

CHAPTER 14

Enhancing Decision Making

LEARNING OBJECTIVES

After reading this chapter, you will be able to answer the following questions:

1. What are the different types of decisions, and how does the decision-making process work?
2. How do information systems support the activities of managers and management decision making?
3. How do decision-support systems (DSS) differ from management information systems (MIS), and how do they provide value to the business?
4. How do executive support systems (ESS) help senior managers make better decisions?
5. What is the role of information systems in helping people working in a group make decisions more efficiently?

OPENING CASE: LIBRO FINANCIAL'S DASHBOARD PROVIDES BETTER LENDING PROCESSES

Libro Financial's use of information systems to automate its lending service illustrates how information systems improve customer service. By partnering with Covarity, a provider of loan management systems, it has automated its underwriting and monitoring of commercial loans. Information systems helped the company operate more efficiently, increase responsiveness to customers, and ensures managers follow up when problems are highlighted by the system. This provides improved risk-management and reduces bad loans. Credit analysts can get a full picture of the lending environment. Customers can also use the Covarity Dashboard to access information, consolidate their reports and prepare presentations.

The chapter-opening diagram calls attention to important points raised by this case and this chapter. Libro management was unable to make good decisions about loans, reducing risk, and improve customer service and satisfaction. Bad loan decisions were reduces, and loan managers were forced to follow-up when loans were at risk.

14.1 DECISION MAKING AND INFORMATION SYSTEMS

“Companies have been able to use technology to do some very cool stuff — to reach customers in new ways, to automate operations. But one thing many businesses haven’t been able to do easily is use the data they’ve collected to find and stamp out waste across operations. Sifting through corporate data was supposed to make executives more efficient. Much of the time, though, it’s just made them more confused.” (*Fortune* magazine, March 3, 2002)

Each of us makes hundreds of decisions every day. If just a fraction of those decisions could be improved through better and more information and better processes, we’d all be delighted. Businesses feel the same way. Customers would be happier, employees would be more motivated, and managers would have an easier job. Most of all businesses could improve their profitability to the benefit of all.

BUSINESS VALUE OF IMPROVED DECISION MAKING

As we’ve discussed throughout these chapters, turning raw data into useful information is the primary goal of any information system. Unfortunately, as we continue to gather more and more data, turning it into useful information becomes harder and harder.

The more useful information you have, based on internal experiences or from external sources, the better your decisions. Business executives are faced with the same dilemmas when they make decisions. They need the best tools available. Decision-Support Systems (DSS), Group Decision-Support Systems (GDSS), and Executive Support Systems (ESS) are the specialized tools we review in this chapter.

Don’t be misled into thinking that the dollar value of improved decision-making process is limited to managers. As more business flatten their organizational structures and push decision making to lower levels, better decisions at all levels can lead to increased business value.

While we discussed organizational roles in Chapter 2, let’s review how people in each level of the organization make decisions.

- **Senior Management:** makes decisions based on internal business information but also external industry and society changes; decisions affect long-term and strategic goals and the firm’s objectives.
- **Middle Management and project teams:** decisions affect resource allocation, short-range plans and performance of specific departments, task forces, teams, and special project groups.

- **Operational management and project teams:** decisions affect subunits and individual employees regarding the resources, schedules and personnel decisions for specific projects.
- **Individual employees:** decisions affect specific vendors, other employees and most importantly the customer.

TYPES OF DECISIONS

There are generally three classifications of decisions:

- **Unstructured decisions:** requires judgment, evaluation, and insight into non-routine situations. Usually made at senior levels of management.
- **Structured decisions:** repetitive, routine, with definite procedures for making the decision. Usually made at the lowest organizational levels.
- **Semistructured decisions:** A combination of the two. Usually made by middle managers.

THE DECISION-MAKING PROCESS

The text describes the four stages of decision making. Stress to students that these four stages are not always consecutive and may well be concurrent or repetitive.

- **Intelligence:** discovering, identifying, and understanding the problem
- **Design:** identifying and exploring solutions to the problem
- **Choice:** choosing among solution alternatives
- **Implementation:** making the chosen alternative work and monitoring how well the solution is working

MANAGERS AND DECISION MAKING IN THE REAL WORLD

Managers help keep chaos to a minimum. We've all worked for the person who proves this theory wrong, but when all is said and done, minimizing chaos is the manager's number one job.

Managerial Roles

Henri Fayol's **classical model of management** says there are five distinct functions of every manager:

- Planning
- Organizing
- Coordinating
- Deciding
- Controlling

While Fayol's theory still merits consideration, a manager's activities are not as cut-and-dry as they first appear.

The textbook discusses a **behavioural model** of managing with these attributes:

1. Accomplishing tasks at an unrelenting pace
2. Fragmented activities completed in a very short time
3. Speculation, hearsay, and gossip are more the norm
4. Oral communication is preferred over written
5. An informal information system is more desirable than a highly structured system

It is important to note that most managers are always looking out for themselves. They establish agendas and goals, build interpersonal networks, and then execute their own personal agendas.

Regardless of the management model followed, managers spend most of their time communicating: listening, talking, reading, and writing. The very simple use of e-mail technology allows managers to complete more communications than ever before. They can also employ other methods of technology that increase the amount of communicating they do.

In his research, Mintzberg found that **managerial roles** fell into three categories:

- **Interpersonal.** Managers act as a representative of the organization to internal and external audiences.
- **Informational.** Managers pass information up and down and around the organization.
- **Decisional.** Once managers make a decision, they must pass it on to someone else. But before they can make that decision, they have to gather information from internal/external sources.

Real-World Decision Making

Since you no doubt have had to make decisions in the real world, you know for a fact that the process is not as cut-and-dry as what we've reviewed so far. Three reasons why the whole process can blow up without a moment's notice:

- **Information Quality:** Was the information used accurate, consistent, complete, valid, timely, accessible, and of high integrity? What if you were making a decision about purchasing a house and found out that there were errors in your credit record that prevented you from obtaining the necessary financing? Perhaps the data was out of date or contained mistakes.
- **Management Filters:** Everyone processes the best information through personal filters and biases. Managers are no different. For instance, you may suggest to your manager that the department purchase a piece of equipment from a certain manufacturer. Your manager disapproves the suggestion because he had a bad experience with that company ten years ago. The manager's bias negates the fact that the company has since improved and is the best and cheapest choice.

- **Organizational Inertia and Politics:** People hate change and will sometimes do whatever they can to keep the status quo. Decision makers are no different especially if they stand to lose. What if your department will benefit from improving its business processes to the benefit of all concerned except that the manager will lose her job? It's likely the manager will not make decisions that will cause her to lose her job. Therefore, nothing gets done regarding improving the processes.

Bottom Line: Everyone makes decisions at all levels of an organization. The goal is to match the four decision-making organizational levels along with the three types of decisions to the appropriate kind of decision support system.

14.2

SYSTEMS FOR DECISION SUPPORT

When we discussed transaction processing systems and management information systems, the decisions were structured and clear-cut. Most decisions facing executives are unstructured or semistructured.

There are four kinds of systems to support the decision makers and the types of decisions they make:

- **Management Information Systems:** routine reports and summaries of transaction-level data for middle and operational-level managers. Best suited to structured and semistructured decisions.
- **Decision-support systems:** combine analytical models with operational data for middle managers making semistructured decisions
- **Executive support systems:** includes external as well internal information for senior managers who generally make unstructured decisions.
- **Group decision-support systems:** supply groups and teams with an electronic environment in which they can make unstructured and semistructured problems.

MANAGEMENT INFORMATION SYSTEMS (MIS) & DECISION-SUPPORT SYSTEMS (DSS)

In order to better understand a decision-support system, let's compare the characteristics of an MIS system with those of a DSS system:

MIS	DSS
Structured decisions	Semistructured, unstructured decisions
Reports based on routine flows of data	Focused on specific decisions or classes of decisions
General control of organization	End user control of data, tools, and sessions
Structured information flows	Emphasizes change, flexibility, quick responses
Presentation in form of reports	Presentation in form of graphics
Traditional systems development	Greater emphasis on models, assumptions, ad hoc queries
	Develop through prototyping; iterative process

You can also understand the differences between these two types of systems by understanding the differences in the types of decisions made at the two levels of management. Are your decisions routine, or are your decisions nonroutine? Students might find it helpful to review the information about decision-making processes from Chapter 2.

Components of DSS

A DSS has three main components: the database, software and the user interface.

The **DSS database** is, of course, data collected from the organization's information systems. Another important source of information the organization may use is external data from governmental agencies or research data from universities. The data can be accessed from the warehouse or from a data mart (extraction of data from the warehouse). Many databases are now being maintained on desktop computers instead of mainframes.

The **DSS software system** must be easy to use and adaptable to the needs of each executive. A well-built DSS uses the **models** that the text describes. You've probably used statistical models in other classes to determine the mean, median, or deviations of data. These statistical models are the basis of data mining.

The what-if decisions most commonly made by executives use **sensitivity analysis models** to help them predict what effect the decisions will have on the organization. Executives don't make decisions based solely on intuition. The more information they have, the more they experiment with different outcomes in a safe mode, the better their decisions. That's the benefit of the models used in the software tools.

Of the three components, the user interface may be the most important one because it's what people relate to, see, and use the most. It must be easy to learn, intuitive, flexible, and reliable.

Using Spreadsheet Pivot Tables to Support Decision Making

Managers are increasingly using spreadsheet software to help them detect and understand patterns in data. Microsoft Excel spreadsheet software has a very powerful tool called a pivot table that categorizes and summarizes data very quickly. A **pivot table** is simply a table that displays two or more dimensions of data in a convenient format. (For precise instructions on how to create **PivotTable** reports and use the **Excel PivotChart Report**, refer to the Student Learning Track on PivotTables.)

Bottom Line: Firms can improve the decision-making process throughout their organizations by providing tools that improve the process and provide a great deal more information than the old-fashioned gut instinct method could. However, systems users must be an integral part of the design, development, and implementation of DSS systems.

WINDOW ON MANAGEMENT: TOO MANY BUMPED FLIERS: WHY?

TO THINK ABOUT QUESTIONS

1. **Is the decision support system being used by airlines to overbook flights working well? Answer from the perspective of the airlines and from the perspective of customers.**

The encouraging statistic is that only 676,408 of the 555 million people who flew in 2006 were bumped, voluntarily or involuntarily. Unfortunately the number of passengers bumped increased 23% in 2006. That could be a sign that the airlines' decision support systems are no longer working well or a reflection of an increase in the overall number of passengers.

U.S. Airways' no-show rate between 7 and 8 percent is significant. On the other hand, JetBlue doesn't seem to have a problem. The variance could be attributed to the difference in refundable versus nonrefundable tickets.

2. **What is the impact on the airlines if they are bumping too many passengers?**

If airlines bump too many passengers it could create ill will from passengers and increase customer dissatisfaction. That can impact overall sales in the long run. Gate attendants become increasingly dissatisfied with their jobs, possibly creating a hostile work environment, because of overbooking decisions. That in turn impacts customer service at a critical customer touch point. The gate attendants also create phony reservations

thereby compounding the problem. Gate attendants also call in sick, costing the airlines additional dollars in benefit costs.

3. What are the inputs, processes, and outputs of this DSS?

Inputs include the historical data of no-shows on flights, the rate at every fare-level available, the number of passengers booked on each flight, the number of passengers bumped on each flight, and whether the passenger is a business traveler.

Processes use computer modeling, including computer algorithms, to examine fares booked on each upcoming flight and the rate of no-shows by geographic region.

Outputs include the number of no-shows predicted on a particular flight. That's based on which fares passengers have booked. Overbooking is based on the numbers generated by the modeling software.

4. What people, organization, and technology factors are responsible for excessive bumping problems?

People: business travelers with high-priced fares are no shows more often; passengers with lower fares tend to show most frequently; gate attendants affect the entire process by creating phony reservations which are later cancelled; fewer passengers are volunteering to accept vouchers.

Organization: smaller planes may be substituted for larger planes; bad weather increases luggage weight requiring passengers to be bumped; airline policies regarding refundable and nonrefundable impact whether passengers show up; airlines are supposed to hold analysts accountable for their outputs but rarely do.

Technology: analysts don't always guess correctly; faulty algorithms result in miscalculations; computer modeling software is apparently flawed.

5. How much of this is a “people” problem? Explain your answer.

The answers to this question will vary but should address the key players: analysts, attendants, passengers, and decision-making processes by key executives.

MIS IN ACTION QUESTIONS

Visit the Web sites for US Airways, JetBlue, and Air Canada. Search the sites to answer the following questions:

- 1. What is the policy of each of these airlines for dealing with involuntary refunds (overbookings)? (Hint: these matters are often covered in the Contract of Carriage.)**

JetBlue: According to paragraph 27 of the Contract of Carriage, passengers who are involuntarily bumped receive \$1000 in compensation unless they take an alternate flight. Link to the document is: http://jetblue.com/p/jetblue_coc.pdf.

US Airways: The policy shown on the Web site is non-specific. The text in its entirety copied from the Web site is “Airline flights may be overbooked, and there is a slight chance that a seat will not be available on a flight for which a person has a confirmed reservation. If the flight is overbooked, no one will be denied a seat until airline personnel first ask for volunteers willing to give up their reservation in exchange for a payment of the airline's choosing. If there are not enough volunteers, the airline will deny boarding to other persons in accordance with its particular boarding priority. With few exceptions, persons denied boarding involuntarily are entitled to compensation. The complete rules for payment of compensation and each airline's boarding priorities are available at all airport ticket counters and boarding locations. Some airlines do not apply these consumer protections to travel from some foreign countries, although other consumer protections may be available. Check with the airline or your travel agent.”

Link to the document is:
<http://usairways.com/awa/content/aboutus/customersfirst/contractofcarriage.aspx>

Air Canada: The text as copied from the website (and almost identical to US Airways) states “**OVERBOOKING NOTICE:** Airline flights may be overbooked, and there is a slight chance that a seat will not be available on a flight for which a person has a confirmed reservation. If the flight is overbooked, no one will be denied a seat until airline personnel first ask for volunteers willing to give up their reservation in exchange for a payment of the airline's choosing. If there are not enough volunteers, the airline will deny boarding to other persons in accordance with its particular boarding priority. With few exceptions, persons denied boarding involuntarily are entitled to compensation. The complete rules for the payment of compensation and boarding priorities are available at all airport ticket counters and boarding locations.”

The author knows that compensation includes accommodation, the next flight in executive class, and future travel voucher.

2. In your opinion, which airline has the best policy? What makes this policy better than the others?

Opinions will vary. Some students will think a flat fee like JetBlue's is better than credit for future flights. Other students may not feel the same way.

3. How are each of these policies intended to benefit customers? How do they benefit the airlines?

The policies are intended to pacify customers who may be bumped from flights and allow them to feel placated. The policies benefit the airlines by allowing them to overbook flights thus ensuring full flights and more income.

WINDOW ON TECHNOLOGY: HOSPITAL CREDITS BUSINESS INTELLIGENCE WITH IMPROVING PATIENT CARE

TO THINK ABOUT QUESTIONS

1. What problems did CVH face with its data tracking and reporting? How did they affect decision making and business performance?

It was not able to provide performance indicators to government, its funding source. This would allow the hospital to assure its funder that they were using the funds with integrity and efficiency. In addition, performance metrics would allow them to improve efficiency, reduce costs and one would think improve patient care.

2. What did the hospital do to remedy those problems?

The hospital adopted a Microsoft product, Performance Point Server, which integrates with a database to allow the hospital to track and monitor performance indicators of approximately 100 operational measures. This allows management to provide Business Intelligence – tracking where there may be problems, as well as planning for the future.

3. Was the business intelligence tool an appropriate selection for CVH? Why or why not?

Yes, it seems to have been successful in that it allowed management to specify its own key performance indicators which it could then track. In addition, it allowed the database to be integrated providing an integrated clinical and financial picture of the performance of the hospital. This met the health-care and financial-accountability requirements.

4. Has improved reporting permitted the hospital to be more accountable to the provincial government? Explain your answer.

Yes. The hospital boosted overall accountability as well as better manage resources. They have better data, and can use this to better plan for the future; when asking for funding they can forecast how the resources will be used. In addition, government will be interested in their improved healthcare provision (such as spotting trends).

MIS IN ACTION

Explore the PerformancePoint Server Web site, and then answer the following questions:

1. Describe the capabilities of PerformancePoint software. List the capabilities that would be most useful for supporting decisions for CVH. Explain how the software would help CVH's employees with these decisions.

From the Microsoft website (retrieved February, 2010):

Business conditions change daily, targets and goals get updated on the fly, and competition can outmaneuver you overnight. You need to quickly see how your business is reacting, understand what changes you need to make, and adjust your business to meet new challenges and opportunities.

It's not easy. Business Intelligence are often built in proprietary applications . Even with reports on current performance, it may be hard to uncover the underlying drivers of change and adjust accordingly. Or the available details differ from what was originally needed in the first place.

Enter Microsoft Office PerformancePoint Server 2007, a single application built to enable the complete performance management cycle by bringing together monitoring and analytics.

Monitoring : *Easily see what is happening now in your organization, measure against your objectives, and understand how your actions impact corporate goals.*

Analytics : *Quickly discover what is driving performance and look at what adjustments you might make to take advantage of new opportunities.*

This indicates that the monitoring and analytics aspects as described in the case are integral to the software, and these were the most important for the hospital. Students can give examples of each such as

Monitoring: patient wait times, patient bed usage, use of operating rooms, monitoring supplies

Analytics: trends in health, trends in demographics, analysis of costs and benefits.

2. Interestingly, since this was written, PerformancePoint Server 2007 will no longer be available for purchase. When the next version of Microsoft Office is released, the Monitoring and Analytics capabilities will be included with SharePoint Server Enterprise. Microsoft will, however, continue to support PerformancePoint. What do you think the response to Microsoft's discontinuation of this package will be from its customers?

Customers will be upset. It may require another implementation and database integration. However, there will probably be middleware developed and consultants available to help with the transfer.

DATA VISUALIZATION AND GEOGRAPHIC INFORMATION SYSTEMS (GIS)

Which would you rather decipher: a long list of seemingly endless list of numbers and complicated data, or a picture that truly can say it all in less than 1,000 words? Consider that almost our whole natural environment is one big graphic that we decipher through

conceptualization. What if we combine thousands and thousands of words and numbers into a graphic that we can more naturally view and draw conclusions through concepts? That's the idea behind **data visualization**. If you want to see a sensible depiction of this emerging technology, go to <http://www.smartmoney.com> and click on the link labeled Tools and Maps. Rather than see traditional, out of context, lists of stock quotes, you can see a visualization of the data and put it into a more meaningful context. Click on one of the map sections and you can drill down through the data in a visual sense.

Many executive decisions depend on the availability of information, internal and external. For instance, a company that ships most of its products on trucks needs data about interstate highway access and traffic patterns to help control shipping costs and make it easier for drivers to access its warehouses. Some company policies limit business locations to high-traffic areas such as malls and similar densely populated areas. Other executive decisions revolve around data about current and potential customers and their geographic location.

Geographic Information Systems (GIS) rely heavily on demographic data from the U.S. Census Bureau. This type of decision-support system helps managers visualize geographic information more easily and make better decisions based on digitized maps. GIS data can be coupled with an organization's internal data to better allocate resources, money, people, time, and material.

WEB-BASED CUSTOMER DECISION-SUPPORT SYSTEMS

Of course, no discussion would be complete without information about how companies are using the Internet and the Web in the customer DSS decision-making process.

Here's an example: You decide to purchase a new home and use the Web to search real estate sites. You find the perfect house in a good neighborhood but it seems a little pricey. You don't know the down payment you'll need. You also need to find out how much your monthly payments will be based on the interest rate you can get. Luckily, the Real Estate Web site has several helpful calculators (**customer decision-support systems (CDSS)**) you can use to determine the down payment, current interest rates available, and the monthly payment. Some customer decision-support systems will even provide an amortization schedule. You can make your decision about the purchase of the home or know instantly that you need to find another house.

GROUP DECISION-SUPPORT SYSTEMS (GDSS)

These systems provide users who may or may not be geographically distributed with tools to make group decisions. These tools can allow many people to collaborate while preserving their anonymity, while also creating a written document of all the activity.

Bottom Line: Executives make semi-structured and unstructured decisions based on historical and current data, from both internal and external sources. Well-built

decision support systems help them make better decisions by making more of these kinds of data available in the decision-making process. Data mining is one of the most effective tools for gathering useful information, provided it's used properly. In addition to data, the components of a DSS include effective software tools and a user-friendly interface.

14.3

EXECUTIVE SUPPORT SYSTEMS (ESS) AND THE BALANCED SCORECARD FRAMEWORK

Executive Support Systems (ESS) supply the necessary tools to senior management. The decisions at this level of the company are usually never structured and could be described as “educated guesses.” Executives rely as much, if not more, on external data than they do on data internal to their organization. Decisions must be made in the context of the world outside the organization. The problems and situations senior executives face are very fluid, so the system must be flexible and easy to manipulate.

THE ROLE OF EXECUTIVES SUPPORT SYSTEMS IN THE FIRM

Executives often face information overload and must be able to separate the chaff from the wheat in order to make the right decision. On the other hand, if the information they have is not detailed enough, they may not be able to make the best decision. An ESS can supply the summarized information executives need and yet provide the opportunity to **drill down** to more detail if necessary.

As technology advances, ESS are able to link data from various sources, both internal and external, to provide the amount and kind of information executives find useful. As common software programs include more options and executives gain experience using these programs, they're turning to them as an easy way to manipulate information.

Just as the Web is proving to be a rich source of information for the general populace, it's also a gold mine of data and information for executives. The information is easily downloaded into existing systems and can be incorporated with other data, used in comparison with internal data, or provide a wider range of viewpoints than isolated internal systems.

As with DSS, executive support systems are usually developed using the prototyping method. Prototyping allows iterative, quick changes to the system. Executives are busy people who don't want to spend a lot of time in the development process. They know what they want, they want it quickly, and they want it to work the first time. That's a tough goal for developers.

ESS must support many of the executive's informational requirements, or she will find other ways to supplement her decision-making tasks. If the system doesn't provide the flexibility to scout out problems or new opportunities, or keep an eye on the competition, executives will ignore the system and seek other ways of getting the information they need — mainly other people.

BUSINESS VALUE OF EXECUTIVE SUPPORT SYSTEMS

As more executives come up through the ranks, they are more familiar with and rely more on technology to assist them with their jobs. Executive support systems don't provide executives with ready-made decisions. They provide the information that *helps* them make their decisions. Executives use that information, along with their experience, knowledge, education, and understanding of the corporation and the business environment as a whole, to make their decisions.

Executives are more inclined to want summarized data rather than detailed data (even though the details must be available). ESS rely on graphic presentation of information because it's a much quicker way for busy executives to grasp a lot of information in less time.

Because of the trend toward flatter organizations with fewer layers of management, companies are employing ESS at lower levels of the organization. This trend will probably continue as more managers become knowledgeable about the power and flexibility of ESS.

Flatter organizations also require managers to access more information about a wider range of activities than in the past. This requirement can be accomplished with the aid of a good ESS. Executives can also monitor the performance of their own areas and of the company as a whole.

The examples of ESS provided in the text offer interesting contrasts of how each organization uses its system to aid in the decision-making process.

National Life: ESS for Business Intelligence:

- Access information from corporate databases through a Web interface
- Ability to drill down into current sales information
- Examine data from many different perspectives.

Bottom Line: Executive support systems meet the needs of corporate executives by providing them with vast amounts of information quickly and in graphic form to *help* them make effective decisions. ESS must be flexible, easy-to-use, and contain both internal and external sources of information.

SUMMARY

1. What are the different types of decisions, and how does the decision-making process work?

The different levels in an organization (strategic, management, operational) have different decision-making requirements. Decisions can be structured, semistructured, or unstructured, with structured decisions clustering at the operational level of the organization and unstructured decisions at the strategic level. Decision making can be performed by individuals or groups and includes employees as well as operational, middle, and senior managers. There are four stages in decision making: intelligence, design, choice, and implementation. Systems to support decision making do not always produce better manager and employee decisions that improve firm performance because of problems with information quality, management filters, and organizational inertia.

2. How do information systems support the activities of managers and management decision making?

Several different models of what managers actually do in organizations show how information systems can be used for managerial support. Early classical models of managerial activities stress the functions of planning, organizing, coordinating, deciding, and controlling. Contemporary research looking at the actual behavioural of managers has found that managers' real activities are highly fragmented, variegated, and brief in duration, with managers moving rapidly and intensely from one issue to another. Managers spend considerable time pursuing personal agendas and goals, and contemporary managers shy away from making grand, sweeping policy decisions.

Information technology provides new tools for managers to carry out both their traditional and newer roles, enabling them to monitor, plan, and forecast with more precision and speed than ever before and to respond more rapidly to the changing business environment. Information systems have been most helpful to managers by providing support for their roles in disseminating information, providing liaisons between organizational levels, and allocating resources. However, some managerial roles cannot be supported by information systems, and information systems are less successful at supporting unstructured decisions.

3. How do decision-support systems (DSS) differ from management information systems (MIS), and how do they provide value to the business?

Management information systems (MIS) provide information on firm performance to help managers monitor and control the business, often in the form of fixed regularly scheduled reports based on data summarized from the firm's transaction processing systems. MIS support structured decisions and some semistructured decisions.

Decision-support systems (DSS) combine data, sophisticated analytical models and tools, and user-friendly software into a single powerful system that can support semistructured or unstructured decision making. There are two kinds of DSS: model-driven DSS and data-driven DSS. DSS can help support decisions for pricing, supply chain management, and customer relationship management as well as model alternative business scenarios. DSS targeted toward customers as well as managers are becoming available on the Web. A special category of DSS called geographic information systems (GIS) uses data visualization technology to analyze and display data for planning and decision making with digitized maps.

4. How do executive support systems (ESS) help senior managers make better decisions?

Executive support systems (ESS) help senior managers with unstructured problems that occur at the strategic level of the firm. ESS provide data from both internal and external sources and provide a generalized computing and communications environment that can be focused and applied to a changing array of problems. ESS help senior executives monitor firm performance, spot problems, identify opportunities, and forecast trends. These systems can filter out extraneous details for high-level overviews, or they can drill down to provide senior managers with detailed transaction data if required. ESS take advantage of firmwide data provided by enterprise systems.

ESS help senior managers analyze, compare, and highlight trends so that the managers may more easily monitor organizational performance or identify strategic problems and opportunities. They are very useful for environmental scanning, providing business intelligence to help management detect strategic threats or opportunities from the organization's environment. ESS can increase the span of control of senior management, allowing them to oversee more people with fewer resources.

5. What is the role of information systems in helping people working in a group make decisions more efficiently?

People working together in a group can use group decision-support systems to help them in the process of arriving at a decision. Group decision-support systems (GDSS) have hardware, software, and people components. Hardware components consist of the conference room facilities, including seating arrangements and computer and other electronic hardware. Software components include tools for organizing ideas, gathering information, ranking and setting priorities, and documenting meeting sessions. People components include participants, a trained facilitator, and staff to support the hardware and software.

A GDSS helps decision makers meeting together to arrive at a decision more efficiently and is especially useful for increasing the productivity of meetings of more than four or five people. However, the effectiveness of a GDSS is contingent on the

composition of the group, the task, appropriate tool selection and meeting support, and the organizational context of the meeting.

KEY TERMS

The following alphabetical list identifies the key terms discussed in this chapter.

Balance scorecard — model for analyzing firm performance that supplements traditional financial measures with measurements from additional business perspectives, such as customers, internal business processes, and learning and growth.

Behavioural models — descriptions of management based on behavioural scientists' observations of what managers actually do in their jobs.

Choice — Simon's third stage of decision making, when the individual selects among the various solution alternatives.

Classical model of management — traditional description of management that focused on its formal functions of planning, organizing, coordinating, deciding, and controlling.

Customer decision-support systems (CDSS) — system to support the decision-making process of an existing or potential customer.

Data visualization — technology for helping users see patterns and relationships in large amounts of data by presenting the data in graphical form.

Decisional role — Mintzberg's classification for managerial roles in which managers initiate activities, handle disturbances, allocate resources, and negotiate conflicts.

Design — Simon's second stage of decision making, when the individual conceives of possible alternative solutions to a problem.

Digital dashboard — displays all of a firm's key performance indicators as graphs and charts on a single screen to provide a one-page overview of all the critical measurements necessary to make key executive decisions.

Drill down — the ability to move from summary data to lower and lower levels of detail

DSS database — a collection of current or historical data from a number of applications or groups. Can be a small PC database or a massive data warehouse.

DSS software system — collection of software tools that is used for data analysis, such as online analytical processing (OLAP) tools, data-mining tools, or a collection of mathematical and analytical models.

Geographic information systems (GIS) — system with software that can analyze and display data using digitized maps to enhance planning and decision making.

Group decision-support systems (GDSS) — an interactive computer-based system to facilitate the solution of unstructured problems by a set of decision makers working together as a group.

Implementation — Simon's final stage of decision making, when the individual puts the decision into effect and reports on the progress of the solution. Also refers to all the organizational activities working toward the adoption and management of an innovation.

Informational role — Mintzberg's classification for managerial roles in which managers act as the nerve centres of their organizations, receiving and disseminating critical information.

Intelligence — the first of Simon's four stages of decision making, when the individual collects information to identify problems occurring in the organization.

Interpersonal role — Mintzberg's classification for managerial roles in which managers act as figureheads and leaders for the organization.

Managerial roles — expectations of the activities that managers should perform in an organization.

Model — an abstract representation that illustrates the components or relationships of a phenomenon.

Pivot table — is simply a table that displays two or more dimensions of data in a convenient format.

PivotTable and PivotChart Reporting — Excel spreadsheet function where you are able to select where your data are, and what type of report you want.

Sensitivity analysis — models that ask “what-if” questions repeatedly to determine the impact of changes in one or more factors on the outcomes.

Semistructured decisions — decisions in which only part of the problem has a clear-cut answer provided by an accepted procedure.

Structured decisions — decisions that are repetitive, routine, and have a definite procedure for handling them.

Unstructured decisions — nonroutine decisions in which the decision maker must provide judgment, evaluation, and insights into the problem definition; there is no agreed-upon procedure for making such decisions.

REVIEW QUESTIONS

1. What are the different types of decisions, and how does the decision-making process work?

List and describe the different levels of decision-making and decision-making constituencies in organizations. Explain how their decision-making requirements differ.

Figure 14.1 illustrates the answer to this question. Each of these levels has different information requirements for decision support and responsibility for different types of decisions.

- Senior management deals mainly with unstructured decisions.
- Middle management deals with semistructured decisions.
- Operational management deals with structured decisions.

Distinguish between an unstructured, semistructured, and structured decision.

Decisions are classified as structured, semistructured, and unstructured.

- Unstructured decisions are those in which the decision maker must provide judgment, evaluation, and insight to solve the problem. Each of these decisions is novel, important, and nonroutine, and there is no well-understood or agreed-on procedure for making them.
- Structured decisions are repetitive and routine, and they involve a definite procedure for handling them so that they do not have to be treated each time as if they were new.
- Semistructured decisions have elements of both unstructured and structured decisions. Only part of the problem has a clear-cut answer provided by an accepted procedure.

List and describe the stages in decision making.

Stages in the decision-making process include:

- Intelligence consists of discovering, identifying, and understanding the problems occurring in the organization. Why is there a problem, where, and what effect it is having on the firm?
- Design involves identifying and exploring various solutions to the problem.
- Choice consists of choosing among solution alternatives.
- Implementation involves making the chosen alternative work and continuing to monitor how well the solution is working.

2. How do information systems support the activities of managers and management decision making?

Compare the descriptions of managerial behaviour in the classical and behavioural models.

The classical model suggests that managers perform five classical functions. These functions are planning, organizing, coordinating, deciding, and controlling. Although the classical model describes formal managerial functions, it does not provide a description of what managers actually do. The behavioural models suggest that managerial behaviour is less systematic, more informal, less reflective, more reactive, less well-organized, and somewhat frivolous. The behavioural models differ from the classical model in that managers perform a great deal of work at an unrelenting pace, managerial activities are fragmented, managers prefer speculation, managers prefer oral forms of communication, and managers give the highest priority to maintaining a diverse and complex web of contacts.

Identify the specific managerial roles that can be supported by information systems.

Table 14–2 compares managerial roles with the support systems. Information systems support the liaison, nerve center, disseminator, spokesperson, and resource allocator roles. Currently information systems do not support the figurehead, leader, entrepreneur, disturbance handler, and negotiator roles. Information systems are the strongest at the informational role and the weakest at the interpersonal and decisional roles.

3. How do decision-support systems (DSS) differ from management information systems (MIS) and how do they provide value to the business?

Distinguish between DSS and MIS.

Management information systems (MIS) provide routine reports and summaries of transaction-level data to middle and operational level managers to provide answers to structured and semistructured decision problems. MISs provide information on the firm's performance to help managers monitor and control the business. They typically produce fixed, regularly scheduled reports based on data extracted and summarized from the firm's underlying transaction processing systems. The formats for these reports are often specified in advance.

Decision-support systems (DSS) provide analytical models or tools for analyzing large quantities of data and supportive interactive queries for middle managers who face semistructured situations. DSSs emphasize change, flexibility, and rapid responses. With a

DSS there is less of an effort to link users to structured information flows and a correspondingly greater emphasis on models, assumptions, ad-hoc queries and display graphics.

Compare a data-driven DSS to a model-driven DSS. Give examples.

A data-driven DSS is a system that supports decision making by allowing users to extract and analyze useful information that was previously buried in large databases. Often TPS data are collected in data warehouses. Multidimensional analysis and data mining tools can then analyze the data.

A model-driven DSS is primarily a stand-alone system that has a model at its heart, perhaps a mathematical or spreadsheet representation of such a model. The emphasis is on the model, scenarios, and what-if sensitivity, such as linear programming.

List and describe the three basic components of a DSS.

Figure 14.3 illustrates the components of a DSS. They include a DSS database, DSS software system, and DSS user interface.

- The DSS database is a collection of current or historical data from a number of applications or groups, organized for easy access by a range of applications. The DSS database may be a small database residing on a PC, or it may be a massive data warehouse that is continuously updated by major organizational TPS.
- The DSS software system is a collection of software tools used for data analysis, including a collection of mathematical and analytical models, OLAP tools, and data mining tools. Various kinds of models may be in the model base, including libraries of statistical, optimization, sensitivity analysis, and forecasting models.
- The DSS user interface permits easy interaction between users and the DSS software tools.

Define a geographic information system (GIS) and explain how it supports decision making.

Geographic information systems (GIS) are a special category of DSS that use data visualization technology to analyze and display data for planning and decision making in the form of digitized maps. The software can assemble, store, manipulate, and display geographically referenced information, tying data to points, lines, and areas on a map. GIS can thus be used to support decisions that require knowledge about the geographic distribution of people or other resources in scientific research, resource management, and development planning. For example, GIS might be used to help state and local governments calculate emergency response times to natural disasters or to help banks identify the best locations for installing new branches or ATM terminals. GIS tools have become affordable even for small businesses and some can be used on the Web.

Define a customer decision-support system (CDSS) and explain how the Internet is used for this purpose.

A customer decision-support system (CDSS) supports the decision-making process of the organization's existing and potential customers. The data can come from both internal and external sources, including enterprise systems and the Web. The Web and Internet can provide online access to various database and information pools along with software for data analysis.

4. How do executive support systems (ESS) help senior managers make better decisions?

Define and describe the capabilities of an ESS.

Executive support systems help senior managers with unstructured problems that occur at the strategic level of the firm. ESSs provide data from both internal and external sources, including data from the Web and provide a generalized computing and communications environment that can be focused and applied to a changing array of problems. ESSs provide easy-to-use analytical tools and online displays to help users select and tailor the data as needed.

Describe how the balanced scorecard helps managers identify important information requirements.

A balanced scorecard focuses on measurable outcomes on four dimensions of a business's performance: financial, business process, customer, and learning and growth. Each dimension uses key performance indicators (KPIs) to understand how well an organization is performing on any of the dimensions at any time. The framework of a balanced scorecard requires managers to focus on more than just financial performance. They must focus on things they are able to influence at the present time like customer satisfaction, business process efficiency, or employee training. The KPIs are developed by senior executives and are automatically provided to users through an executive support systems

Explain how ESS enhance managerial decisions making and provide value for a business.

ESSs help senior executives monitor firm performance, spot problems, identify opportunities, and forecast trends. These systems can filter out extraneous details for high-level overviews or drill down to provide senior managers with detailed transaction data if required. Some display a high-level view of firm performance in the form of a digital dashboard. ESS help executives monitor key performance indicators and to measure performance against external environmental changes. ESS expand executives' span of control because information is readily available and easy to access.

5. What is the role of information systems in helping people working in a group make decisions more efficiently?

Define a group decision-support system (GDSS) and explain how it differs from a DSS.

A GDSS is an interactive computer-based system that facilitates the solution of unstructured problems by a set of decision makers working together as a group. GDSS have been developed in response to the growing concern over the quality and effectiveness of meetings. In general, DSS focus on individual decision making, whereas GDSS support decision making by a group.

Explain how a GDSS works and how it provides value for a business.

Hardware, software tools, and people are the three GDSS elements. Hardware includes the conference facility itself (room, tables, chairs) that is laid out to support group collaboration. It also includes electronic hardware such as electronic display boards as well as audiovisual, computer, and networking equipment. Software tools include electronic questionnaires, electronic brainstorming tools, idea organizers, questionnaire tools, tools for voting or setting priorities, stakeholder identification and analysis tools, policy formation tools, and group dictionaries. People include the participants, a trained facilitator, and the staff to support the hardware and software.

GDSS enable more people to attend and participate in a meeting. A GDSS improves the productivity of large group meetings by allowing attendees to contribute simultaneously to the discussion. A GDSS can guarantee anonymity, follow structured methods for organizing and evaluating ideas, preserve the results of meetings, and increase the number of ideas generated and the quality of decisions while producing the desired results in fewer meetings.

Discussion Questions

1. As a manager or user of information systems, what would you need to know to participate in the design and use of a DSS or an ESS? Why?

Managers and users of information systems would want to specify what kinds of decisions the systems should support, and where the data for those decisions should come from. In a typical enterprise, workers are capturing data, sharing data with other workers, retrieving insights from captured data, and managing the information as per agreed upon guidelines. However, data are turned into valuable business information and insight only when they can be easily captured, systematically stored, properly retrieved, readily shared, and well managed. Data management, DSS, and ESS represent the cornerstone of any data warehousing program.

Data warehouses have become a critical component in enabling management to make

decisions quickly and accurately. For example, telecommunications companies use it to manage churn and ensure the retention of their customers, while retail firms rely on data mining to maximize product mix and shelf space, and governments use it to manage federal welfare and healthcare programs. Across industries, data warehousing programs have achieved a 400 percent ROI, on average, while increasing productivity, reducing speed of analysis, and revealing business opportunities that were otherwise hidden from management among layers of unreachable data. However, if management is not part of the design and use of a DSS or ESS, then this information may not be available or utilized, and if not, the firm may not be able to gain or maintain competitive advantage. One thing is for sure: the competition is using these systems to enhance decision making.

2. If businesses used DSS, GDSS, and ESS more widely, would they make better decisions? Do you agree? Why or why not?

Competitiveness increasingly depends on the quality of decision making. So naturally, companies often rely on their own history and their past transactions and activities to make future decisions. When businesses make decisions, it is usually helpful to use a decision-support system and firm-wide data. These systems can automate certain decision procedures, and they can offer information about different aspects of the decision situation. They can also help managers question existing decision procedures. It can be useful to explore the outcomes of alternative organizational scenarios. And, of course, using GDSS can improve how groups make decisions, and also improve the decision that might have been made by an independent person.

The size of the corporate information base is increasing at the rate of 400 percent every three years. Until recently, the idea of analyzing years of accumulated transaction data in a single pass seemed expensive and unachievable. In addition to the difficulties caused by data format incompatibilities, the computational requirements would have consumed much of the company's data processing capacity for days or even weeks. Analysis has been limited to fairly simple queries run after hours against relatively small subsets of data. In recent years, scalable hardware and software technologies have fueled data warehousing, enabling decision makers to unleash the power of analysis provided as a result.

On the other hand, remember that these systems do not automatically lead to better decisions unless the decision problem or situation is clearly understood and the systems are appropriately designed.

COLLABORATION AND TEAMWORK: DESIGNING A UNIVERSITY GDSS

With three or four of your classmates, identify several groups in your university that could benefit from a GDSS. Design a GDSS for one of those groups, describing

its hardware, software, and people elements. If possible, use Google Sites to post links to Web pages, team communications announcements, and work assignments; to brainstorm; and to work collaboratively on project documents. Try to use Google Docs to develop a presentation of your findings for the class.

Responses will vary for this question and will depend on the sources of information students were able to research. Elements that students should include in their presentations are:

Hardware: the GDSS will require computers and networking equipment, overhead projectors, and display screens.

Software: The GDSS requires special electronic meeting software that collects, documents, ranks, edits, and stores the ideas offered in decision-making meetings. It may use OLAP tools, data mining tools, or a scaled down statistical modeling application. Depending on the group, it may use spreadsheet pivot tables. Students may consider adding a Web-based customer decision-support system to the GDSS. Most importantly, the GDSS should support some form of group communications like instant messaging or email.

People: A more elaborate GDSS would include a professional facilitator and support staff.

LEARNING TRACK MODULE

Building and Using Pivot Tables

Students will find a Learning Track Module on this topic at the MyMISLab for this chapter.

HANDS-ON MIS: PROJECTS

Management Decision Problems

1. Canadian Pacific Railway: The company used a tonnage-based operating model that focused on minimizing the total number of freight trains in service and maximizing the size of each train. It did not necessarily use crews, locomotives, and equipment efficiently, resulting in inconsistent transit times and delivery schedules. How could a DSS help Canadian Pacific and other railroads compete with trucking firms more effectively?

The railroad company can use a geographic information system to analyze and display data for planning and decision making in the form of digitized maps. The software assembles, stores, manipulates, and displays geographically referenced information, typing data to points, lines, and areas on a map. The GIS have modeling capabilities, enabling managers to change data and automatically revise business scenarios to find

better solutions. The company can use external data from chambers of commerce, industries, and government agencies to determine product shipping metrics. Couple that with data from its internal database to decide optimal delivery times. Transaction processing data fed into the DSS could help make decisions about the best crew scheduling. OLAP and multidimensional DSS could mix the right crews, locomotives and delivery schedules to meet customer demands.

2. Applebee's: the largest casual dining chain in the world wants to develop menus that are tastier and contain more items that customers want and are willing to pay for. How might information systems help management implement this strategy? What pieces of data would Applebee's need to collect? What kinds of reports would be useful to help management make decisions on how to improve menus and profitability?

Applebee's can use data from transaction processing systems and point-of-sale systems to track which menu items sell the best. The company can use external demographic data to understand potential customers by accessing data about ages, income levels, and the number of children per family. The company can also use external weather data to track which menu items should be advertised. For instance, if the weather prediction calls for a snowstorm, the company can feature hot soups and sandwiches. Managers can use trend reports to determine which menu items are selling the best at any particular time. Reports broken into regions may be helpful since tastes differ based on geographic location. Grits sell well in the South but poorly in the Northwest. Reports on how well individual items sell during specific times of the day or week may be helpful to adjust marketing campaigns.

IMPROVING DECISION MAKING: USING PIVOT TABLES TO ANALYZE SALES DATA

Software skills: Pivot tables

Business skills: Analyze sales data

Use Excel's PivotTable to help you answer the following questions:

- Where are the average purchases higher? The answer might tell managers where to focus marketing and sales resources, or pitch different messages to different regions.
- What form of payment is the most common? The answer could be used to emphasize in advertising the most preferred means of payment.
- Are there any times of day when purchases are most common? Do people buy products while at work (likely during the day) or at home (likely in the evening)?
- What's the relationship between region, type of product purchased, and average sales price?

The data for this exercise is found in the file named Ch14_Pivot_Table_Question.xls located in the Chapter 14 folder. For the solution file, please see the file named Ch14_Pivot_Table_Solution.xls, also in the Chapter 14 folder.

IMPROVING DECISION MAKING: USING A WEB-BASED DSS FOR RETIREMENT PLANNING

Software skills: Internet-based software

Business skills: Financial planning

The Web site at TD Canada Trust (<http://www.tdcanadatrust.com/planning/yrs.jsp>) provides Web-based DSS for financial planning and decision making. Use this site to determine how much you need to save to have enough income for your retirement. Assume that you are 50 years old and plan to retire in 16 years. You have one dependent and \$100 000 in savings. Your current annual income is \$85 000. Your goal is to be able to generate an annual retirement income of \$60 000, including all pension benefit payments.

1. Use the web site to determine how much money you need to save to achieve your retirement goal.
2. Critique the site—its ease of use, its clarity, the value of any conclusions reached, and the extent to which the site helps investors understand their financial needs and the financial markets.

Student responses will vary depending on a number of variables, including other pensions. Using the information give, the DSS predicts a hefty shortfall and suggests a monthly investment/savings plan of approximately \$1600.

Generally students will find the site easy to use, and the report that is produced is professional and intuitive. It is easy to change the data, and recreate the report using the revised input.

CASE STUDY: CAN INFORMATION SYSTEMS MAKE YOUR HEALTH CARE BETTER?

1. What problems are hospitals and physicians encountering in diagnosing diseases and prescribing medications? What management, organization, and technology factors are responsible for these problems?

Hospitals and physicians encounter a number of problems related to diagnosing diseases and prescribing medications. Some of the problems listed in this business case include:

- Errors made in relation to medications being prescribed both in hospitals and physicians' offices.
- Inappropriate prescriptions taken by patients results in many deaths each year.
- Adverse drug events account for more than 41% of hospital admissions and more

- than \$2 billion in annual inpatient costs.
- Many prescription errors result from human factors such as poor handwriting, memory lapses, fatigue, and distractions.
- Communication issues between nurses and doctors can sometimes lead to errors.
- Too much time being taken in diagnosing the disease.
- Doctors required to remember massive amounts of information and details when accessing and treating a problem.

2. Are DSS systems appropriate solutions? Why or why not? What management, technology, and organization issues are involved in the use of these systems?

These systems offer many advantages; however, the medical community has not embraced their use. Doctors rely on their training and human skills to evaluate the medical situation, and have little faith in the use of technology such as DSS.

DSS systems can be considered successful solutions; however, the greatest obstacle to the adoption of this type of system will involve changing the “mind set” of the medical community. Benefits that make these solutions attractive include reducing the likelihood that errors may be made, reducing the instances of legal liability associated with mistakes, increasing efficiency and communication among doctors and nurses, and addressing the needs of patients faster and more accurately. On the other hand, these systems are also costly and time consuming in their implementation. ROI may take some time to realize. The systems themselves are basically shells and require time and expertise to develop.

One study found that basic decision-support systems did not significantly reduce high rates of adverse drug events. Another study found numerous potential glitches in its hospital system where the system actually created new ways of making errors because of its design. DSS systems must support sophisticated decisions, such as drug choice, dosages, and patent-monitoring strategies, and they must be well designed.

Management:

- Design, implement, and populate DSS systems
- Streamline design of systems to ensure operational efficiency

Organization:

- Incorporate systems into medical offices and hospitals

Technology:

- Deploy DSS

3. What obstacles prevent computer systems from improving the medical industry? How can these obstacles be removed?

Physicians must be willing to incorporate the use of these systems into their workflow. Many doctors resist changing their ways because a system is complex or

takes more time to use than the procedures to which they are accustomed. Time constraints, heavy patient schedules, and the costs of these systems are also contributing factors that delay wider acceptance and implementation.

Other obstacles listed in the case include:

- Weaknesses in decision-support systems need to be improved.
- Some DSS systems are relatively expensive.
- Mapping the workflow “is a very tedious process and requires the ability to translate physician-speak into computerese”.
- Gearing the system too much toward physicians and not enough toward nurses, who may feel the greater impact on their daily tasks when a DSS system is installed.
- DSS systems can be more rigid than traditional paperwork.
- Doctors and nurses alike must trust the system. If they do not, they are more likely to ignore the automated prompts.
- Using decision-support software can be a difficult sell for doctors because they prefer to trust their experience and training. Some doctors resist the idea that they need help remembering procedures and treatments.
- Many physicians feel that diagnosing medical conditions is as much an art as it is a science and diagnostic decision-support (DDS) systems have not proven to be more successful than human diagnostics. The result is that very few doctors use these systems.
- Doctors balk at the cost of systems as well as the time it would take to enter the necessary patient data into the systems.

Obstacles can be reduced through:

- Educating medical community on the benefits of these systems.
- Medical doctors becoming more involved and committed to the development of DSS systems.
- Improvements in technology and adoption of digital patient record systems.