

MANAGEMENT SUPPORT SYSTEMS

this chapter begins by summarizing the phases of the decision-making process and the types of decisions that are made. Next, you learn about a decision support system (DSS), its components and its capabilities, and see how it can benefit an organization. In addition, you learn about other management support systems used in decision making: executive information systems (EISs), group support systems (GSSs), and geographic information systems (GISs). This chapter concludes with an overview of guidelines for designing a management support system.



learning outcomes

After studying this chapter, you should be able to:

- L01** Describe the phases of the decision making process in a typical organization and the types of decisions that are made.
- L02** Describe a decision support system.
- L03** Explain an executive information system's importance in decision making.
- L04** Describe group support systems, including groupware and electronic meeting systems.
- L05** Summarize the uses for a geographic information system.
- L06** Describe the guidelines for designing a management support system.



12.1 Decision Organizational

■ In a typical organization, these capabilities are:

- **Structural** programs that exist in the organization and are kept in the technical files.

12.1 Types of Decisions in an Organization

In a typical organization, decisions fall into one of these categories:

- **Structured decisions**—**Structured decisions**, or programmable tasks, can be automated because a well-defined standard operating procedure exists for these types of decisions. Record keeping, payroll, and simple inventory problems are examples of structured tasks. Information technologies are a major support tool for making structured decisions.

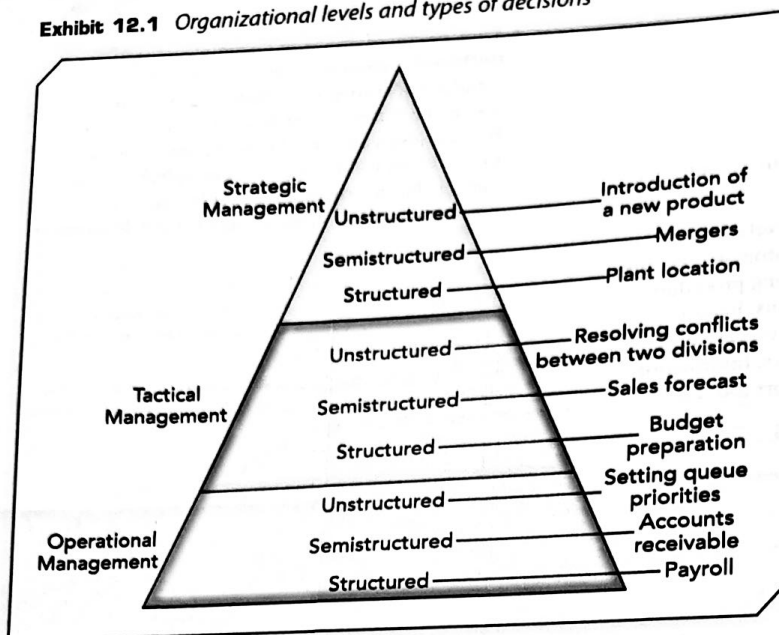
- **Semistructured decisions**—**Semistructured decisions** are not quite as well defined by standard operating procedures, but they include a structured aspect that benefits from information retrieval, analytical models, and information systems technology. For example, preparing budgets has a structured aspect in calculating percentages of available funds for each department.

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Exhibit 12.1 Organizational levels and types of decisions



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Semistructured decisions are often used in sales forecasting, budget preparation, capital acquisition analysis, and computer configuration.

- **Unstructured decisions—Unstructured decisions** are typically one-time decisions, with no standard operating procedure pertaining to them. The decision maker's intuition plays the most important role, as information technology offers little support for these decisions. Areas involving unstructured decisions include research and development, hiring and firing, and introducing a new product.

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Management support systems (MSSs) are the different types of information systems that have been developed to support certain aspects and types of decisions. Each type of MSS is designed with unique goals and objectives.

In the **intelligence phase**, a decision maker examines the organization's environment for conditions that need decisions. Data is collected from a variety of sources (internal and external) and processed. From this information, the decision maker can discover ways to approach the problem.

Semistructured and unstructured decisions are challenging because they involve multiple criteria, and often users have to choose between conflicting objectives. For example, a manager might want to give raises to employees to boost morale and increase employee retention but has been asked to reduce the total cost of production. These two objectives conflict, at least in the short run. Artificial intelligence applications (discussed in Chapter 13) might be helpful in the future for handling qualitative decisions. Exhibit 12.1 shows organizational levels (operational, tactical, and strategic) and types of decisions.

Different types of information systems have been developed to support certain aspects and types of decisions. Collectively, these systems are called **management support systems (MSSs)**, and each type is designed with its own goals and objectives, as discussed in this chapter.

12.1.a Phases of the Decision-Making Process

Herbert Simon, winner of the 1978 Nobel Prize in economics, defines three phases in the decision-making process: intelligence, design, and choice.¹ A fourth phase, implementation, can be added. The following sections explain these phases.

Intelligence Phase

In the **intelligence phase**, a decision maker (a marketing manager, for example) examines the organization's environment for conditions that need decisions. Data is collected from a variety of sources (internal and external) and processed. From this information, the decision maker can discover ways to approach the problem.

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This phase has three parts: First, you determine what the reality is—identify what is really going on in order to help define the problem. Second, you get a better understanding of the problem by collecting data and information about it. Third, you gather data and information needed to define alternatives for solving the problem.

As an example, say an organization has noticed a decrease in total sales over the past 6 months. To pinpoint the cause of the problem, the organization can collect data from customers, the marketplace, and the competition. After the data has been processed, analysis can suggest possible remedies. Information technologies, particularly database management systems, can help in this analysis. In addition, many third-party vendors, such as Nielsen and Dow Jones, specialize in collecting data about the marketplace, the competition, and the general status of the economy. The information they collect can support the intelligence phase of decision making.

Design Phase

In the **design phase**, the objective is to define criteria for the decision, generate alternatives for meeting the criteria, and define associations between the criteria and the alternatives. Criteria are goals and objectives that decision makers establish in order to achieve certain performance levels. For example, the criterion in the previous example of decreased sales might simply be to increase sales. To make this criterion more specific, you can state it as "Increase sales by 3 percent each month for the next 3 months." Next, the following alternatives could be generated:

- Assign more salespeople to the target market.
- Retrain and motivate current salespeople.
- Reassign current salespeople.
- Revamp the product to adjust to consumers' changing tastes and needs.
- Develop a new advertising campaign.
- Reallocate existing advertising to other media.

Defining associations between alternatives and criteria involves understanding how each alternative affects the criteria. For example, how would increasing the sales force increase sales? By how much does the sales force need to be increased to achieve a 3 percent increase in sales? Generally, information technology does not support this phase of decision making very much, but group support systems and electronic meeting systems, discussed later in this chapter, can be useful. Expert systems (covered in Chapter 13) are helpful in generating alternatives, too.

Choice Phase

The **choice phase** is usually straightforward. From the practical alternatives, the best and most effective course of action is chosen. It starts with analyzing each alternative and its relationship to the criteria to determine whether it is feasible. For instance, for each salesperson added, how are sales expected to increase? Will this result be economically beneficial? After a thorough analysis, the choice phase ends with decision makers recommending the best alternative. For the problem of decreased sales, the organization decided to use the first alternative, assigning more salespeople to the target market. A decision support system (DSS) can be particularly useful in this phase. DSSs are discussed later in the chapter, but these systems help sort through possible solutions to choose the best one for the organization. Typically, they include tools for calculating cost-benefit ratios, among others. For example, say an organization is deciding which of three transportation systems to use for shipping its products to retail outlets. A DSS can assess cost factors and determine which transportation system minimizes costs and maximizes profits. Generally, information technologies are more useful in the intelligence and choice phases than in the design phase.

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Implementation Phase

In the **implementation phase**, the organization devises a plan for carrying out the alternative selected in the choice phase and obtains the resources to implement the plan. In other words, ideas are converted into actions. Information technologies, particularly DSSs, can also be useful in this phase. A DSS can do a follow-up assessment on how well a solution is performing. In the previous example of selecting a transportation system, a DSS might reveal that the system the organization chose is not performing as well as expected and suggest an alternative.

In the **implementation phase**, the organization devises a plan for carrying out the alternative selected in the choice phase and obtains the resources to implement the plan.

A **decision support system (DSS)** is an interactive information system consisting of hardware, software, data, and models (mathematical and statistical) designed to assist decision makers in an organization. Its three major components are a database, a model base, and a user interface.

12.2 Decision Support Systems

For the purposes of this book, a **decision support system (DSS)** is an interactive information system consisting of hardware, software, data, and models (mathematical and statistical) designed to assist decision makers in an organization. The emphasis is on semistructured and unstructured tasks. A DSS should meet the following requirements:

- Be interactive.
- Incorporate the human element as well as hardware and software.
- Use both internal and external data.
- Include mathematical and statistical models.
- Support decision makers at all organizational levels.
- Emphasize semistructured and unstructured tasks.

「Because most DSS users are senior executives with little computer training, user friendliness is essential in these systems.」

12.2.a Components of a Decision Support System

A DSS, shown in Exhibit 12.2, includes three major components: a database, a model base, and a user interface. In addition, a fourth component, the DSS engine, manages and coordinates these major components. The database component includes both internal and external data, and a database management system (DBMS) is used for creating, modifying, and maintaining the database. This component enables a DSS to perform data analysis operations.

The **model base** component includes mathematical and statistical models that, along with the database, enable a DSS to analyze information. A model base management system (MBMS) performs tasks similar to a DBMS in accessing, maintaining, and updating models in the model base. For example, an MBMS might include tools for conducting what-if analysis so a forecasting model can generate reports showing how forecasts vary, depending on certain factors.

Finally, the user interface component is how users access the DSS, such as when querying the database or model base, for help in making decisions. From the end user's point of view, the interface is the most important part of a DSS and must be as flexible and user friendly as possible. Because most DSS users are senior executives with little computer training, user friendliness is essential in these systems.²

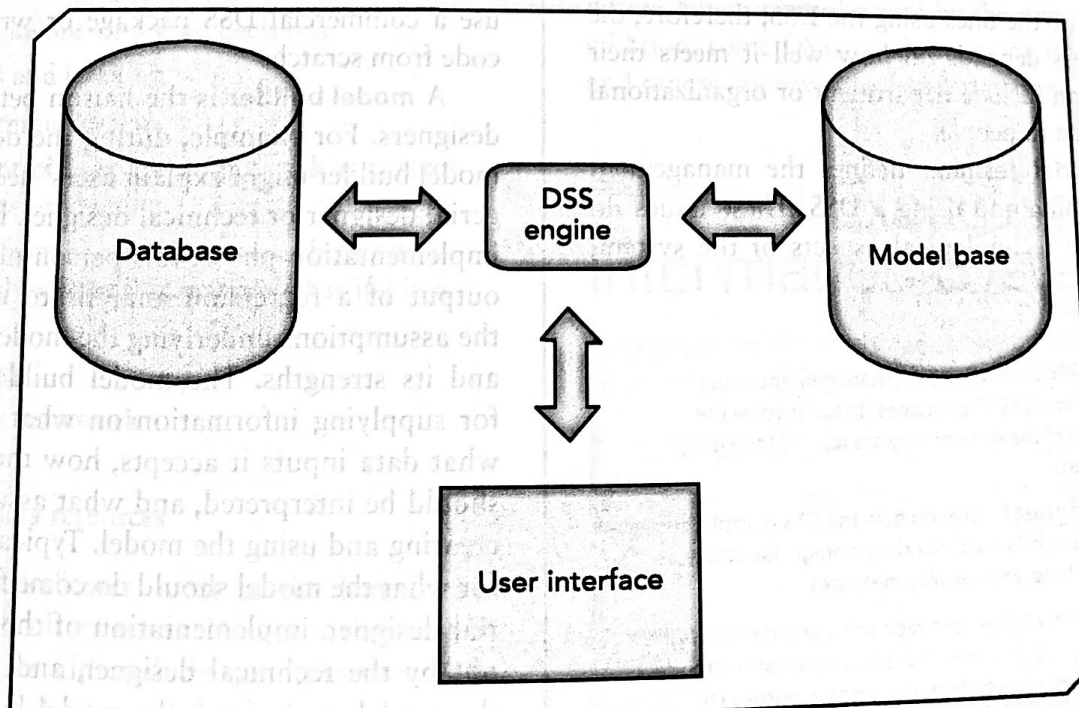
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12.2.b DSS Capabilities

DSSs include the following types of features to support decision making:

- **What-if analysis**—This shows the effect of a change in one variable, answering questions such as “If labor costs increase by 4 percent, how is the final cost of a product affected?” and “If the advertising

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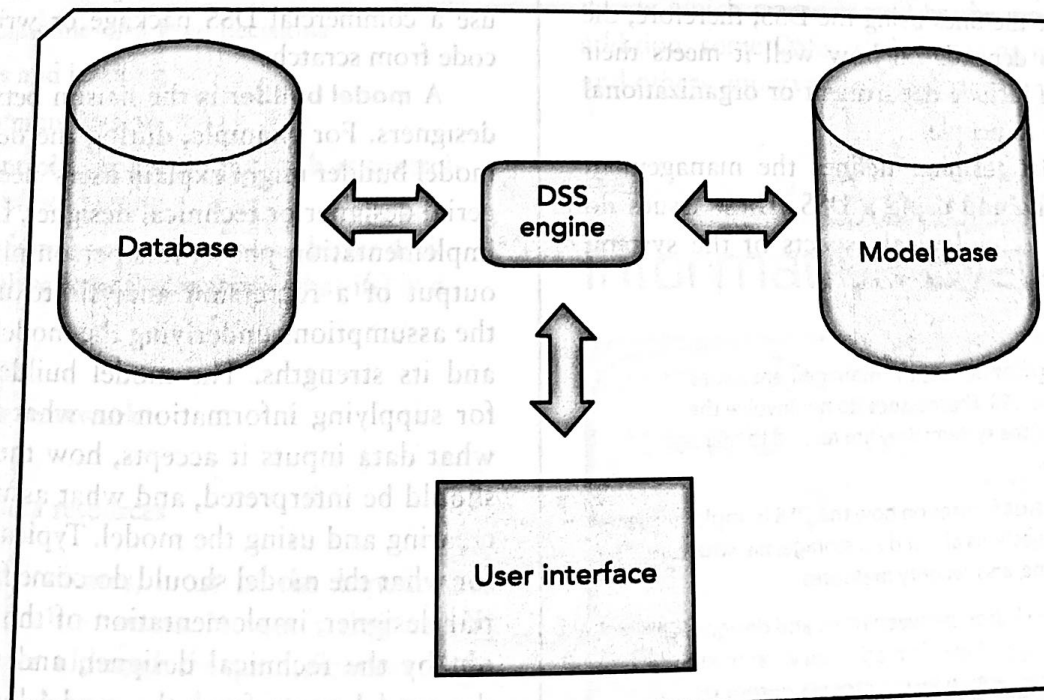
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budget increases by 2 percent, what is the effect on total sales?"

- **Goal seeking**—This is the reverse of what-if analysis. It asks what has to be done to achieve a particular goal—for example, how much to charge for a product in order to generate \$200,000 profit, or how much to advertise a product to increase total sales to \$50,000,000.

- **Sensitivity analysis**—This enables you to apply different variables, such as determining the maximum price you could pay for raw materials and still make a profit, or determining how much the interest rate has to go down for you to be able to afford a \$100,000 house with a monthly payment of \$700.

- **Exception reporting analysis**—This monitors the performance of variables that are outside a defined range, such as pinpointing the region that generated the highest total sales or the production center that went over budget.

A typical DSS has many more capabilities, such as graphical analysis, forecasting, simulation, statistical analysis, and modeling analysis.

12.2.c Roles in the DSS Environment

To design, implement, and use a DSS, several roles are involved. These include the user, managerial designer, technical designer, and model builder.³

Users comprise the most important category because they are the ones using the DSS; therefore, the system's success depends on how well it meets their needs. Users can include department or organizational units in addition to people.

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The **technical designer** focuses on how the DSS is implemented and usually addresses questions about data storage, file structure, user access, response time, and security measures.

A **model builder** is the liaison between users and designers. He or she is responsible for supplying information on what the model does, what data inputs it accepts, how the model's output should be interpreted, and what assumptions go into creating and using the model.

they are related to management's goals and needs. This person specifies data requirements, what models are needed, how these models might be used, and how users want to view the results (graphics, text, and so forth). This role addresses questions such as the following:

- What type of data should be collected, and from what sources?
- How recent should the collected data be?
- How should the data be organized?
- How should the data be updated?
- What should the balance between aggregated (lump sum) and disaggregated (itemized) data be?

The **technical designer** focuses on how the DSS is implemented and usually addresses the following questions:

- How should the data be stored (centralized, decentralized, or distributed)?
- What type of file structure should be used (sequential, random, or indexed sequential)?
- What type of user access should be used? Menu driven, such as QBE? Or command line, such as SQL?
- What type of response time is required?
- What types of security measures should be installed?

The technical designer might be a computer specialist or a consultant from outside the company and may use a commercial DSS package or write the system's code from scratch.

A **model builder** is the liaison between users and designers. For example, during the design phase, the model builder might explain users' needs to the managerial designer or technical designer. Later, during the implementation phase, this person might explain the output of a regression analysis to users, describing the assumptions underlying the model, its limitations, and its strengths. The model builder is responsible for supplying information on what the model does, what data inputs it accepts, how the model's output should be interpreted, and what assumptions go into creating and using the model. Typically, requirements for what the model should do come from the managerial designer, implementation of the model is carried out by the technical designer, and specifications for the model come from the model builder. The model builder can also suggest new or different applications of a DSS.

「You can quantify the benefit of saving time, for instance, by measuring the 2 hours a manager wasted looking for information that a DSS could have made available immediately.」

12.2.d Costs and Benefits of Decision Support Systems

Some DSSs can be developed from resources already available in the organization, which can reduce costs, but many require new hardware and software. Before making this investment, organizations should weigh the costs and benefits of using a DSS. Costs and benefits can be difficult to assess, however, because these systems are focused on effectiveness rather than efficiency. In addition, a DSS facilitates improvements but does not necessarily cause them. For example, how do you assign a monetary value to facilitating communication or expediting problem solving?

Peter G. Keen, a former MIT professor, conducted an interesting study on how organizations use DSSs and concluded that the decision to build a DSS seems to be based on value rather than cost. He outlined the benefits of a DSS as follows⁴:

- Increase in the number of alternatives examined
- Fast response to unexpected situations
- Ability to make one-of-a-kind decisions
- New insights and learning
- Improved communication
- Improved control over operations, such as controlling the cost of production
- Cost savings from being able to make better decisions and analyze several scenarios (what-ifs) in a short period
- Better decisions
- More effective teamwork
- Time savings
- Better use of data resources

As this study indicates, most of the benefits are intangible and difficult to assess. However, they can be quantified to a degree, although the quantification might vary, depending on the person doing the calculations. You can quantify the benefit of saving time, for instance, by measuring the 2 hours a manager wasted looking

for information that a DSS could have made available immediately. Of course, you would probably also notice that a manager who did not have to waste this much time is less frustrated and more productive, but quantifying these results is harder, or at least requires more work, such as conducting interviews or surveys.

The benefit of improving communication and interactions between management and employees is perhaps the most difficult to quantify, but it is one of the most important.⁵ DSSs can, and are, improving how decision makers view themselves, their jobs, and the way they spend time. Therefore, improving communication and expediting learning are among the main objectives of a DSS.^{6,7}

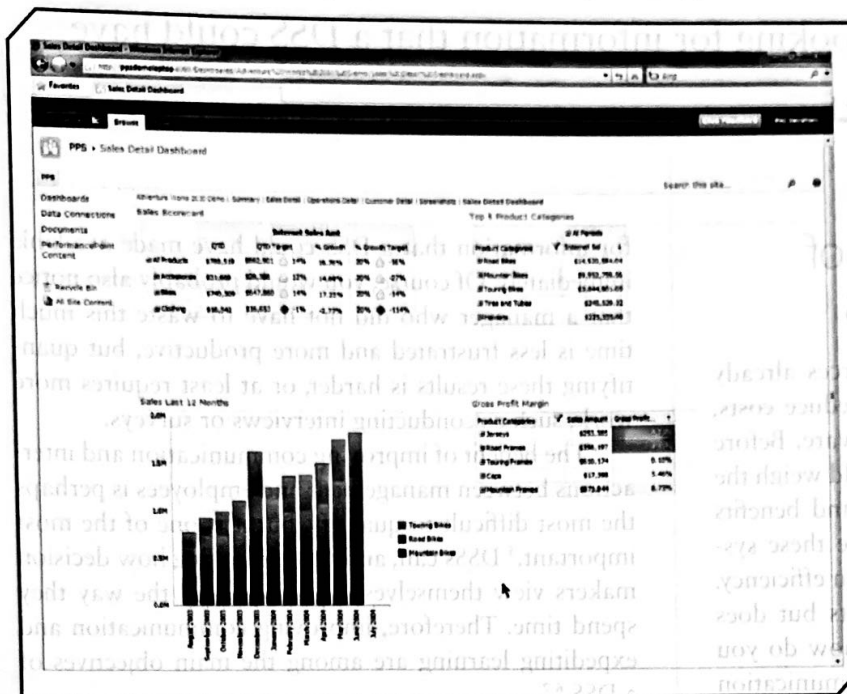
A DSS is said to have achieved its goals if employees find it useful in doing their jobs. For example, a portfolio manager who uses a financial DSS to analyze different scenarios would certainly find the ease of analyzing a variety of variables, such as the interest rate and economic forecasts, to be useful. The manager can try different values for these variables quickly and easily to determine which variable has the greatest effect and decide which portfolio will be the most profitable. In addition, some DSSs result in saving on clerical costs, and others improve the decision-making process.

12.3 Executive Information Systems

Executive information systems (EISs), a branch of DSSs, are interactive information systems that give executives easy access to internal and external data and typically include “drill-down” features

Executive information systems (EISs), branches of DSSs, are interactive information systems that give executives easy access to internal and external data and typically include “drill-down” features and a digital dashboard for examining and analyzing information.

Exhibit 12.3 Digital dashboard



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factor; for car manufacturers, location of dealerships might be a critical success factor. An EIS should be designed to provide information related to an organization's critical success factors.

Most EISs include a **digital dashboard**, which integrates information from multiple sources and presents it in a unified, understandable format, often as charts and graphs. Digital dashboards and scorecards offer up-to-the minute snapshots of information and assist decision makers in identifying trends and potential problems. Many digital dashboards are Web based, such as the one included in Microsoft SharePoint. Exhibit 12.3 shows an example of a digital dashboard.

The following are some important characteristics of an EIS^{8,9}:

- Tailored to meet management's information needs
- Can extract, compress, filter, and track critical data
- Provides online status access, trend analysis, and exception reporting
- Offers information in graphical, tabular, and text formats
- Includes statistical analysis techniques for summarizing and structuring data
- Retrieves data in a wide range of platforms and data formats
- Contains customized application-development tools
- Supports electronic communication, such as e-mail and video conferencing

12.3.a Reasons for Using EISs

An EIS can put a wealth of analytical and decision-making tools at managers' fingertips and includes graphical representations of data that helps executives make critical decisions. In addition, executives can use EISs to share information with others more quickly and easily. Managers can use these tools to improve the

(explained in Chapter 3) and a digital dashboard for examining and analyzing information. (Although some experts consider executive support systems and executive management systems variations of EISs, this book considers them to fall under the term *EIS*.)

Ease of use plays an important role in the success of an EIS. Because most EIS users are not computer experts, simplicity of the system is crucial, and EIS designers should focus on simplicity when developing a user interface. Typically, GUIs are used, but adding features such as multimedia, virtual reality, and voice input and output can increase ease of use.

Another important factor in an effective EIS is access to both internal and external data so executives can spot trends, make forecasts, and conduct different types of analyses. For an EIS to be useful, it should also collect data related to an organization's "critical success factors"—issues that make or break a business. In banks, interest rates are considered a critical success

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efficiency and effectiveness of decision making in the following ways:

- Increase managers' productivity by providing fast and easy access to relevant information.
- Convert information into other formats, such as bar charts or graphs, to help managers analyze different business scenarios and see the effect of certain decisions on the organization.
- Spot trends and report exceptions, such as gathering data on profitability and production costs at a manufacturing plant to determine whether closing the plant is more beneficial than keeping it open.

12.3.b Avoiding Failure in Design and Use of EISs

As with other management support systems, effective design and implementation of an EIS requires top-management support, user involvement, and the right technologies. The following factors can lead to a failed EIS^{10,11}:

- The corporate culture is not ready, there is organizational resistance to the project, or the project is viewed as unimportant.
- Management loses interest or is not committed to the project.
- Objectives and information requirements cannot be defined clearly, or the system does not meet its objectives.
- The system's objectives are not linked to factors critical to the organization's success.
- The project's costs cannot be justified.
- Developing applications takes too much time, or the system is too complicated.
- Vendor support has been discontinued.
- Some of today's senior executives missed the computer revolution and might feel uncomfortable using computers. Ongoing education and increasing computer awareness should solve this problem.

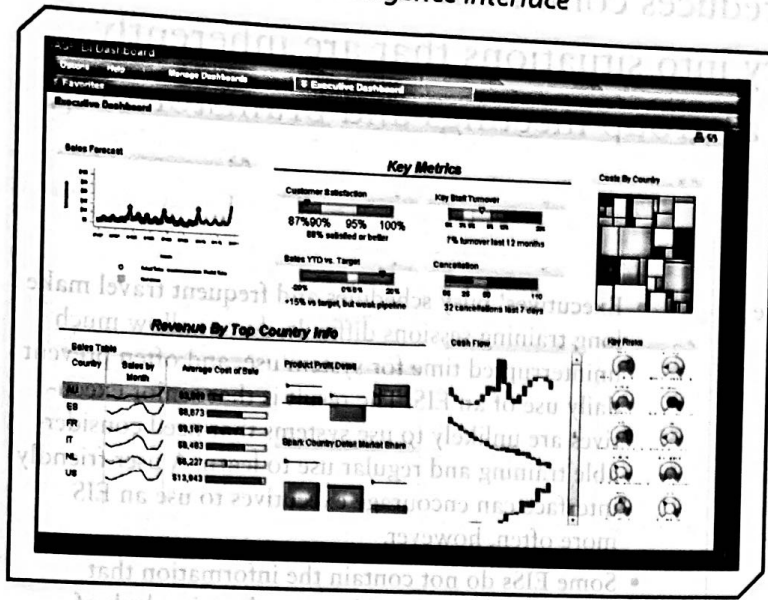
- Executives' busy schedules and frequent travel make long training sessions difficult, do not allow much uninterrupted time for system use, and often prevent daily use of an EIS. The result is that senior executives are unlikely to use systems that need considerable training and regular use to learn. A user-friendly interface can encourage executives to use an EIS more often, however.
- Some EISs do not contain the information that senior executives need because there is a lack of understanding about what executives' work involves. Designers must determine what types of information executives need before designing a system.

12.3.c EIS Packages and Tools

EISs are generally designed with two or three components: an administrative module for managing data access, a builder module for developers to configure data mapping and screen sequencing, and a runtime module for using the system. Sometimes, administrative and builder modules are combined into one module. Some EIS packages provide a data storage system, and some simply package data and route it to a database, usually on a LAN. Most EIS packages come with a standard graphical user interface (GUI).



Exhibit 12.4 Business Intelligence interface



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Exhibit 12.4 shows a screen from one EIS package, Business Intelligence (SAS Institute).

Generally, managers perform six tasks for which an EIS is useful: tracking performance, flagging exceptions, ranking, comparing, spotting trends, and investigating/exploring. Most EIS packages provide tools for these tasks, such as displaying summaries of data in report or chart format and sequencing screens to produce slide shows. Exception or variance reporting is another useful technique that managers use to flag data that is unusual or out of normal boundaries. Both unusual and periodic events can be defined to trigger visual cues or activate intelligent agents to perform a specific task. Intelligent agents, covered in Chapter 13, are “smart” programs that carry out repetitive tasks and can be programmed to make decisions based on specified conditions. Widely used EIS packages include SAS Business Intelligence (www.sas.com/technologies/bi), Monarch Datawatch (www.datawatch.com), and Cognos PowerPlay (www-01.ibm.com/software/data/cognos/products/series7/powerplay).

Group support systems (GSSs) assist decision makers working in groups. These systems use computer and communication technologies to formulate, process, and implement a decision-making task and can be considered a kind of intervention technology that helps overcome the limitations of group interactions.

12.4 Group Support Systems

In today's business environment, decision makers often work in groups, so you hear the terms *group computing* or *collaborative computing* used often. All major software vendors are competing to enter this market or increase their market share in this fast-growing field. In this collaborative environment, there has been an increase in **group support systems (GSSs)**, which are intended to assist decision makers working in groups. DSSs are usually designed to be used by a particular decision maker; a GSS is designed to be used by more than one decision maker.

These systems use computer and communication technologies to formulate, process, and implement a decision-making task and can be considered a kind of intervention technology that helps overcome the limitations of group interactions. The intervention aspect of a GSS reduces communication barriers and introduces order and efficiency into situations that are inherently unsystematic and inefficient, such as group meetings and brainstorming sessions. A GSS, with the help of a human facilitator, enhances decision making by providing a clear focus for group discussion, minimizing politicking, and focusing attention on critical issues. The success of a GSS depends on the following:

- Matching the GSS's level and sophistication to the group's size and the scope of the task
- Providing supportive management (especially at the CEO level) that is willing to “champion” using a GSS in the organization

Related technologies for group support, such as electronic meeting systems (EMSs), groupware, computer-mediated communication (CMC), computer-supported cooperative work (CSCW), and e-collaboration, are not considered full-function GSSs because they do not have decision-making tools, but they are less expensive and include communication and problem-solving mechanisms for effective team management.^{12,13}

GSSs are useful for committees, review panels, board meetings, task forces, and decision-making

sessions that require input from several decision makers. They can be used to find a new plant location, introduce a new product or advertising campaign, participate in an international bid, brainstorm alternatives, and other tasks. In addition to all the capabilities of a DSS, a GSS should include communication features so decision makers in many different locations can still work together to participate in the decision-making process.

12.4.a Groupware

The goal of **groupware** is to assist groups in communicating, collaborating, and coordinating their activities. It is intended more for teamwork than for decision support. For the purposes of this book, groupware is a collection of applications that supports decision makers by providing access to a shared environment and information. A shared environment can consist of an e-mail message, a memo, a single file, or even an entire database.

Groupware is software that helps a group of decision makers work with the same application, regardless of their locations. Groupware tools include e-mail, chat applications, video conferencing, and database sharing. IBM Lotus Notes, Microsoft SharePoint (see the information box on Microsoft Office SharePoint Server: A New Type of Groupware), and Novell GroupWise are common examples of groupware, the capabilities of which include the following:

- Audio and video conferencing
- Automated appointment books

- Brainstorming
- Database access
- E-mail
- Online chat
- Scheduling
- To-do lists
- Workflow automation

LANs, WANs, and MANs, discussed in Chapter 6, are the network foundations for groupware. Although e-mail is not the same thing as groupware, it provides the main functions of groupware: transmitting text messages across a network. The adjoining information box introduces an application of groupware in the healthcare industry.

The Internet has become an important part of groupware. The most important advantage of a Web-based GSS is being able to use open network standards, meaning the GSS can be used on any operating system or type of workstation. The most notable disadvantages are speed limitations (because the Internet is often slower than a company's proprietary network) and security issues. Some examples of Web-based GSS tools are Microsoft Office SharePoint Server and IBM Lotus Domino. Another type of software used for e-collaboration is an electronic meeting system, such as Microsoft Live Meeting, Metastorm, and IBM FileNet.

Groupware assists groups in communicating, collaborating, and coordinating their activities. It is a collection of applications that supports decision makers by providing access to a shared environment and information.

Groupware and Health IT

Hospital personnel have become accustomed to electronic health records (EHRs) over the last 25 years, but the technology, which presumes a client-server, physician-centric model, has never been very popular. Today, there is an alternative: IT systems that integrate and coordinate the data provided by every member of the healthcare team, from the doctor to the patient. Under the general heading of "clinical groupware," there are now software products available—RMDNetworks and Shared Health are two examples—that are Web based, networkable, and interactive, thereby improving health care through better communication and coordination. Clinical groupware is used by groups, not individuals, and the patient is considered a vital member of that group. The overall aim is to provide a unified view of the patient by collecting and analyzing data and information from a variety of sources. Clinical groupware has the following additional benefits¹⁴:

- Inexpensive to acquire and use
- Offers evidence-based guidance
- Routinely collects quality and performance measures
- Provides a collaborative workflow platform

New Generations of Electronic Meeting Systems

Increasingly, consumers and businesspersons are using computers and mobile devices for one-to-one video calls. Group video calls are also on the rise. To use this technology, there are several options available, and they are either free or very inexpensive. Here are some popular examples:

- **Microsoft's Skype**—Offers individual video calls for free; group video calling requires a plan that costs about \$10 a month. The maximum number of participants is 10.¹⁵
- **Apple's FaceTime**—Available free of charge on Apple's iPhone, iMac, iPad, and iPod Touch.¹⁶
- **Tango Video Calls**—Allows video chats among different devices including Windows phones, Android and iOS phones, tablets, and PCs.¹⁷
- **Google's Hangouts**—Allows video chat for up to nine people with Hangouts on Google+.¹⁸
- **ooVoo from ooVoo LLC**—Allows up to 12 participants in group video chats that are free. The service is available on the Internet using PCs, Macs, iPhones, and other smartphones and tablets.¹⁹
- **Zoom.us from Zoom Video Communications**—Allows high-definition group video chat for up to 15 participants. It works over wired and Wi-Fi Internet connections or cellular 3G and 4G networks.^{20,21}

12.4.b Electronic Meeting Systems

Electronic meeting systems enable decision makers in different locations to participate in a group decision-making process. There are various types, but they all have the following features:

- **Real-time computer conferencing**—This allows a group of people to interact via their workstations

and share files, such as documents and images. The conference often includes an audio link, but there is no video capability.

- **Video teleconferencing**—The closest thing to a face-to-face meeting, this requires special equipment and sometimes trained operators. Video cameras are used to transmit live pictures and sounds, which makes video teleconferencing more effective than phone conferencing but also more expensive. The main drawback is that participants cannot share text and graphics.
- **Desktop conferencing**—This combines the advantages of video teleconferencing and real-time computer conferencing. With desktop conferencing, participants can have multiple video windows open at one time. They also have interfaces to a conference installed on their workstations, so these systems are easier for employees to use. The adjoining information box highlights new generations of electronic meeting systems.

12.4.c Advantages and Disadvantages of GSSs

Advantages of GSSs include the following:

- Because decision makers do not have to travel as much (which includes paying for planes, hotels, and meals), costs as well as stress levels are reduced.
- Because decision makers are not traveling long distances, they have more time to talk with one another and solve problems.
- Shyness is not as much of an issue in GSS sessions as it is in face-to-face meetings.
- Increasing collaboration improves the effectiveness of decision makers.

Electronic meeting systems enable decision makers in different locations to participate in a group decision-making process.

Microsoft Office SharePoint Server: A New Type of Groupware

Microsoft Office SharePoint Server 2013, part of the Microsoft Office suite, is used to improve collaboration, provide content management features, carry out business processes, and provide access to information that is essential to organizational goals (<http://sharepoint.microsoft.com/en-us/Pages/default.aspx>). You can create SharePoint sites that support content publishing, content management, records management, and business intelligence needs. You can also conduct searches for people, documents, and data as well as access and analyze large amounts of business data. SharePoint Server 2013 provides a single, integrated location where employees can collaborate with team members, find organizational resources, search for experts and information, manage content and workflow, and use the information they have found to make better decisions.

「A GIS can provide all kinds of information that enables you to zero in on specific customers.」

Disadvantages of GSSs include the following:

- *Lack of the human touch*—Gestures, handshakes, eye contact, and other nonverbal cues can be lost, which can hinder the effectiveness of meetings. New developments in virtual reality technologies (discussed in Chapter 14) could solve this problem, however.
- *Unnecessary meetings*—Because arranging a GSS session is easy, there is a tendency to schedule more meetings than are necessary, which wastes time and energy.
- *Security problems*—GSS sessions have the same security problems as other data communication systems, so there is the possibility of private organizational information falling into the hands of unauthorized people. Tight security measures for accessing GSS sessions and transferring data are essential.

12.5 Geographic Information Systems

Executives often need to answer questions such as the following:

- Where should a new store be located to attract the most customers?
- Where should a new airport be located to keep the environmental impact to a minimum?
- What route should delivery trucks use to reduce driving time?
- How should law enforcement resources be allocated?

A well-designed **geographic information system** (GIS) can answer these questions and more. This system captures, stores, processes, and displays geographic information or information in a geographic context, such as showing the location of all city streetlights on a map. A GIS uses spatial and nonspatial data and specialized techniques for storing coordinates of complex geographic objects, including networks of lines (roads, rivers, streets) and reporting zones (zip codes, cities, counties, states). Most GISs can superimpose the results

of an analysis on a map, too. Typically, a GIS uses three geographic objects:

- *Points*—The intersections of lines on a map, such as the location of an airport or a restaurant
- *Lines*—Usually a series of points on a map (a street or a river, for example)
- *Areas*—Usually a section of a map, such as a particular zip code or a large tourist attraction

Digitized maps and spatially oriented databases are two major components of a GIS. For example, say you want to open a new store in southwest Portland, Oregon, and would like to find out how many people live within walking distance of the planned location. With a GIS, you can start with the map of the United States and zoom in repeatedly until you get to the street map level. You can mark the planned store location on the map and draw a circle around it to represent a reasonable walking distance. Next, you can request a summary of U.S. census data on everyone living inside the circle who meet certain conditions, such as a particular income level, age, marital status, and so forth. A GIS can provide all kinds of information that enables you to zero in on specific customers. A GIS can perform the following tasks:

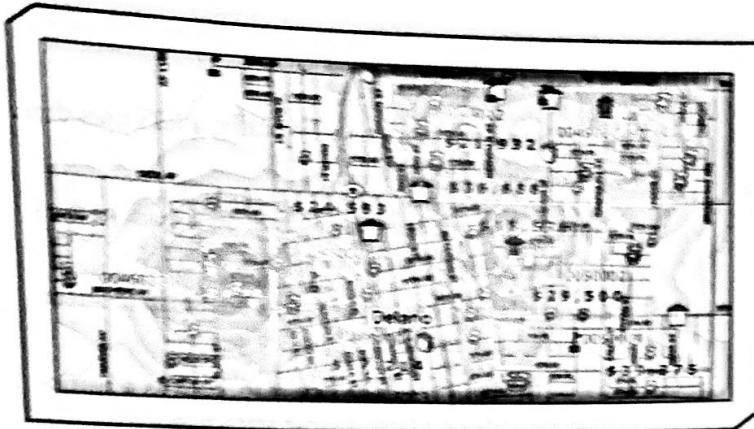
- Associate spatial attributes, such as a manufacturing plant's square footage, with points, lines, and polygons on maps.
- Integrate maps and database data with queries, such as finding zip codes with a high population of senior citizens with relatively high income.

A GIS can support some sophisticated data management operations, such as the following:

- Show the customers who live within a 5-mile radius of the Super Grocery at the corner of 34th and Lexington. A database cannot answer this question because it cannot determine the latitude/longitude coordinates of the store, compute distances using the specified location as the center, identify all zip codes within this circle, and pull out the customers living in these zip codes.

A **geographic information system (GIS)** captures, stores, processes, and displays geographic information or information in a geographic context, such as showing the location of all city streetlights on a map.

Exhibit 12.5 Locations of child care centers: an example of a pin map



- Show the customers whose driving route from work to home and back takes them through the intersection of 34th and Lexington. A database cannot address this query, either. In this case, the GIS maps customers' home and work locations and determines all possible routes. It can then narrow down the customer list by picking only those whose shortest route takes them through the specified intersection.

A GIS with analytical capabilities evaluates the impact of decisions by interpreting spatial data. Modeling tools and statistical functions are used for forecasting purposes, including trend analysis and simulations. Many GISs offer multiple windows so you can view a mapped area and related nonspatial data simultaneously, and points, lines, and polygons can be color coded to represent nonspatial attributes. A zoom feature is common for viewing geographic areas in varying levels of detail, and map overlays can be useful for viewing such things as gas lines, public schools, or fast-food restaurants in a specified region. A buffering feature creates pin maps that highlight locations meeting certain criteria, such as finding a new store location based on population density. Exhibit 12.5 shows an example of output from Environmental Systems Research Institute (ESRI), a major vendor of GIS software. To see examples of different types of maps, visit www.esri.com.

A common example of a GIS—and one you have probably used often—is getting driving directions from Google Maps. It is an interactive GIS that identifies routes from start to destination, overlays routes on a map, shows locations of nearby landmarks, and estimates distances and driving times. It is also considered a DSS because you can change routes by dragging

different points and have what-if analysis performed on alternative routes (such as taking back roads instead of the highway), including estimates of driving time to help you decide which route is best. Google Maps has a user-friendly interface that helps you visualize the route, and after you make a decision, you can print driving directions and a map.

12.5.a GIS Applications

GISs integrate and analyze spatial data from a variety of sources. Although they are used mainly in government and utility companies, more businesses

are using them, particularly in marketing, manufacturing, insurance, and real estate. No matter into what category a GIS falls, most applications require a GIS to handle converting data to information, integrating data with maps, and conducting different types of analysis. GIS applications can be classified in the following categories, among several others:

- **Education planning**—Analyzing demographic data toward changing school district boundaries or deciding where to build new schools.
- **Urban planning**—Tracking changes in ridership on mass-transit systems and analyzing demographic data to determine new voting districts, among many other uses.
- **Government**—Making the best use of personnel and equipment while dealing with tight budgets, dispatching personnel and equipment to crime and fire locations, and maintaining crime statistics.
- **Insurance**—Combining data on community boundaries, street addresses, and zip codes with search capabilities to find information (some from federal and state agencies) on potential hazards, such as natural disasters, auto-rating variables, and crime rate indexes.^{22,23}
- **Marketing**—Pinpointing areas with the greatest concentration of potential customers, displaying sales statistics in a geographic context, evaluating demographic and lifestyle data to identify new markets, targeting new products to specific populations, analyzing market share and population growth in relation to new store locations, and evaluating a company's market position based on geographic location.^{24,25} For example, PepsiCo uses a GIS to find the best locations for new Pizza Hut and Taco Bell outlets.

- **Real estate**—Finding properties that meet buyers' preferences and price ranges, using a combination of census data, multiple listing files, mortgage information, and buyer profiles. GISs also help establish selling prices for homes by surveying an entire city to identify comparable neighborhoods and average sales prices. GISs can be used for appraisal purposes to determine relationships between national, regional, and local economic trends and the demand for local real estate.²⁶

- **Transportation and logistics**—Managing vehicle fleets, coding delivery addresses, creating street networks for predicting driving times, and developing maps for scheduling routing and deliveries.²⁷

The adjoining information box discusses how GISs can be used to monitor and reduce the spread of disease.

12.6 Guidelines for Designing a Management Support System

before designing any management support system, the system's objectives should be defined clearly, and then the system development methods discussed in Chapter 10 can be followed. Because MSSs have a somewhat different purpose than other information systems, the important factors in designing one are summarized in the following list:

- **Support from the top**—Without a full commitment from top management, the system's chances of success are low.
- **Objectives and benefits clearly defined**—Costs are always in dollars, but benefits are qualitative. The design team should spend time identifying all costs and benefits in order to present a convincing case to top management. When benefits are intangible, such as improving customer service, the design team should associate the benefit with a measurable factor, such as increased sales.
- **Identifying executives' information needs**—Examine the decision-making process that executives use to

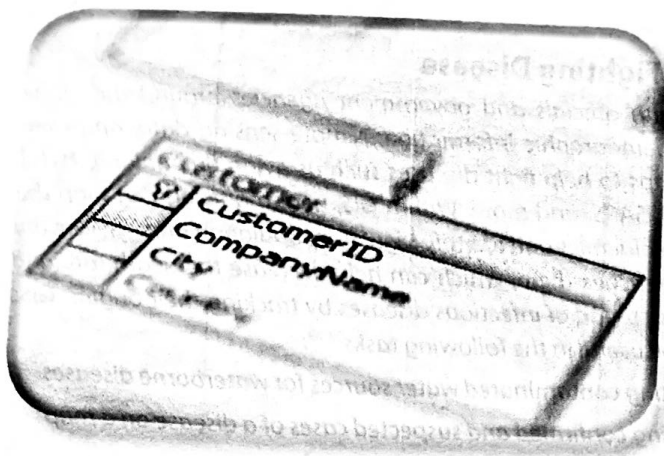
GISs for Fighting Disease

Public health officials and government agencies around the globe use GISs, demographic information, remote-sensing data, and even Google Maps to help fight diseases such as avian flu, malaria, H1N1 (swine flu), SARS, and more. With a GIS, health officials can map the spread of epidemics and identify high-risk population areas before the epidemic reaches them, which can help decrease the death rate and reduce the spread of infectious diseases by tracking their origins. GISs can also be useful in the following tasks^{28,29}:

- **Locating contaminated water sources for waterborne diseases**
- **Plotting confirmed and suspected cases of a disease on a map**
- **Identifying existing medical infrastructures**
- **Determining how far people have to travel to reach a healthcare center and whether public transportation is available**
- **Monitoring virus mutations and their locations during an outbreak and assisting in early identification of infected people or animals**
- **Determining the geographic distribution of diseases**
- **Planning and targeting interventions**
- **Routing healthcare workers, equipment, and supplies to remote locations**
- **Locating the nearest healthcare facility**

find out what kinds of decisions they are making—structured, semistructured, or unstructured—and what kind of information they need to make these decisions.

- **Keeping lines of communication open**—This is important to ensure that key decision makers are involved in designing the MSS.
- **System's complexity hidden, interface kept simple**—Avoid using technical jargon when explaining the system to executives because they might lose interest if they think the system is too technical. Executives are not interested in the choice of platform or software, for example. Their main concern is getting the information they need in the simplest way possible. In addition, the system must be easy for executives to learn, with little or no training. To most executives, the interface is the system, so its ease of use is a crucial factor in the system's success.
- **Keeping the "look and feel" consistent**—Designers should use standard layouts, formats, and colors in windows, menus, and dialog boxes for consistency and ease of use. That way, a user who has learned the database portion of the system, for example, should be able to switch to the report-generating portion with little trouble because the interface is



familiar. You can see this in Microsoft Office, which uses similar features, such as formatting toolbars, in all its applications. Users accustomed to Word, for example, can learn how to use Excel quickly because the interface is familiar.

- **Designing a flexible system**—Almost all aspects of an MSS, including the user interface, change over time because of rapid developments in technology and the dynamic business environment. A flexible system can incorporate changes quickly.
- **Making sure response time is fast**—MSS designers must monitor the system's response time at regular intervals, as executives rarely tolerate slow response

times. In addition, when a system function takes more than a few seconds, make sure a message is displayed stating that the system is processing the request. Using a progress bar can help reduce frustration, too.

The Industry Connection highlights the software and services available from SAS Corporation, one of the leaders in decision support systems.

12.7 Chapter Summary

In this chapter, you learned about different types of decisions and the decision-making stages in a typical organization. You reviewed the components of a decision support system, along with its capabilities, key players, and costs and benefits. In addition, you learned how executive information systems are used and what factors affect their success, and the advantages and disadvantages of group support systems. Finally, you learned about the capabilities and possible uses of geographic information systems and reviewed guidelines for designing management support systems.

Industry Connection

SAS, INC.³⁰

SAS was founded in the early 1970s to analyze agricultural research data. Eventually, it developed into a vendor of software for conducting comprehensive analysis and

- **SAS Business Intelligence**—Analyzes past data to predict the future, including features for reporting, queries, analysis, OLAP, and integrated analytics
- **Data Integration**—Gives organizations a flexible, reliable way to respond quickly to data integration requirements at a reduced cost

generating business intelligence information for a variety of decision-making needs. Products and services offered by SAS include the following:

- **SAS Analytics**—Provides an integrated environment for modeling analyses, including data mining, text mining, forecasting, optimization, and simulation; provides several techniques and processes for collecting, classifying, analyzing, and interpreting data to reveal patterns and relationships that can help with decision making

case study 1

COLLABORATION SYSTEMS AT ISUZU AUSTRALIA LIMITED

Isuzu Australia Limited (IAL) is responsible for marketing and distributing Isuzu trucks in Australia. With just 65 employees, IAL depends on its national dealer network to maintain its market position. In the past, all information was distributed to dealers manually, which was expensive, time consuming, and prone to errors. IAL chose IBM WebSphere Portal and Workplace Web Content Management as an online portal and content management system to replace the existing manual system. With the new system, employees can publish information themselves and use the system's instant-messaging features to collaborate on decisions. Since the system's implementation in 2006,

IAL has seen major cost savings, reduced errors, and faster, more efficient communication. Collaboration and knowledge sharing have also increased with use of the system's wiki feature.³¹



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Answer the following questions:

1. What prompted IAL to use collaboration technologies?
2. What are some applications of collaboration technologies at IAL?
3. Which platform was chosen by IAL as an online portal and content management system?