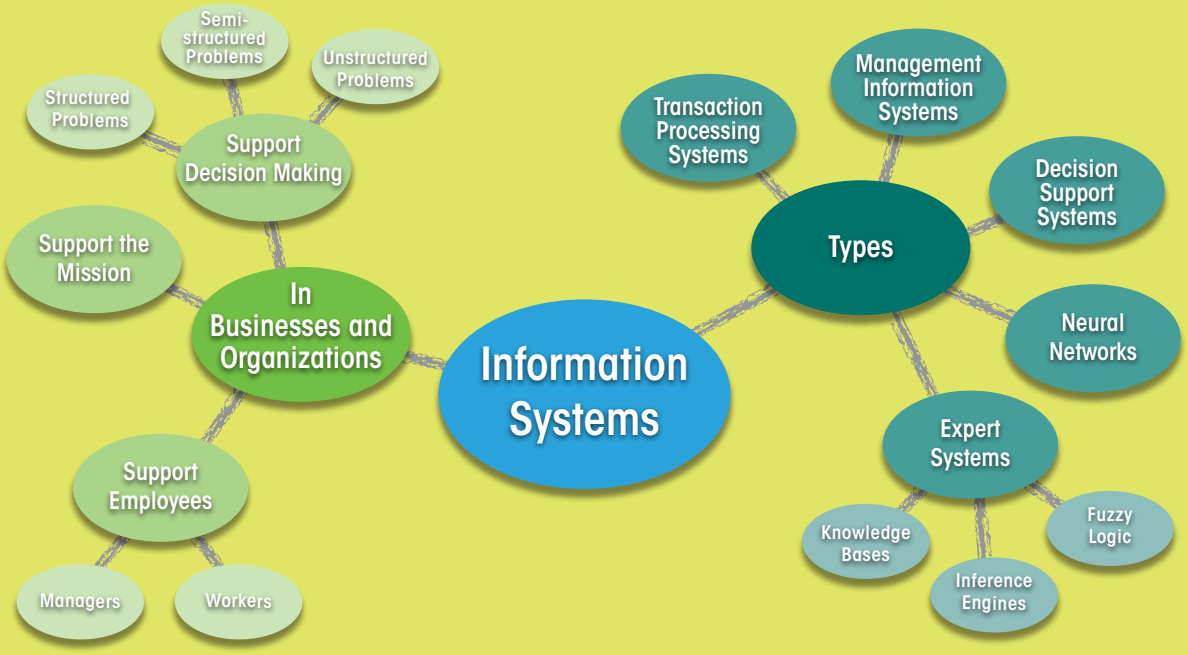


Information Systems

SECTION A

YOU ARE PROBABLY a member of an organization, such as a student club, fraternity or sorority, sports team, or political party. You also deal with all kinds of organizations every day: your school, stores, banks, and government agencies. Most organizations use information systems to operate more effectively, gather information, and accomplish tasks. In this section, you'll review some basic concepts about organizations and find out how information systems enhance organizational activities.

INFORMATION SYSTEMS IN ORGANIZATIONS

What is an information system? An **information system** collects, stores, and processes data to provide useful, accurate, and timely information, typically within the context of an organization (Figure 10-1).

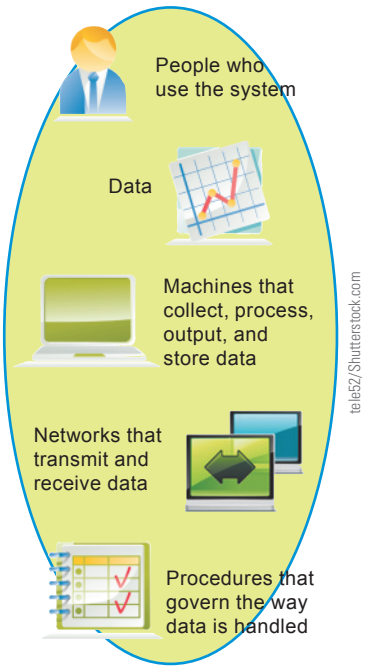
Although an information system does not necessarily have to be computerized, today most information systems rely on computers and communications networks to store, process, and transmit information with far more efficiency than would be possible using manual systems. In this textbook, the term *information system* refers to a system that uses computers and usually includes communications networks.

What's the official definition of *organization*? An **organization** is a group of people working together to accomplish a goal. Organizations have accomplished amazing feats, such as sending astronauts into space, providing live television coverage of global events, and inventing freeze-dried ice cream. They also accomplish all kinds of day-to-day, routine tasks, such as offering banking services, selling merchandise, improving the environment, and policing neighborhoods.

Any organization that seeks profit by providing goods and services is called a **business**. Some organizations are formed to accomplish political, social, or charitable goals that do not include amassing profit. Such an organization is known as a **nonprofit organization**.

FIGURE 10-1

Information systems encompass many aspects of an organization.



tele52/Shutterstock.com

What is a mission statement? Every organization has a goal or plan that's referred to as its **mission**. All activities that take place in an organization, including those that involve computers, should contribute to this mission.

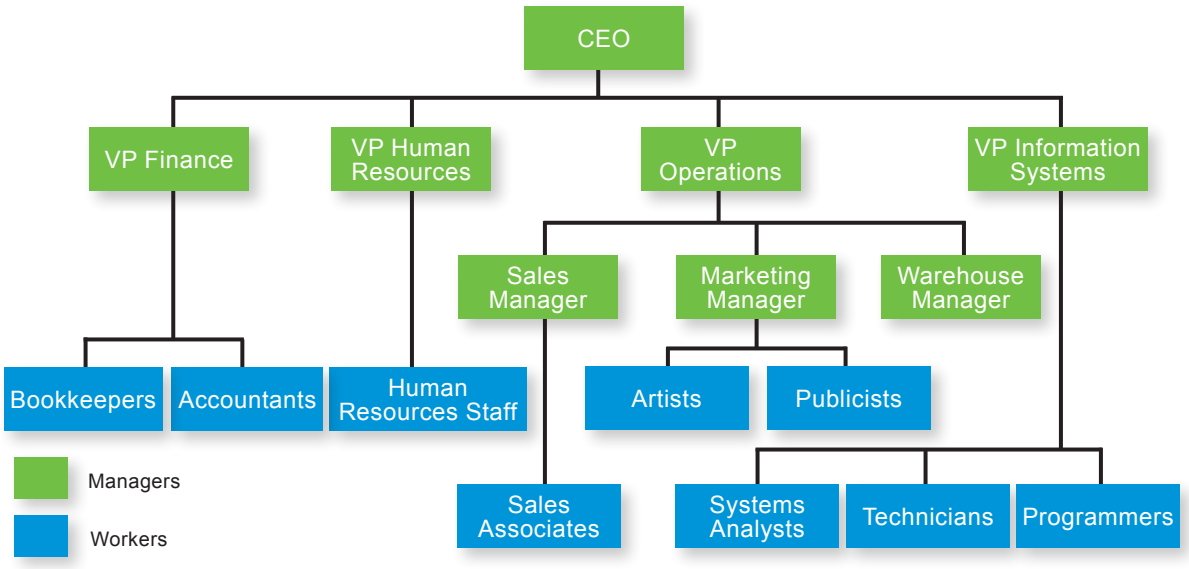
The written expression of an organization's mission is called a mission statement. A **mission statement** describes not only an organization's goals, but also the way in which those goals will be accomplished.

Who uses information systems? An information system is used by the people in an organization and its customers. You've undoubtedly used many information systems—for example, when registering for classes, getting cash from an ATM, and purchasing merchandise on the Web. You might even work for a business or nonprofit organization where you access an information system as part of your job.

Not everyone in an organization uses an information system in the same way. An information system must support the needs of people who engage in many different organizational activities.

To coordinate the activities of employees, most organizations use a hierarchical structure. An **organizational chart**, such as the one in Figure 10-2, depicts the hierarchy of employees in an organization.

FIGURE 10-2
An Organizational Chart



How are employees classified? In many organizations, and most businesses, employees can be classified as workers or managers. **Workers** are the people who directly carry out the organization's mission. For example, they assemble cars, write newspaper articles, sell merchandise, answer telephones, lay bricks, cut trees, fix engines, or perform other types of labor. Workers routinely produce and collect data for information systems. For example, as checkout clerks ring up sales, their cash registers store each item in a database.

Managers determine organizational goals and plan how to achieve those goals. They approve new products, authorize new construction, and supervise workers. Executive managers plan an organization's long-range goals for profitability, market share, membership levels, and so on. This emphasis on long-range and future goals is referred to as **strategic planning**.

TRY IT!

Which of the following best describes the person who determines a company's mission statement?

- ❍ A strategic planner
- ❍ An executive
- ❍ A systems analyst
- ❍ A religious leader

Mid-level managers are responsible for figuring out how to achieve long-range goals through sales, marketing, or new product development. They set incremental goals that can be achieved in a year or less—a process referred to as **tactical planning**.

Low-level managers are responsible for scheduling employees, ordering supplies, and other activities that make day-to-day operations run smoothly—a process referred to as **operational planning**. Information systems can provide some or all of the data needed for strategic, tactical, and operational planning.

How do information systems help the people in an organization? An information system can help people perform their jobs more quickly and effectively by automating routine tasks, such as reordering inventory, taking customer orders, or sending out renewal notices. Information systems can also help people solve business and organizational problems.

One of the major functions of an information system is to help people make decisions in response to problems. According to Herbert Simon, who was well known for his insights into organizational behavior, the decision-making process has three phases, shown in Figure 10-3.

Phase 1: Recognize a problem or a need to make a decision.

Phase 2: Devise and analyze possible solutions to the problem.

Phase 3: Select an action or a solution.

FIGURE 10-3

The three decision-making phases are usually clear cut, leading to decisions that are objective, standardized, and based on factual data.

What kinds of problems need to be solved? All problems are not alike, but they can be classified into three types: structured, semi-structured, and unstructured (Figure 10-4).

FIGURE 10-4

Problem Classifications

Type of Problem	Example	Methodology
A **structured problem** is an everyday, run-of-the-mill, routine problem. When you make decisions in response to structured problems, the procedure for obtaining the best solution is known, the objective is clearly defined, and the information necessary to make the decision is easy to identify.	Which customers should receive overdue notices?	The information for this decision is usually stored in a file cabinet or computer system. The method for reaching a solution is to look for customers with outstanding balances, and then check whether the due dates for their payments fall before today's date.
A **semi-structured problem** has a known procedure for arriving at a solution; however, the process might involve some degree of subjective judgment. Also, some of the information regarding the problem might not be available, might lack precision, or might be uncertain.	How many mountain bikes should a store stock for the holidays?	The decision can be based on the previous year's sales; but because future consumer spending is uncertain, determining the appropriate amount of holiday inventory might require some guesswork.
An **unstructured problem** requires human intuition as the basis for finding a solution. Information relevant to the problem might be missing, and few parts of the solution can be tackled using concrete models. If experts are presented with a problem but they disagree on a solution, it is likely an unstructured problem.	Should Saks Fifth Avenue stock Japanese-inspired evening gowns?	The purchasing agent for women's clothing makes this decision based on her intuition of customer taste and fashion trends.

Can an information system solve all three types of problems? Traditionally, information systems have contributed most to solving structured problems, but tools have emerged to help people tackle semi-structured and unstructured problems as well. Despite these tools and the data they provide, many semi-structured and unstructured problems continue to be solved based on "guesstimates."

An information system's ability to assist with problem solving and decision making depends on the data it collects and makes available. Some information systems collect and store **internal information** generated by the organization itself. Other information systems store or provide access to **external information** generated by sources outside the organization. Later in this section, you'll learn how different types of information systems deal with internal and external information.

Do organizations require different kinds of information systems? Because organizations have different missions and face different problems, they require different kinds of information systems. A small business might require a basic information system for accounting, inventory, and payroll. A large business might require an **enterprise information system** that supports a variety of business activities such as inventory management, point-of-sale cash registers, e-commerce, payroll, and managerial planning.

An information system or its components can be classified as a transaction processing system, management information system, decision support system, or expert system.

TRY IT!

How would you classify the problem of having to decide which courses to take next semester?

- ❍ Structured problem
- ❍ Semi-structured problem
- ❍ Unstructured problem
- ❍ Big problem

10

TRANSACTION PROCESSING SYSTEMS

What's a transaction? In an information system context, a **transaction** is an exchange between two parties that is recorded and stored in a computer system. When you order a product at a Web site, buy merchandise in a store, or withdraw cash from an ATM, you are involved in a transaction.

What is a transaction processing system? A **transaction processing system** (TPS) provides a way to collect, process, store, display, modify, or cancel transactions. Most transaction processing systems allow many transactions to be entered simultaneously.

The data collected by a TPS is usually stored in databases, and can be used to produce a regularly scheduled set of reports, such as monthly bills, weekly paychecks, annual inventory summaries, and daily manufacturing schedules. Figure 10-5 lists some examples of business transaction processing systems.

FIGURE 10-5
Business Transaction Processing Systems


Payroll


Accounting


Airline reservations


Inventory


Point of sale


Cellular phone billing

In the 1970s, early transaction processing systems, such as banking and payroll applications, used **batch processing** to collect and hold a group of transactions until the end of a day or pay period, when the entire batch was processed. Batch processing proceeds without human intervention, until all transactions are completed or until an error occurs.

In contrast to batch processing, most modern transaction processing systems use **online processing**—a real-time method in which each transaction is processed as it is entered. Such a system is often referred to as an **OLTP system** (online transaction processing system).

OLTP uses a **commit or rollback strategy** to ensure that each transaction is processed correctly. This strategy is crucial because most transactions require a sequence of steps, and every step must succeed for the transaction to be completed.

How does commit or rollback work? If you withdraw cash from an ATM, the bank's computer must make sure your account contains sufficient funds before it deducts the withdrawal from your account and allows the ATM to deliver cash. If the ATM is out of cash, however, the transaction fails, and the withdrawal should not be deducted from your account.

A TPS can commit to a transaction and permanently update database records only if every step of the transaction can be successfully processed. If even one step fails, however, the entire transaction fails and a rollback returns the records to their original state. Figure 10-6 diagrams the processes that take place in a typical TPS, and the video that accompanies the figure provides additional information about commit or rollback.

TRY IT!

When you make an online purchase, which of the following indicates a TPS rollback?

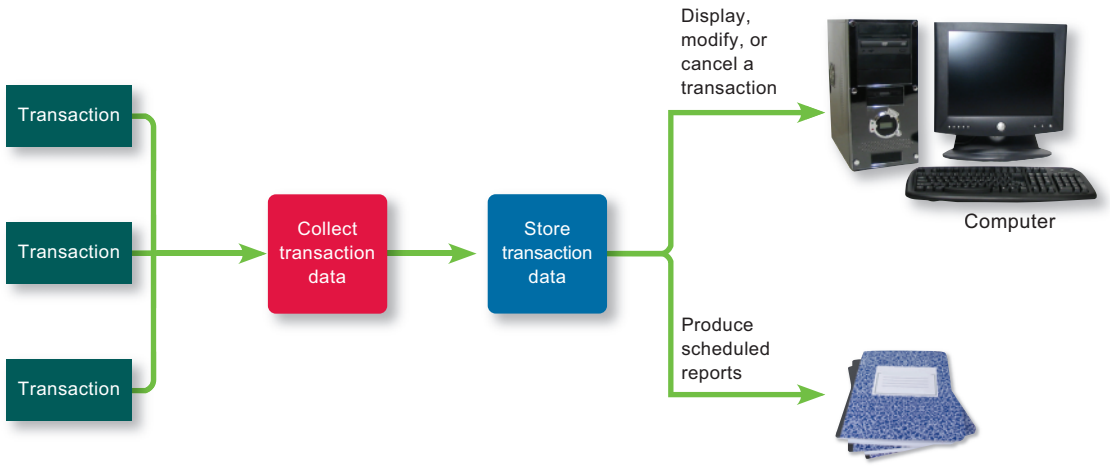
- ❍ A sale price on the merchandise
- ❍ A discount when you enter a coupon code
- ❍ A message that you've exceeded your debit card balance
- ❍ An offer to participate in a customer satisfaction survey

FIGURE 10-6

A transaction processing system is characterized by its ability to:

- Collect, display, and modify transactions
- Store transactions
- List transactions

Scroll down and start the video to see how a TPS processes an ATM transaction.



What are the limitations of transaction processing systems? Although a TPS excels at maintaining transaction data entered by clerical personnel and online customers, its reporting capabilities are limited. A typical TPS generates **detail reports**, which provide a basic record of completed transactions. However, managers need more sophisticated reports to help them understand and analyze data. These reports are usually created by a management information system.

10

MANAGEMENT INFORMATION SYSTEMS

What is a management information system? The term *management information system* is used in two contexts. It can be a synonym for the term *information system*, or it can refer to a specific category or type of information system.

We'll use the term **management information system** (MIS, pronounced "em-eye-ess") in this second context to refer to a type of information system that uses the data collected by a transaction processing system, and manipulates that data to create reports used by managers to make routine business decisions in response to structured problems. As Figure 10-7 shows, an MIS is characterized by the production of periodic reports that managers use for structured and routine tasks.

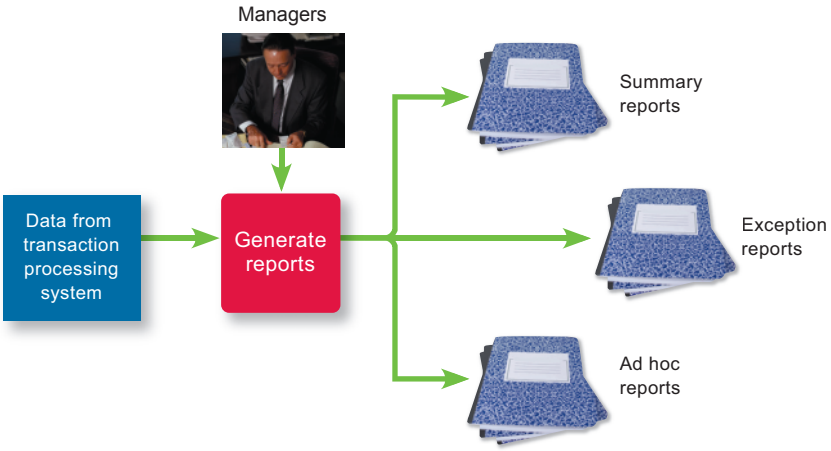


FIGURE 10-7

A management information system is characterized by its ability to:

- Produce routine and on-demand reports
- Provide useful information for managerial activities
- Increase managerial efficiency
- Provide information used for structured, routine decisions

Use your interactive eBook to find out how ATM data would be used in an MIS.

One of the major goals of an MIS is to increase the efficiency of managerial activity. Different levels of management have different information needs. In response to these different needs, an MIS can produce scheduled reports or ad hoc reports. An **ad hoc report** (sometimes called a demand report) is a customized report generated to supply specific information not available in scheduled reports. These reports are normally used by upper-level managers to gather data pertaining to specific business problems.

Scheduled reports, such as monthly summaries and exception reports, are used by various levels of management, follow a fixed format, and are produced according to a preset timetable. A **summary report** combines, groups, or totals data. For example, a summary report might show total annual sales for the past five years. Summary reports are useful in tactical and strategic planning. An **exception report** contains information that is outside normal or acceptable ranges (Figure 10-8).

Low Inventory–May 30

Item#	Description	Minimum Quantity	Current Quantity	Vendor
J506	Qualo-bag	12	10	REI
05D-8	Sm. Backpack	48	22	REI
B99A	Med. Backpack	48	40	REI
L2020	Canteen	24	3	ZB Ind.
D2990	Flashlight	36	8	ZB Ind.
6-334	Tent stakes	112	24	Granot

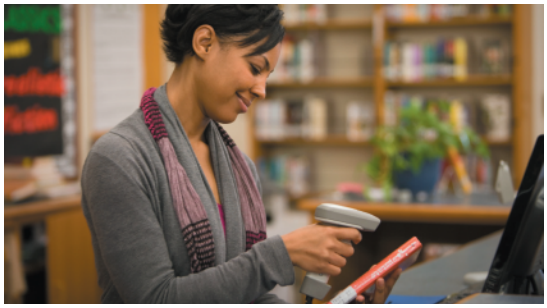
FIGURE 10-8

Exception reports help managers take action, such as reordering inventory. Managers also use exception reports to analyze potential problems, such as continued inventory shortages or an excessive number of customers making late payments.

How does an MIS differ from a TPS? Whereas a TPS simply records data, an MIS can consolidate data by grouping and summarizing it. For example, most modern library systems contain both a TPS and an MIS, which serve different functions, as Figure 10-9 explains.

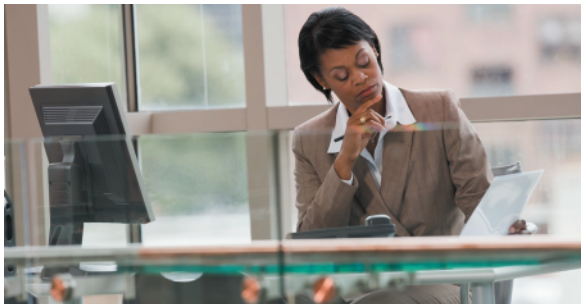
FIGURE 10-9
A library's TPS performs different functions than its MIS.

TPS



Purpose: Track books by maintaining a database of titles, checkout dates, and so forth.
Users: Library patrons locate books and librarians check books in and out.
Key characteristic: Manage transactions as books are checked in and out.

MIS



Purpose: Provide librarians with summary and exception reports needed to manage the collection.
Users: Librarians request and analyze reports.
Key characteristics: Summary reports indicate how many books are checked out each day, each week, each month, or each year; exception reports list long-overdue books.

What are the limitations of a management information system? A traditional MIS is based on the data collected by a transaction processing system. Sometimes, however, the MIS software that generates reports is not flexible enough to provide managers with the exact information needed. Further, an MIS usually cannot create models or projections—two important strategic planning tools. Today's competitive business environment calls for more sophisticated data manipulation tools, such as those that decision support systems provide.

DECISION SUPPORT SYSTEMS

What's a decision support system? A **decision support system** (DSS) helps people make decisions by directly manipulating data, analyzing data from external sources, generating statistical projections, and creating data models of various scenarios. A DSS provides tools for routine decisions, non-routine decisions, structured problems, and even semi-structured problems in which a decision might be based on imprecise data or require guesstimates.

A special type of decision support system, called an **executive information system** (EIS), is designed to provide senior managers with information relevant to strategic management activities—such as setting policies, planning, and preparing budgets—based on information from internal and external databases.

A decision support system derives its name from the fact that it *supports* the decision maker; that is, it provides the tools a decision maker needs to analyze data. A DSS might recommend a course of action, but the final choice remains the responsibility of the human decision maker.

Decision makers use DSSs to design decision models and make queries. A **decision model** is a numerical representation of a realistic situation, such as a cash-flow model of a business that shows how income adds to cash accounts and how expenses deplete those accounts. A **decision query** is a question or set of instructions describing data that must be gathered to make a decision.

TRY IT!

Visit the online site Let Simon Decide. Would you consider it a DSS?

- ❍ Yes, it is designed to help people make decisions
- ❍ Yes, but it can only be used for problems that it is programmed to solve
- ❍ No, it is a transaction processing system
- ❍ No, it doesn't use statistical analysis

A DSS typically includes modeling tools, such as spreadsheets, so that managers can create a numerical representation of a situation and explore what-if alternatives. DSS statistical tools help managers study trends before making decisions. In addition, a DSS usually includes data from an organization's transaction processing system, and it might include or access external data, such as stock market reports, as shown in Figure 10-10.

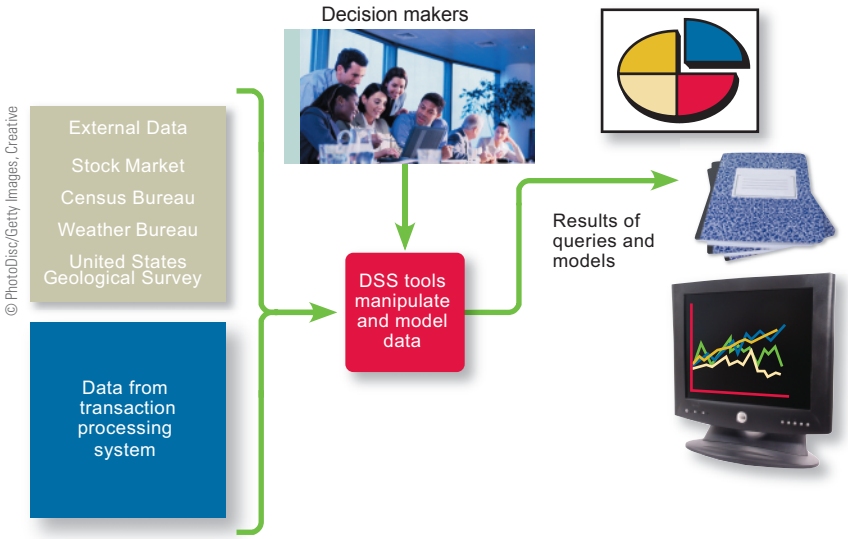


FIGURE 10-10

A decision support system is characterized by its ability to:

- Support, rather than replace, managerial judgment
- Create decision models
- Improve the quality of decisions
- Help solve semi-structured problems
- Incorporate external data

Use your interactive eBook to learn how a DSS helps decision makers at a fast food franchise.

What kinds of decisions can a DSS handle? A DSS can be used to tackle diverse problems because it contains a good selection of decision support tools. Directors of a disaster-relief organization might use a DSS to set fund-raising targets based on internal data from its accounting system and previous donations recorded by its TPS system.

A disaster relief DSS can also incorporate external information based on national fund-raising trends and current economic statistics pertaining to employment and disposable income. This data can be manipulated to examine what-if scenarios, such as "What if donations continue to decrease, but we are faced with another disaster similar to the 2011 tsunami in Japan?"

What are the limitations of a DSS? A DSS helps people manipulate the data needed to make a decision but does not actually make a decision. Instead, a person must analyze the data and reach a decision. A DSS is not a substitute for human judgment. Therefore, a DSS is appropriate in situations where it is used by trained professionals.

Many organizations, however, would like an alternative in which not every decision needs to be made by a highly paid expert. The major limitation of most decision support systems is they require users to have in-depth knowledge of the business problem that underlies the decision, plus a good background on what-if models and statistics.

When organizations want an information system to make decisions without direct guidance from an experienced decision maker, they turn to expert systems.

TRY IT!

Would a bank use a DSS to watch for fraudulent credit card use?

- ❍ Yes, managers could be supplied with a DSS so they could monitor customer accounts
- ❍ Yes, tellers could use it to decide whether to permit a cash advance
- ❍ No, human decision makers cannot monitor every credit card transaction
- ❍ No, it isn't needed because credit cards have security numbers on the back

EXPERT SYSTEMS AND NEURAL NETWORKS

What is an expert system? An **expert system**, sometimes referred to as a knowledge-based system, is a computer system designed to analyze data and produce a recommendation, diagnosis, or decision based on a set of facts and rules, as shown in Figure 10-11.

The facts and rules for an expert system are usually derived by interviewing one or more experts, and then incorporated into a **knowledge base**. The knowledge base is stored in a computer file and can be manipulated by software called an **inference engine**. The process of designing, entering, and testing the rules in an expert system is referred to as **knowledge engineering**.

What kinds of decisions can an expert system make? An expert system is not a general-purpose problem solver or decision maker. Each expert system is designed to make decisions in a particular area or domain.

An expert system created for use at the Campbell Soup Company captured the knowledge of an expert cooking-vat operator to help less experienced employees troubleshoot problems that might arise during the cooking and canning process.

Other expert systems have been developed to watch for fraudulent credit card use, locate mineral deposits, diagnose blood diseases, underwrite complex insurance policies, order a customized personal computer, and recommend stock purchases.

How are expert systems built? Expert systems can be created with a computer programming language, but an expert system shell offers a set of tools designed to simplify the development process. An **expert system shell** is a software tool containing an inference engine and a user interface that developers use to enter facts and rules for a knowledge base. An expert system shell also has tools for testing a knowledge base to make certain it produces accurate decisions.

Can an expert system deal with uncertainty? Expert systems are designed to deal with data that is imprecise, or with problems that have more than one solution. Using a technique called **fuzzy logic**, an expert system can deal with imprecise data by working with confidence levels.

Suppose an expert system is helping you identify a whale you spotted off the California coast. The expert system asks, "Did you see a dorsal fin?" You're not sure. You think you saw one, but it could have been a shadow. If the expert system is using fuzzy logic, it will let you respond with something like "I'm 85% certain I saw a dorsal fin." Based on the confidence level of your answer to this and other questions, the expert system might be able to tell you that it is "pretty sure," maybe 98% confident, that you saw a gray whale.

How does an expert system work? When it is time to make a decision, the inference engine begins analyzing the available data by

FIGURE 10-11

A simple expert system, such as this automechanic expert, collects information about car trouble by asking questions. Answers are analyzed according to a set of facts and rules to produce a repair recommendation.

© MediaTechnics

RULE 1:
IF you turn the key and there is no response,
THEN the battery is dead and you should recharge the battery.

RULE 2:
IF you turn the key and the engine sputters,
THEN you might be out of gas and you should check the fuel gauge.

RULE 3:
IF you turn the key and the engine sounds normal,
THEN the transmission might be malfunctioning. Check the position of the shift lever.

RULE 4:
IF none of the above choices applies to the problem,
THEN the expert system will ask additional questions.

following the rules in the knowledge base. If the expert system needs additional data, it checks external databases, looks for the data in a transaction processing system, or asks the user to answer questions. Figure 10-12 outlines the flow of information in an expert system and summarizes its capabilities.

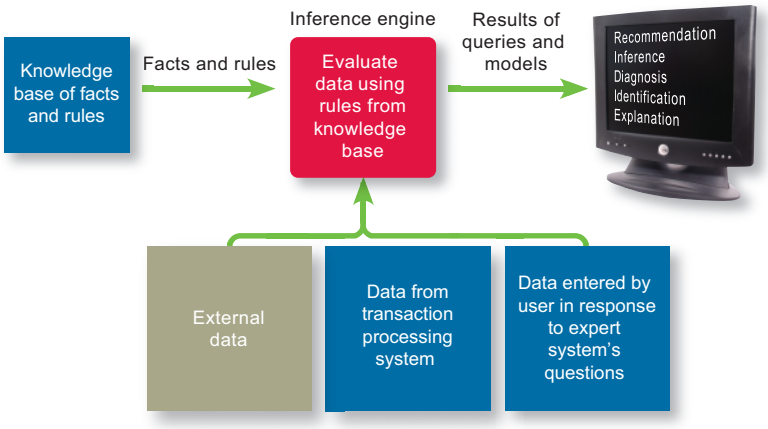


FIGURE 10-12

An expert system is characterized by its ability to:

- Replicate the reasoning of a human expert
- Work with internal or external data
- Produce a recommendation or decision

Watch how an expert system determines if a student should be admitted to graduate school.

Is it possible to build an expert system without an expert? An expert system begins with a set of facts and rules. But if the rules are not known, a computer can "learn" how to make decisions based on hundreds or thousands of lightning-fast trial-and-error attempts. A **neural network** uses computer circuitry to simulate the way a brain might process information, learn, and remember.

A neural network could be connected to a digital projector that displays photos of people's faces. Which faces are males and which are females? The neural network begins with a list of criteria with no values attached. "Hair length" might be one criterion, but the neural network is not programmed to expect that females usually have longer hair than men. Based on the evidence, a neural network begins to establish its own criteria—its own rules—about the data.

Neural networks have been successfully implemented in many business and financial applications where identification and trend analysis are important. A useful application of neural networks takes place in video surveillance systems, such as one that analyzes video footage of busy central London streets, watching for faces that match those of known terrorists (Figure 10-13).

FIGURE 10-13

Neural networks have been developed for a variety of applications, including surveillance.

© Jeremy Horner/CORBIS

QuickCheck

SECTION A

1. Effective _____ systems are designed to support goals that help an organization carry out its mission statement.
2. Executive managers typically engage in _____ planning, whereas mid-level managers are responsible for _____ planning.
3. _____ processing holds a group of transactions for later processing, whereas _____ processing handles each transaction as it is entered.
4. A(n) _____ collects data from a TPS and uses it to create scheduled and ad hoc reports. (Hint: Use the acronym.)
5. A(n) _____ system uses an inference engine to process rules and produce a diagnosis, recommendation, or decision.

CHECK ANSWERS