final exam study hours on DSS may give him/her the best possible grade in that course, but his/her overall average could be better served by studying six hours for each of four exams. The drop from A+ to B in the DSS course would be more than offset by the improvement from Ds to Bs and Cs in the other three.

2. Compare the normative and descriptive approaches to decision making.

Normative decision making uses models, or methods that have perhaps previously been derived from models that tell a decision maker what he or she should do. These prescriptive models are often developed by utilizing optimization methods. The technology of expert systems, which will be discussed later in the book but which students may have seen elsewhere, derives them from the “rules of thumb” used by recognized experts in the field of the decision.

Descriptive decision making uses models that tell a decision maker “what-if.” These are usually simulation models.

3. Define rational decision making. What does it really mean to be a rational decision maker?

Rational decision making follows the economic assumptions of rationality. A rational decision maker exhibits certain assumed behaviors: (1) Humans are economic beings, whose objective is to maximize the attainment of goals; (2) for a decision-making situation, all viable alternative courses of action and their consequences, or at least the probability and the values of the consequences are known; and (3) decision makers have an order or preference that enables them to rank the desirability of all consequences of the analysis (best to worst).

Being a rational decision maker means making decisions according to these assumptions.

4. Why do people exhibit bounded rationality when problem solving?

Humans in general have limitations that prevent us from being completely rational. We usually simplify things. Individuals’ evaluation scales for the costs and benefits of a decision may be nonlinear and may not follow those of the organization. (For example, a manager may see great personal benefit in not exceeding a budget by even $1, but very little benefit by coming under it by more than a minimal amount. The view from the executive suite would not have such a
sharp cut-off. Economic utility theory addresses this area.) Also, individual characteristics may result in a restricted rationality.

5. Define scenario. How is a scenario used in decision making?

A scenario is a statement of assumptions about the operating environment of a particular system in a given time. It describes the system's configurations. By changing scenarios and measuring the goal attainment level, it is possible to compare alternatives under different sets of conditions.

6. Some “errors” in decision making can be attributed to the notion of decision making from the gut. Explain what is meant by this and how such errors can happen.

In general, people have a tendency to measure uncertainty and risk badly. They tend to be overconfident and have an illusion of control in decision making. As a result, decisions in which some part of the future is unknown, which is true of most business decisions, are often made more optimistically than they should be.

In addition, those who decide “from the gut” often do not develop a clear picture of all the details and implications of a situation. This approach can save time if a decision maker’s intuition is attuned to a situation from extensive experience, but can lead to errors if it is applied to unfamiliar situations. An executive who has made successful “gut” decisions in the past may not even recognize that his or her experience does not apply to a new, but superficially similar, situation.

Section 2.7 Review Questions

1. Explain the difference between a principle of choice and the actual choice phase of decision making.

A principle of choice is a criterion used to describe the acceptability of a solution approach. In other words, it is a basis for deciding whether one approach or another is superior. A principle of choice is general: that is, it applies to many possible decision-making situations.

The choice phase of decision making uses one or more principles of choice, chosen during this decision phase or prior to it, to select an alternative in a specific situation.

2. Why do some people claim that the choice phase is the point in time when a decision is really made?

Because, in a sense, it is. The decision, choosing one of the available alternatives, is made during this stage. It is, therefore, easy to equate the two.

However, the choice phase as the term is usually used covers more than this single point in time. It also includes the comparisons that lead up to it and the assessment of robustness and possible adverse consequences that may lead a decision maker to choose an alternative that is less desirable under ideal conditions but also less likely to lead to disaster in other circumstances.
3. How can sensitivity analysis help in the choice phase?

Sensitivity analysis determines how an alternative responds to small changes in the input parameters. An alternative that appears best for the nominal set of parameters might produce far worse results for small changes in them. Another alternative, which might not be as attractive if all parameters have their nominal values, might be more robust—that is, it might not degrade as much if they depart from those values. It might therefore be a better choice in practice, since some statistical variation in these values is only to be expected.

Section 2.8 Review Questions

1. Define implementation.

Implementation is defined as the initiation of a new order of things, the introduction of change; putting a recommended solution to work.

2. How can a DSS support the implementation of a decision?

A DSS supports the implementation of a decision through communication, explanation, and justification. In a financial decision, for example, a DSS would include not only the detailed financial goals and cash needs for the near term, but would also provide the calculations, intermediate results, and statistics used to determine the aggregate figures. It also conveys to subordinates that the decision maker has thought through the assumptions behind as decision’s goals and is serious about their importance. Finally, it allows people to explain and justify their suggestions and opinions with graphical support.

Section 2.9 Review Questions

1. Describe how DSS/BI technologies and tools can aid in each phase of decision making.

Intelligence phase: The primary requirement of decision support for the intelligence phase is 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.

Decision support/business intelligence technologies can also help. (Automatic) data mining and (manual) online analytic processing support this phase by identifying relationships among activities and other factors. Geographic information systems (GIS) can be utilized either as stand alone or integrated with these systems, so that a decision maker can determine opportunities and problems in a spatial sense.

Another aspect of identifying internal problems and opportunities is monitoring operations. Business activity monitoring, business process management and product life-cycle management provide such capability. Routine and ad-hoc reports can also help: regular reports can be designed to assist in
problem finding by comparing expectations with current and projected performance.

*Design phase:* This phase involves generating alternative courses of action, agreeing on choice criteria and their weights, and forecasting the consequences of various alternatives. Several of these activities can use standard models such as financial and forecasting models. Either standard or special models can generate alternatives for structured problems. OLAP and data mining software are useful in identifying relationships to use in such models. An expert system can assist with qualitative methods as well as with the expertise required in selecting quantitative analysis and forecasting models.

A knowledge management system, if available, can be consulted to determine whether such a problem has been encountered before, or if there are experts on hand to provide quick understanding and answers. CRM systems, revenue management systems, ERP, and SCM software are useful in providing models of business processes that can test assumptions and scenarios. If a problem requires brainstorming to help identify important issues and options, a group DSS may prove helpful.

*Choice phase:* In addition to providing models that rapidly identify a best or good enough alternative, a 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. A knowledge management system helps identify similar past experiences; CRM, ERP, and SCM systems can test the impact of each choice. If a group makes the decision, a group support system can provide support to lead to consensus.

*Implementation phase:* DSS can be used in implementation activities such as decision communication, explanation, and justification. Implementation phase DSS benefits are partly due to the vividness and detail of analyses and reports used for these purposes.

All phases of the decision-making process can be supported by improved communication by collaborative computing through GSS and KMS. Computerized systems can facilitate communication by helping people explain and justify their suggestions and opinions.

Decision implementation can also be supported by expert systems. An ES can be used as an advisory system regarding implementation problems (such as handling resistance to change). Finally, an ES can provide training that may smooth the course of implementation.

Impacts along the value chain are typically identified by BAM, BPM, SCM, and ERP systems. CRM systems report and update internal records based on the impacts of the implementation. These inputs are then used to identify new problems and opportunities—a return to the intelligence phase.

(Note to graders: The text provides additional examples.)
2. Describe how new technologies can provide decision-making support.

With the development of mobile commerce (m-commerce), more and more personal devices (personal digital assistants, cell phones, tablet computers, laptop computers) can access information sources, and users can respond to systems with information updates, collaboration efforts, and decisions. This can help salespeople, for example, to be more effective by accessing their CRM while on the road. Constant access to corporate data, inventory and otherwise, can only help them in their work. Wireless devices are taking on greater importance in the enterprise, generally by accessing specialized Web servers that provide data and communication directly to the m-commerce device.

Section 2.10 Review Questions

(This section has no review questions.)

ANSWERS TO QUESTIONS FOR DISCUSSION

1. Why is intuition still an important aspect of decision making?

Intuition is a critical factor that decision makers use in solving unstructured and semi-structured problems. The best decision makers recognize the tradeoff between the marginal cost of obtaining further information and analysis versus the benefit of making a better decision. (General Patton's adage, “A good decision today is better than a perfect decision tomorrow,” reflects the application of this principle to his situation.) When decisions must be made quickly, the intuition of a seasoned, excellent decision maker is called for ideally. When an inexperienced or ill-trained decision maker attempts to use intuition, however, disaster can strike.

(See the related answer to Review Question 6 of Section 2.6 above.)

2. Define efficiency, define effectiveness, and compare and contrast the two.

Efficiency refers to the proper utilization of resources, doing things right. Effectiveness refers to the attainment of goals, doing the right things.

Driving from New York City to Boston by way of Chicago in a hybrid compact that gets 50 miles per gallon (21 km/liter) may be efficient, but is not effective (in terms of reaching the goal, Boston, quickly).

Driving directly, but alone in a large vehicle that gets 12 mpg (5 km/l), may be effective but is not efficient as it uses four times the resources—in some sense, wasting 75 percent of them.

Ideally, one should be both effective and efficient, but if that is not possible a decision maker should focus on effectiveness.
3. Why is it important to focus on the effectiveness of a decision, not necessarily the efficiency of making a decision?

The effectiveness of a decision affects an organization for as long as the decision matters, and as broadly as the decision scope. The efficiency of making the decision affects only the decision-making process itself. Since the resources involved in making a decision are far less than those affected by its implementation, it is more important to make sure the decision is correct than to save resources used in making it.

4. What are some of the measures of effectiveness in a toy manufacturing plant, a restaurant, an educational institution, and the U.S. Congress?

**Toy manufacturing plant**: Cost per unit produced, percent of orders delivered on time, quality of finished product (perhaps measured by number of defects per output or the incidence of warranty claims).

**Restaurant**: Revenue per table per shift, percent of repeat customers, rate of return on investment, rating by professional reviewers, rating by local health inspection authorities.

**Educational institution**: Students’ performance on national tests, number of students getting jobs in their discipline after graduation, amount of funded research per faculty member, percentage of students successfully finishing and receiving degrees, success of athletic teams.

**U.S. Congress**: Number of bills passed per year, public image.

Since these are not the only measures for any of the examples, other correct answers are possible.

5. Even though implementation of a decision involves change, and change management is very difficult, explain how change management has not changed very much in thousands of years. Use specific examples throughout history.

Moses, while attempting to lead the children of Israel away from idol worship, found them rebellious and often desiring to return to slavery in Egypt rather than face the unknown of the desert. When he left them for a few days, they reverted to idolatry with the Golden Calf.

Many of those living in England’s North American colonies in the 1770s preferred the security and known economic benefits of that form of government to the possible benefits, but unknown risks, of independence.

Railroads of the 1950s and 1960s could not adapt to the changes required to see themselves as in the transportation business and therefore lost most of their passengers to airlines and buses.

U.S. automobile companies in the 1970s did not change their products from the large cars, built and bought with the expectation of being traded in
frequently, that they were used to. As a result, they lost market share to foreign firms, whose cars offered higher quality and better fuel economy.

Of course, many other examples are possible.

6. Despite the advances in ADM methods and tools, why should we still insist that a human being still be responsible for every decision?

Advances are not perfection. Decision-making tools have their limitations and often cannot detect when they have reached their limits or when a factor that was not programmed into them affects the answer. A combination of human intuition and automated support usually yields the best decisions.

Some fully structured decisions can be made without human intervention, such as a decision as to how much to withhold from a pay check for income taxes. These hardly qualify as “decisions,” however. Moreover, even in those cases, the overall system should include an opportunity for some type of human review at some point in the process to guard against software bugs or other errors. The need for such review increases with the criticality and finality of the decision.

7. Why should all information system development projects focus on some aspect of decision making in practice?

Because information, if it is not used to make decisions, is not really useful. Focusing on how information can be used to make decisions helps any IS development project focus its resources on the most important areas.

(The decision for which information is needed may not be obvious. For example, a reporting system may have to conform to government financial accounting requirements. From the standpoint of the IS developer within a company, there is no decision here. However, while the requirements may be fixed in a practical sense to that person, they ultimately reflect someone’s potential need to make a decision on the basis of the reported information.)

8. Your company is considering opening a branch in China. List typical activities in each phase of the decision (intelligence, design, choice, implementation) whether to open or not open.

Intelligence: Should we invest in China? What are the possible advantages, disadvantages, risks? What resources would have to be diverted from other activities? When could we start?

Design: Select criteria for assessing the alternatives (e.g., the ROI, market share); create alternatives: invest now, invest later, do not invest; levels and timing of investment; information flow for decision making; prepare a model; how will the choice be made, by whom, and when?

Choice: Get information; final evaluation; sensitivity analysis; solve model.

Implementation: Prepare an implementation plan; deal with resistance to change and necessary approvals and authorizations; conduct training; transfer resources.
These are not the only possible activities for any of the phases; many other correct answers are possible.

9. You are about to sell your car. What principles of choice are you most likely to use in deciding whether to offer or reject offers? Why?

Satisficing. You cannot optimize. The sequential nature of the coming offers makes it a typical situation in which you set an aspiration level (say $3,500). You should accept the first offer that meets your aspiration level. (Others suggest using the first offer to calibrate the market, then accepting the first one that exceeds it, or other approaches—but they are all satisficing.)

10. You are about to buy a car. Using Simon’s four-phase model, describe your activities at each step.

Intelligence: You recognize that your needs could be better served by a different car, due to a change in your present car (decreasing reliability, growing repair bills) or your situation (changed transportation needs, more money).

Design: Determine parameters that describe the appropriate car to buy. Also determine the criteria (objective function) that indicates the value of certain features in a car. From the multiple criteria, a principle of choice should be developed. The alternatives must be identified as well. This is a multiple-criteria problem. In assessing alternatives, it may be necessary to visit dealers to drive candidate cars and determine actual selling prices.

Choice: Choose the car.

Implementation: Buy the car.

11. The use of scenarios is popular in computerized decision making. Why? For what types of decisions is this technique most appropriate?

Scenarios help decision makers experiment with different settings, which helps in determining the robustness of a decision in a variety of environments. This is appropriate for decision making under risk.

12. Explain, through an example, the support given to decision makers by computers in each phase of the decision process.

Intelligence: A computer can scan a large amount of information to identify problems such as a decline in sales.

Design: To boost sales, several advertising proposals may be evaluated. A computerized model that shows the cost of an advertising program and its expected effect on sales can help a decision maker assess their potential.
Choice: Once alternatives are identified and their potential effect forecasted, a choice can be made. The computer can rank choices by cost/benefit ratio, net benefit or any other desired criterion.

Implementation: A detailed “what-if” analysis can convince management that the proposed alternative is indeed the best. Computer-generated graphics can ease the implementation process.

13. Some experts believe that the major contribution of DSS is to the implementation of a decision. Why is this so?

Proposed solutions are no good unless they are implemented. Implementation in many cases is the most difficult phase of decision making. However, a specific DSS may be designed to help with any decision phase or phases, in which case the contribution of that DSS is to those phases.

14. Most managers are capable of using the telephone without understanding or even considering the electrical and magnetic theories involved. Why is it necessary for managers to understand MSS tools to use them wisely?

It is important because the design of an MSS must be optimized for its use in the way a telephone does not. It must reflect specific user needs if it is to be useful. MSS developers, no matter how technically competent they are, cannot be expected to understand these as well as needed.

Also, the potential for disaster is high if a manager attempts to apply an inappropriate MSS technology to a problem (e.g., a neural network when an expert system is appropriate).

(By the way, (a) the folks who specify the features of a complex office telephone system have to know a good deal about them too, and (b) managers don’t need to understand the electrical and magnetic theories behind computers, either.)

ANSWERS TO END OF CHAPTER APPLICATION CASE QUESTIONS

1. Apply principles of the intelligence phase of Simon’s decision making model, and discuss major problems that led to the subprime mortgage crisis.

The intelligence phase includes the following activities: search and scanning of threats, weaknesses, and problems; problem identification; and problem ownership.

The stories reporting the reasons for the financial crisis paint a picture of a complete disregard for risk, irrational assumptions, lying, pure and simple greed, and follow-the-crowd mentality (groupthink). A key contributing factor was mortgage-backed securities (MBS). How did MBS bring the US Economy to its knees?
The process of restructuring and re-packaging a pool of financial assets yielding future cash-flows is called securitisation. Such Financial instruments are called Securities, specifically Asset-Backed Securities and are sold to prospective investors who would be interested a piece of the future cash-flows. Any financial asset yielding future cash flows can be securitised by the above process.

Securitisation of assets which are essentially mortgages are called Mortgage Backed Securities (MBS). The riskiness of MBS depends on:

a. Type of Mortgagor or Borrower:
   i. Residential MBS - on residential Property
   ii. Commercial MBS - on commercial property

b. Type of Mortgaged Assets:
   i. Prime- Borrowers with good credit scores, reliable credit history, verifiable income / assets (Lower Default Risk Rating)
   ii. Subprime- weaker credit scores, no verification of income etc, (Higher Default Risk Rating)

High-risk mortgages based on subprime rates that were used as securities. Those people responsible and profiting from these financial instruments made several wrong assumptions (or totally ignored the risks) regarding what would happen if too many people defaulted on their mortgage payments. Also, homeowners were taking on higher debt than they could afford, if they had been charged prime rates (instead of subprime rates). Subprime rates lasted only about five years, and afterwards, the prime rate would be charged. That change to prime interest rates on the mortgages resulted in a huge increase in monthly mortgage payments that too many owners could not pay. Those conditions led to a huge rate of home foreclosures when mortgage payments were not being paid. One devastating assumption was that real estate prices would continue to increase, but they fell because of the foreclosures. As such, the mortgage backed securities that were listed as assets on companies’ balance sheets became worthless causing them to fail.

In the worst case scenario, the financial guarantee provided by Fannie Mae and Freddie Mac would play a significant role in the event that an adverse economic scenario hits the mortgage market, as they would pitch in and be able to protect the interests of the investors as well as the general economic environment in the mortgage market.

2. Given what has already taken place, reapply the intelligence phase principles to determine the current state of the problem.

Intelligence is the search for information, which should include the following searches.

The Troubled Asset Relief Program, commonly referred to as TARP, is a program of the U.S. government to buy low-value assets and equity from financial institutions to strengthen its financial sector. It is the largest component of the government's measures in 2008 to address the subprime mortgage crisis. As long as the TARP program remains in effect, the financial problems due to the subprime can be assumed to still exist.
In addition, scanning reliable sources for information on unemployment rates and monthly changes in those rates; as well as the current rates and changes in home foreclosures, bank failures, new home builds, mortgage interest rates and terms; prime interest rates, GDP, cost of living index; stock market indices (e.g., NY Stock Exchange, NASDAQ) will provide information to determine the state of the problem and the state of the economy (recession or recovery) when students complete this case.

3. What can you recommend about the crisis now? Apply design and choice phase principles to guide you.

Based on the continuation of the TARP program, high unemployment, and other rates indicating a recession, there has not been a full recovery from the financial crisis.

Students will make recommendations based on the rates listed in the answer to question #2 and the actual state of the economy when answering this question. Students should not rely on intuition, but provide current statistics from reliable sources to validate their recommendations.

Types of recommendation about the crisis may be:
   a. implement government programs to stimulate the economy
   b. increase or decrease prime rates
   c. extend or reduce the length of unemployment payments
   d. offer incentives or support improve the skills of workers who have lost their jobs.

4. What issues will you have to keep in mind as you move your proposed solutions to implementation?

Implementation depends on the solutions that students recommend. Students’ answers should involve reference to a feedback mechanism to check the effectiveness of the recommendation--and to make adjustments as necessary.