
They have been produced by Prentice-Hall, a division of Pearson Education.

http://www.svnit.ac.in/~rpg/laudon/

CONTENTS

1. Information Systems Revolution: Transforming Business and Management
2. The Strategic Role of Information Systems
3. Information Systems, Organizations, and Business Processes
4. Information, Management, and Decision Making
5. Ethical and Social Impact of Information Systems
6. Computers and Information Processing
7. Information Systems Software
8. Managing Data Resources
9. Telecommunications and Networks
10. The Internet: Electronic Commerce and Electronic Business
11. Redesigning The Organization With Information Systems
12. Approaches to Systems-Building
13. System Success and Failure: Implementation
14. Managing Knowledge
15. Enhancing Management Decision Making
16. Information Systems Security and Control
17. Managing International Information Systems
18. Managing Infrastructure and Enterprise Systems
Chapter 1: The Information Systems Revolution: Transforming Business and Management

1.1 Why Information Systems?

Ask managers to describe their most important resources and they'll list money, equipment, materials, and people - not necessarily in that order. It's very unusual for managers to consider information an important resource and yet it is. This chapter will help explain why you need to manage this resource as closely as any other in your organization.

The Competitive Business Environment

For many years computer technology was relegated to the backrooms or basements of a corporation. Only the "techies" worried about it and were often the only ones who really knew how it all worked. Now computers are all over the organization - one on every desk. It's not enough for you to know how to pound a keyboard or click a mouse. It's not even enough for you to know how to surf the Web. Now every employee, including you, must know how to take advantage of Information Systems to improve your organization and to leverage the available information into a competitive advantage for your company.

Emergence of the Global Economy

Next time you purchase a product, any product, look at the fine print and see where it's made. It could be China, or the Philippines, or South America, or even in the USA. You can disagree with the many manufacturing jobs that are being moved from the U.S. to foreign countries. But look at the vast number of jobs that are being created in this country. Maybe they aren't the traditional factory jobs we're used to. In fact, many of our new jobs are in the information industry. Many of them service whole new markets that didn't exist just a few years ago. There was no position called "Webmaster" in 1991 because the Web didn't exist. But now, that particular job category is one of the fastest growing in the U.S. and overseas. The global economy Laudon & Laudon talk about is being made possible by
technology. And that's why it's so important that you understand how to use Information Systems Technology instead of just computer technology. There's a big difference between the two, and we'll talk about it more.

Transformation of Industrial Economies

"In a knowledge- and information-based economy, knowledge and information are key ingredients in creating wealth." (text, page 6) Think back to the early 1900s when the horse and buggy were the main form of transportation. Along came a guy named Ford who built a whole new industry around the automobile. Many jobs, such as horse groomers, horse shoers, and buggy manufacturers, were lost forever. Now think about all the new jobs that were created - not just in the factories but all the other businesses associated with the car. The people in the horse and buggy industry adapted, retrained for the new jobs, and the whole country changed.

The same thing is happening now with the information industry. Many of the new jobs that are being created have better working conditions, better pay, and more advantages than the old jobs had. You just have to be equipped to take advantage of the situation. You have to take advantage of retraining opportunities. You have to gain the skills necessary for the transformation of the industries that have been a mainstay of this country. It's not that hard - it just takes a lot of hard work.

We often think of industries such as manufacturing and financial institutions as information-based. But even farmers and ranchers in this country are learning information-based skills so that they can become more efficient and cut costs. They are taking advantage of the technological explosion by using computers and Global Positioning Systems on their farms and ranches to increase crop yields or reduce workloads. They're catching on to the idea that Information Systems are a key to success.

Transformation of the Business Enterprise
You can't help but know about all the job cuts occurring in our country. It seems like every week we hear about thousands and thousands of people losing their jobs. Back in the 80s most of the job losses were in the blue collar sector. In the 90s it seems many of the cuts are being made in the white collar, management jobs. Why? Think about it. Technology, to a large extent, has driven organizations to change the way they operate and that includes the way they manage. We're going to take an in-depth look at how organizations work and how they've been transformed by technology.

But it isn't always bad! You just have to ask yourself this question: "With all the job losses in the last few years, many driven by technological changes, why has the U.S. unemployment rate dropped to it's lowest in decades and remained so low?"

Maybe this chart will help you understand the answer to that question.
What Is an Information System?

Too often you hear someone say, "Oh yeah, I know how to use a computer. I can surf the Web with the best of them and I can play Solitaire for hours. I'm really good at computers." Okay. So that person can pound a keyboard, use a mouse at lightning speed, and has a list of favorite Web sites a mile long. But the real question is "Is that person information literate?" Just because you can pound the keyboard doesn't necessarily mean you can leverage the technology to your advantage or the advantage of your organization. An organization can gather and keep all the data on its customers that a hard drive can hold. You can get all the output reports that one desk can physically hold. You can have the fastest Internet connection created to date. But if the organization doesn't take advantage of customer data to create new opportunities, then all it has is useless information. If the output report doesn't tell the management that it has a serious problem on the factory floor, then all that's been accomplished is to kill a few more trees. If you don't know how to analyze the information from a Web site to take advantage of new sales leads, then what have you really done for yourself today?

Most of us think only of hardware and software when we think of an Information System. There is another component of the triangle that should be considered, and that's the people side, or "persware." Think of it this way:
In this section of the text, Laudon & Laudon discuss the components of an information system. They talk about the input, processing, output and feedback processes. Most important is the feedback process; unfortunately it's the one most often overlooked. Just as in the triangle above, the hardware (input and output) and the software (processing) receive the most attention. With those two alone, you have computer literacy. But if you don't use the "persware" side of the triangle to complete the feedback loop, you don't accomplish much. Add the "persware" angle with good feedback and you have the beginnings of information literacy.

A Business Perspective on Information Systems

Using feedback completes the information processing loop. To be a good Information Systems manager, however, you must bring into that loop far more than just the computer data. For instance, your information system reports that you produced 100,000 widgets last week with a "throwback" rate of 10%. The feedback loop tells you that the throwback rate has fallen 2% in the last month. Wow, you
say, that's a pretty good improvement. So far, so good. But if you put that information into a broader context, you're still costing the organization a huge sum of money because each percentage point on the throwback rate averages $10,000. And when you bring in available external environmental information, your company is 5% above the industry norm. Now that's information you can use - to your advantage or disadvantage!

If you, as a manager, can then take other information from the internal and external environments to come up with a solution to this problem, you can consider yourself "information literate."

Organizations

Organizations are funny things. Each one tends to have its own individual personality and yet share many things in common with other organizations. Look at some of the organizations you may be associated with - softball team, fraternity/sorority, health club, or a child's soccer team. See, organizations exist everywhere and each of them has its own structure, just as workplace organizations have their own structure and personality to fit their needs, or in some cases, habits.

A baseball team needs talented, well-trained players at different positions. Sometimes, the success of the team depends on a good, well-informed coach or manager. So too with the workplace organization. Business organizations need many kinds of players with various talents, who are well-trained and well-informed, in order to succeed.

Every organization requires tools to help it succeed. If the baseball team uses bats that are 25 years old against a team whose bats are 2 years old, they will have to work harder on their own to make up for that disadvantage. If your child's soccer team uses balls with torn seams, they're going to have a harder time hitting the ball into the goal. So if your organization is using older equipment or uses it the wrong way, it just stands to reason it is going to have a harder time beating the odds.
Management

Every good organization needs a good manager. Pretty simple, pretty reasonable. Take professional baseball managers. They don't actually play the game, they don't hit the home run, catch the flyball for the last out, or hang every decoration for the celebration party. They stay on the sidelines during the game. Their real role is to develop the game plan by analyzing their team's strengths and weaknesses. But that's not all; they also determine the competition's strengths and weaknesses. Every good manager has a game plan before the team even comes out of the locker room. That plan may change as the game progresses, but managers pretty much know what they're going to do if they are losing or if they are winning. The same is true in workplace organizations.

Technology

Do you own a Digital Video Disk? Probably not, since it's only been on the market for a short time. How old is your car or truck? Manufacturers are constantly offering us new vehicles, yet we tend to upgrade only every few years. Your personal computer may be a year old or three years old. Do you have the latest gadgets? Chances are you don't. Face it, you just can't keep up with all the new stuff. No one can. Think about how hard, not to mention expensive, it is for an individual to acquire everything introduced to the marketplace. Think how difficult it is sometimes to learn how to use every feature of all those new products.

Now put those thoughts into a much larger context of an organization. Yes, it would be nice if your company could purchase new computers every three months so you could have the fastest and best technology on the market. But it can't. Not only is it expensive to buy the hardware and the software, but the costs of installing, maintaining, updating, integrating, and training must all be taken into account. We'll look at the hardware and software sides of the Information Systems triangle in upcoming chapters, but it's important that you understand now how difficult it is for an organization, large or small, to take advantage of all the newest technology.
Bottom Line: Information Literacy is more than just clicking a mouse, pounding the computer keyboard, or surfing the Web. It's about integrating various elements of an organization, technical and non-technical, into a successful enterprise. As a successful manager you must concentrate on all three parts of the Information Systems triangle (hardware, software, and personware) and integrate them into a single, cohesive system that serves the needs of the organization, the wants of the customer, and the desires of the employees. The more complex, the harder to manage, but the greater the payoff.

1.2: Contemporary Approaches to Information Systems

There are several different approaches to Information Systems: technical, behavioral, sociotechnical. Think of this analogy: A "techie" looks at most things associated with computing as a series of zeroes or ones. After all, everything in a computer is ultimately reduced to a zero or a one. So using the technical approach, you could say that 2 + 2 = 4. The behavioral approach, on the other hand, takes into account the very nature of human beings. Nothing is totally black and white. Therefore the behavioral approach to the same equation would be "2 + 2 = maybe 4 or perhaps 3.5 to 5.5, but we'll have to put it before the committee and see what the next quarter's figures say." Neither approach is better than the other, depending on the situation. Neither approach is more right than the other, depending on the situation.

An organization can't afford to view its information resources as belonging to either the techies (technical approach) or the non-techies (behavioral approach). Responsibility for information belongs to everyone in the organization. This is the sociotechnical approach, that is, a combination of the two. Everyone has to work together to ensure that Information Systems serve the entire organization.

To help you understand the importance of viewing Information Systems through the sociotechnical approach, look at what the
current trade journals are saying. David Haskin, writing in the April 1999 issue of Windows Magazine, quotes Steve Roberts, vice president of information technology for Mind Spring Enterprises, an Atlanta-based Internet service provider: "The gap in understanding between technical and nontechnical people is the biggest challenge I've seen." Haskin goes on to say, "Because technology is the bedrock on which successful businesses are built, the stakes in making this relationship work are high. Failing to use the correct technology can put you at a competitive disadvantage, and glitches in existing technologies can bring a business to a grinding halt."

**Bottom Line: Information Systems and the use of technology belong to everyone in an organization. This concept is best carried out through a sociotechnical approach, which allows both the technical and behavioral approaches to be combined for the good of the organization.**

1.3 The New Role of Information Systems in Organizations

Managers can't ignore technology any more and pass it off to secretaries or clerical workers or the Information Technology department. Information Systems are critical to the success of an organization at all managerial levels.

*The Widening Scope of Information Systems*

![FIGURE 1.7](image)
If you take a look at Figure 1.7 you can understand the evolution of Information Systems in organizations. Technology was considered, well, too technical for the rest of us to understand. Computers were relegated to the back room with a few technicians running around in white coats. No one else understood what these people did or how they did it. It was a different world and actually seemed disconnected from the mainstream operations of the company.

As the time line indicates, technology and its associated Information Systems are now integrated throughout the organization. Everyone is concerned about technology’s role and impact on their work activities. End users take on greater responsibilities for the success of Information Systems and are actually doing a lot of the work that once belonged to the techies. Even the executive levels of an organization can no longer ignore the technology and pretend that it belongs to someone else.

We are constantly bombarded with new tools, new technology, and new methods of doing business. It almost seems as though just as you master a word processing program, here comes a whole new program you have to learn from scratch. But the plain fact is that organizations, especially larger ones, just can’t change as fast as the technology. Companies make huge investments not just in hardware, but in software and persware. Training people, building new operating procedures around technology, and changing work processes take far longer than the technological pace will allow.

The introduction of new technology can severely disrupt organizations. Productivity naturally slips. Learning curves cost time and money. Most system installations or changes used to affect mainly data workers or production workers. Now they affect every level of the organization, even the management and strategic levels. Every part of the organization is involved in the introduction or change of technology and everyone plays a part in its success.
The Network Revolution and the Internet

Even though the Internet as a whole has existed since 1969, the World Wide Web didn't exist until around 1993-1994. That's less than 10 years. Now you can't pick up a magazine or a newspaper, turn on the television or radio, even drive by a billboard, without some kind of reference to "dot com." Businesses are rushing to the Internet in an effort to keep up with the competition or to create whole new businesses. Now organizations struggle with such issues as how to design and develop a Web site or how to determine a fair email policy for employees.

The fastest and biggest change in modern computing is the Internet. To say that the Internet is transforming the way we live, work, and play is probably the greatest understatement in years. Businesses can create new opportunities but they can also lose opportunities just as quickly. Now an organization has to design new systems, or transform old ones, with not just the company in mind, but 100 million other users of the Internet, Extranets, and Intranets. They have to decide how much or how little information to provide in what way, with what level of access, how best to present it, etc. It's a huge job!

New Options for Organizational Design: The Networked Enterprise

Many of the job losses of the 1990s occurred because technology allowed organizations operate efficiently with flatter organizations - with fewer levels of bureaucracy. One manager can now oversee a larger group of people. More important, technology increases the span of communication a manager can accomplish with a single email. You can make information available to a greater number of people much more easily than ever before.

But wait. You can make that information available to more people, but you have to train them how to use it, and when it's appropriate to use it and with what latitude they can use it. Again, it all comes back to the "persware" portion of the triangle. Yes, your hardware enables more people to connect to the Information System, and the software is becoming much easier to use and more widespread than
ever before. But you still have to concentrate on the people who are using the software to connect to the hardware.

Technology now allows workers to work from anywhere. It's becoming common for companies to literally shift their work through time zones. That is, the person in New York will shift blueprints for a new product to a worker in California. The Californian can then collaborate on the product for an additional three hours before zipping it to another person across the ocean who will work on it while the others sleep. Talk about telecommuting!

Technology now allows companies in foreign countries to merge their organizations in ways never before possible. Think of Daimler from Germany and Chrysler in Michigan. Opportunities for new products and new production methods exist with this merger. However, think of the challenges it poses to management information systems and employees.

FIGURE 1.9
The figure you see depicts the possibilities of virtual organizations. XYZ and ABC companies can team up, work on a project, and then go their separate ways. ABC could then seek out LMN corporation to develop a new technology from which both will gain but which neither could accomplish on their own. This is happening more and more in technology companies. In November 1998, America Online purchased Netscape. At the same time AOL announced a collaboration with Sun Microsystems to develop and deliver enhanced technology that AOL couldn't produce on its own. A few years ago, virtual organizations were difficult to develop and even more difficult to manage. New technologies and new management information systems now make such partnerships easier and more productive than ever before.

As we'll see in future chapters, new technology allows businesses to reorganize their work flows, allowing them to become more efficient and to meet new challenges. The potential for saving money is tremendous, and so are the opportunities to better meet customer demands.

A few years ago we couldn't imagine having Levi Strauss make a pair of jeans just for us. It wasn't possible for a gardening company to produce a catalog strictly for our own backyard. There was no way for an airline reservation company to know your favorite city to visit and send you special ticket deals for a weekend getaway in a weekly email message. All that is now possible thanks to the newer management information systems. But with all these new opportunities come new challenges and problems. How do you keep all that data straight? How do you keep from getting Suzy's order in New York mixed up with Bobby's order in Dallas? How do you know that Mike lives in sunny Arizona and not snowy Michigan? (See mass customization)

**Enterprise Resource Planning**, which we'll talk about in other chapters, is only possible through new and improved technology.
Companies are realizing that they can't afford "islands of information" and must have the means to share information resource across all boundaries. And speaking of boundaries, most of those are either rearranged or eliminated because of technological changes. Suppliers, customers, and governmental agencies are now linked electronically to organizations that increase the efficiency and decrease the cost of operations in what are called **interorganizational systems**.

One common mistake with many organizations wanting to do business on the Internet is the idea that they can simply throw up a Web site, add an email software program for customer communication, and voilà they are ready to do business in cyberspace. They haven't addressed any of their internal processes and possible changes to the way they do business. They've spent hundreds of thousands or millions of dollars and can't get enough sales to support a day's worth of expenses.

**Electronic Commerce and Electronic Business**

### Table 1.5  Examples of Electronic Commerce and Electronic Business

**Electronic Commerce**

**Amazon.com** operates a virtual storefront on the Internet offering more than 3 million book titles for sale. Customers can input their orders via Amazon.com's Web site and have books shipped to them.

**Travelocity** provides a Web site that can be used by consumers for travel and vacation planning. Visitors can find out information on airlines, hotels, vacation packages, and other travel and leisure topics, and they can make airline and hotel reservations on-line through the Web site.

**Mobil Corporation** created a private network based on Internet technology that allows its 300 lubricant distributors to submit purchase orders online.

**Electronic Business**

Ebook_mis.doc
**Roche Bioscience** scientists worldwide use an intranet to share research results and discuss findings. The intranet also provides a company telephone directory and newsletter.

**University of Texas Medical Branch at Galveston** publishes nursing staff policies and procedures on an intranet. The intranet reduces paperwork and enhances the quality of nursing services by providing immediate notification of policy changes.

**Dream Works SKG** uses an intranet to check the daily status of projects, including animation objects, and to coordinate movie scenes.

**TABLE 1.5**

**Electronic markets** are allowing businesses to take advantage of technology to create new methods of buying and selling. For a while it seemed as though the middleman was going out of business because of the direct connection between customers and merchants. While this is true in some industries, new opportunities are springing up for the middleman in other areas. We'll look at this issue in more detail later.

Amazon.com, the largest retailer on the Internet selling books and CDs, loses millions of dollars a year and yet is one of the best success stories in E-commerce. Its fiercest rival, Barnes & Noble Books, has also spent millions of dollars converting traditional retailing operations to the Internet. Unfortunately, Barnes & Noble's efforts at E-commerce are considered somewhat of a failure. Why? Because Barnes and Noble hasn't fully changed its core processes to accommodate the changes required for doing business on the Web.

There are many opportunities offered by the Internet, Extranets, and Intranets. Yet there are many problems associated with developing a company's electronic commerce and electronic business. It is easy to put up a Web site - a snazzy, colorful Web site that looks very pretty and may even be easy to use. But you must consider how you're
going to incorporate that part of your business with the other, more established methods of doing business. What internal processes must you change or adapt? What new processes must you establish? What training must you do with the people who will run the E-business, both technical and non-technical?

"Changes in business processes, customer and supplier relationships, data access, data ownership, distribution strategy, and marketing tactics underpin most Web-commerce efforts." Information Week magazine, Dec 7, 1997, page 53.

**Bottom Line: Employing new Information Systems in an organization requires changes to old methods and processes. Managing the changes is as important to the success of the new technology as managing the system itself.**

.4 Learning to Use Information Systems: New Opportunities with Technology

Is this new technology worth the headaches and heartaches associated with all the problems that can and will arise? Yes. The opportunities for success are endless. The new technologies do offer solutions to age-old problems. Improvements are possible to the way you operate and do business.

The rest of the book and this course will give you tools you can use to be successful with the current and future Management Information Systems.

1. **The Strategic Business Challenge:** Companies spend thousands of dollars on hardware and software, only to find that most of the technology actually goes unused. "How can that be?" you ask. Usually because they didn't pay attention to the full integration of the technology into the organization. Merely buying the technology without exploiting the new opportunities it offers for doing business smarter and better doesn't accomplish much. Think and rethink everything you do
and figure out how you can do it better. Change is inevitable, and information must be managed just as you would any other resource.

2. **The Globalization Challenge:** The world becomes smaller every day. Competition increases among countries as well as companies. A good Management Information System meets both domestic and foreign opportunities and challenges. How does Daimler/Chrysler integrate its organizations and cultures into one - or almost one?

3. **The Information Architecture Challenge:** You have to decide what business you are in, what your core competencies are, and what the organization's goals are. Those decisions drive the technology, instead of the technology driving the rest of the company. Purchasing new hardware involves more than taking the machine out of the box and setting it on someone's desk. Remember the triangle of hardware, software, and persware. Take care of the people and they will take care of the rest! **Information architecture** describes how to incorporate technology into the mainstream processes in which the business is involved. How will the new Information System support getting the product produced and shipped? How will Advertising and Marketing know when to launch ad campaigns? How will Accounting know when to expect payment?

4. **The Information Systems Investment Challenge:** Too often managers look at their technological investments in terms of the cost of new hardware or software. They overlook the costs associated with the non-technical side of technology. Is productivity up or down? What is the cost of lost sales opportunities and lost customer confidence from a poorly managed E-Business Web site? How do you determine if your Management Information System is worth it?

5. **The Responsibility and Control Challenge:** Remember, humans should drive the technology, not the other way around. Too often we find it easier to blame the computer for messing up than to realize it's only doing what a human being told it to do. Your goal should be to integrate the technology into the world of people. Humans do control the technology, and as a manager, you shouldn't lose sight of that.
Bottom Line: Management's focus must continually change to take advantage of new opportunities. Changes should take place throughout the organization. They require lots of attention and planning for smooth execution.

Discussion Questions:

Click on the Discussion icon in the top toolbar to answer the following Discussion Questions.

1. Why is it important to understand the difference between Computer Literacy and Information Literacy?
2. What are the three elements of an Information System that managers must consider?
3. What are some of the factors managers must consider when considering changes in technology?
4. What are some of the new roles Information Systems are playing in organizations?

Chapter 2: The Strategic Role of Information Systems

2.1 Key System Application in the Organization
2.2 Information Systems and Business Strategy
2.3 Using Systems for Competitive Advantage: Management Issues

Discussion Questions

2.1 Key System Applications in the Organization

As we go through this chapter, we'll look at the six major types of Information Systems organizations use in their operations. To help distinguish between the type of function each one is designed to accomplish and to fit them all together, we're going to look at them in the context of manufacturing candy bars. Yep, candy bars. Everyone likes them and everyone has eaten one, so they will be easy to relate to. We'll call the company WorldWide Candy and we'll give the candy bar the timely name of Cybernuts.

You'll see at the end of this discussion the integral role each type of system plays from determining which kind of candy bar to make, to
how to make it, to how many people the company will need to make the candy bar, to how to sell it, to how this particular candy bar fits into the strategic success of the company.

FIGURE 2.2

The six major types of information systems.

As we move through this discussion, we'll dissect this figure and show you how the various systems fit together.

**Transactional Processing System**
The operational level of the organization includes the various units listed in the figure and is responsible for daily operations. The information systems used in this level of the organization are transactional processing systems (TPS), so-called because they record the routine transactions that take place in everyday operations. TPS combine data in various ways to fulfill the hundreds of information needs a company requires to be successful. The data are very detailed at this level. For instance, a TPS will record how many pounds of sugar are used in making our Cybernuts candy bar. It also records the time it takes from beginning to end to make the candy bar. And it can record the number of people working on the assembly line when our candy bar is made and what functions they perform.

People using Transaction Processing Systems usually need information to help them answer routine questions such as "How many Cybernuts candy bars did we produce yesterday?" or "How much sugar do we have on hand for today's production run?"

Since there's more to making the Cybernuts candy bar than just running the assembly line, a TPS will record the sales and marketing actions surrounding the sale of the product. The system will record not just the number of dollars used in the marketing program, but also how many stores are actually stocking the candy bar and where the product is located inside the stores.

You have to remember that a lot of action is required to get the product from the manufacturing plant to the store shelves. How much did the company pay to package the product, store the product,
and ship the candy bar to the stores? All that data can be recorded in a Transaction Processing System, right down to how many truck drivers were required to deliver the product to the local convenience store.

As you see in the figure, the operational level of an organization also includes functions not directly associated with the actual production of the Cybernuts candy bar but vital in keeping the company running smoothly. The people in Accounting may not be pouring the chocolate over the nuts on the assembly line, but those workers that do appreciate the fact that they get a paycheck every two weeks. Production workers also like to know that the Human Resource division is keeping track of training programs that may help them advance within the company.

Each of these divisions requires an information system that helps it keep track of the many, many details that make the production worker happy and productive. The best Transaction Processing System will be integrated throughout the organization to supply useful information to those who need it when they need it.

**Bottom Line:** The Transaction Processing System records the data from everyday operations throughout every division or department in the organization. Each division/department is tied together through the TPS to give a clear cut set of information to management levels throughout the company.

*Knowledge Work and Office Automation Systems*
Let’s first look at the Knowledge Work Systems and then we'll discuss Office Automation Systems.

You may not think of a Knowledge Work System as an integral part of the overall Information System of an organization. Most of the other systems have been recognized for many years, while this one may be thought of as relatively new.

Knowledge workers are those who promote the creation of new knowledge and integrate it into the organization. Research scientists may discover new methods of mixing sugar and cocoa beans and dairy products to make a better chocolate. Maybe a team of engineers will develop a new method of packaging the Cybernuts candy bar to make it easier to open. The legal knowledge workers may spend their time determining the copyright protections that could be afforded to the Cybernuts product name.

The knowledge work system (KWS) may not be where the research takes place; that could happen in a separate system devoted to research methodology, such as a Computer Aided Design (CAD) system. The knowledge work system is that part of the overall company-wide system that incorporates the research findings into the Information Systems maintained by the company so that the other divisions may take advantage of the data.

For instance, let's assume that the Production Research Scientists have developed a richer, smoother, creamier chocolate for the Cybernuts candy bar. This new recipe calls for alterations to the recipe Production has used for the last 20 years. Right away, you can
understand why production workers need to have the information in the Knowledge Work System so they can alter the assembly line for the new product. But, stop for a minute and think about all the other areas of WorldWide Candy Company that need to know the new recipe - or at least parts of it. Procurement will need to know that instead of buying 1000 pounds of sugar for every 5000 candy bars produced, it now needs to order 1500 pounds of sugar. Instead of the 500 gallons of milk for the old recipe, the Cybernuts candy bar requires 750 gallons of milk. And so on. Product Packaging must be aware that instead of wrappers to fit a five-inch candy bar, it will need a wrapper to fit the 6-inch Cybernuts bar. But we can't stop there.

This new product will require 25 fewer workers to make than the old candy bar. Human Resources must be able to help the excess workers find new positions either inside or outside the company. Perhaps they can be moved to other areas of the company and retrained for other jobs. Perhaps they will have to be furloughed. Accounting must know that the workers will be changing their jobs or leaving the company; Finance must also be aware of the new supply requirements and of the changing workforce.

Now you can see how no part of the company will be unaffected by what may seem on the surface to be a simple change in the recipe for a new candy bar. An effective Knowledge Work System will help feed this information to those other parts of the company so that they can make any necessary changes.

Even in this day of the promised paperless society, no job is completed until the paperwork is done. The **Office Automation System (OAS)** is dedicated mostly to data workers, who are no less important to the success of WorldWide Candy than any other worker. The new recipe discovered by the Knowledge Workers must be patented. An Office Automation System worker must complete the necessary paperwork to be filed with the U.S. Patent Office. The Office Automation System makes easy work of developing press releases that Sales and Marketing will use to announce the new and improved Cybernuts candy bar. The clerical workers in Human

Ebook_mis.doc
Resources will use their OAS to process the job changes the Production workers will need for their new positions.

One of the newest forms of OAS is the Document Imaging Systems that have been incorporated into most effective systems in the last few years. Technological improvements now make the old file cabinet bulging with pieces of paper a relic that can be stored in the basement. Those pieces of paper can be optically stored on a small plastic platter (compact disc) and retrieved within minutes by software programs. No more human beings thumbing through piles and piles of paper.

**Bottom Line:** A Knowledge Work Information System aids knowledge workers such as engineers, scientists, and legal workers. The Knowledge Work System helps create or gather new knowledge useful to all parts of the organization. An Office Information System is used by data workers to fulfill the coordination and communication functions vital to a company.

**Management Information Systems**

![Management Information Systems (MIS)](image)

**FIGURE 2.2c**
Think about the functions of managers that you may have learned in other classes: directing, controlling, communicating, planning, decision making. Each manager takes on these roles countless times in a day. Managers review endless amounts of data that hopefully make their job easier and them more efficient.

Those using Management Information Systems (MIS) require information on a periodic basis instead of a daily, recurring basis like those using a Transaction Processing System. Managers also require information on an exception basis. That is, they need to know if production is higher or lower than the targeted rate or if they are over or under their budgets. They also need to know about trends instead of straight numbers. The questions they may ask of the system would be "How far behind in production are we for this quarter?" or "How many more workers would we need if we increased production by 10,000 candy bars per quarter?"

In the old days the managers had to perform many functions without the aid of technology. If they wanted to know how many candy bars were produced in a month, they had to wait until that one piece of information was produced in a report published at the end of the quarter. If there was a problem getting a shipment out to the convenience store in Podunk, the shipping manager may not have known about it until a customer complained six months later. The Human Resources Department manager would likely not be able to find out about new job opportunities in a different part of the company until after the workers were laid off and had found other employment. Worse yet, Production might have to stop the assembly lines because Accounting hadn't purchased enough supplies to cover the increase in the number of candy bars rolling off the line.

Before integrated systems, managers received periodic printed reports that gave them lots of data but often didn't supply information that they could utilize to make timely decisions. Planning was sometimes a wasted effort because the information the managers needed just wasn't there when they needed it.

With the integration of information systems up and down the management levels, and throughout the corporation, managers can
often get needed information in a real-time mode. The data are kept on line, the system can gather the precise information managers need to make a decision, and the information can be cross-integrated into all departments of the company. All divisions in the company can see what's going on throughout the corporation. Information can be passed from department to department so that they are all working "off the same page."

The MIS will draw data from the Transaction Processing System to help managers answer structured questions such as "How much more sugar must we purchase if we increase production from 5000 Cybernuts candy bars to 7000 candy bars?"

The Human Resources Department alone can place vast amounts of personnel information, including job opportunities within the organization, on an Intranet that workers can access when they find it convenient.

For the Cybernuts candy bar, with the improved Management Information Systems available, Accounting managers will know that they must increase their purchases of sugar and milk to support the new recipe. The Shipping manager will know in time to plan for the new size wrapper the Cybernuts candy bar will require. The Sales and Marketing manager can know almost instantaneously that the shipment to Podunk is going to be delayed and so can call the convenience store manager ahead of time to let her know.

The greatest advantage of the new Management Information Systems is that managers no longer have to wait until a specific time of the month or quarter to receive information that they need to fulfill their daily functions.

**Bottom Line: A Management Information System is used by managers throughout the organization to help them in directing, planning, coordinating, communicating, and decision making. The MIS will help answer structured questions on a periodic basis.**
**Decision Support Systems**

**Decision Support systems (DSS)** also serve the management level of an organization but in a somewhat different way than an MIS. An MIS uses **internal** data to supply useful information. A DSS uses internal data also but combines it with **external** data to help analyze various decisions management must make. Analyzing complex, interactive decisions is the primary reason for a company to use a DSS.

The Sales and Marketing management of WorldWide Candy would use a DSS to answer a semistructured question such as "What price should we charge for the Cybernuts candy bar so that we can maximize our profits and minimize our costs?" Using a DSS the manager in charge of the Manufacturing Division could determine the best answer to the semistructured question, "How does the change in the size and packaging of the Cybernuts candy bar affect the other products we produce, not just in shipping, but also on the display shelf at the convenience store?"

You'll notice we describe decisions at this level as semistructured. Not all decisions required for an organization to function smoothly are cut and dried. There are a lot of gray areas in successfully managing an organization, and the larger the company, the more diverse the decision-making process becomes.
Since a company is affected not by what goes on within the company but also by external forces not under its control, Decision Support Systems can help upper-level management. What happens to the pricing structure and availability of the raw materials for the Cybernuts candy bar if civil war breaks out in the sugar-producing countries of Central America? The price of oil can greatly affect the profit and loss of the Cybernuts candy bar because of shipping costs. All these external events can be put into context in a Decision Support System so that WorldWide's management can make effective decisions.

Decision Support Systems also help those functions of an organization that may not be directly related to manufacturing products. Remember the workers who were no longer required in manufacturing the Cybernuts candy bar? What is the best way for the Human Resources Department to handle this situation? Perhaps there is a planned increase in production coming up in the next quarter that will require these workers. The Human Resources Manager could use a Decision Support System to determine if it is better to keep them on the payroll even if they won't be fully utilized for the next three months because the unemployment rate is so low the company will have difficulty hiring new workers when it needs them. Or perhaps the workers have specialized skills that aren't easy to find, so the company will actually save money in the long run by keeping these employees on the books.

**Bottom line:** Decision Support Systems are used for complex "what-if" questions that require internal and external data. Decisions at this management level are mostly semistructured, so the Information System must respond to the unique requirements of the executives.
Executive Support Systems

Executive Support Systems (ESS) are used at the very upper echelons of management. At the strategic level, the typical decision is very unstructured. Often there is no specific question but rather a series of undefined situations executives may face. These executives require summarized, historical information gleaned from all other levels of the organization, coupled with large amounts of external data gathered from many sources.

Let's assume that the Cybernuts candy bar is the most successful, most popular candy bar ever made. (You could say it's success is due to the effective use of the previous five information systems!) The Universal Food Products Corporation just can't create a product that comes close to the success of Cybernuts (its information systems aren't as good) and is very envious of WorldWide Candy. So Universal Food Products offers to buy the Cybernuts product from WorldWide for what seems to be an astronomical amount of money.

WorldWide executives can use their Executive Support System to determine if this offer is in the best interest of all. They can analyze the information gathered from all of the internal information systems and couple that with external data to help them make the decision. By using an Executive Support System, company executives can analyze internal and external data and make their decision based on information, not on emotion.
Since executives haven't been using computers that long or don't have time to fiddle around learning how to type, Executive Support Systems must be easy to use and the information must be easily manipulated. The ESS must be able to readily incorporate external information with internal data to offer concise, complete information dealing with the imprecise and incomplete scenarios executives face. And most important, the systems must have a fast response time.

**Bottom Line:** An Executive Support System helps managers make strategic decisions affecting the entire company. The systems use internal and external data to give executives the information they need to determine the proper course of action in unstructured situations.

**Relationships of Systems to One Another: Integration**
Interrelationships among systems.

The key element for all these systems is integration. The Cybernuts candy bar wouldn't be near the success it is if all systems didn't work together and help each other. If the information from the Transaction Processing System didn't feed into the Management Information System which incorporated information from the Knowledge Work System which fed into the Office Automation System which helped the Decision Support System which then worked with the Executive Support System, then the Cybernuts candy bar would just be another junk food.

2.2 Information Systems and Business Strategy

Did you ever play a game you intentionally wanted to lose before you started? Usually the answer to this question is no. It's very unusual for businesses to want to fail. Companies have every intention of beating their competition by using Strategic Information Systems.

Keep in mind that when we discuss the strategic role of information systems in this section we aren't talking about strategic level information systems. The strategic level system discussed earlier involved a decision such as "Should we accept Universal Food Products' offer to purchase the Cybernuts candy bar line?"

Information Systems can play a strategic role in an organization if they are used effectively throughout the company. Two ways to do that are through beating the competition and adding value to products or services. We can use Information Systems throughout WorldWide Candy to make Cybernuts better than any other candy bar, at perhaps a lower price, and to make consumption of the Cybernuts candy bar the "hip" thing to do.

Business-Level Strategy and the Value Chain Model

You have to decide where you want your business to fit in the marketplace. Are you going to:
1. Become the low-cost producer
2. Differentiate your product or service
3. Change the scope of competition

Leveraging Technology in the Value Chain

Be better than the competition. That's the mantra of most companies that are serious about winning the game. Areas of the organization most affected by leveraging technology are producing the product, getting it to the stores, and making the customer happy. Think of all the activities that go into getting the Cybernuts candy bar made, from procuring raw materials to actual production. Then consider how the candy bar gets from the factory to the store shelves. And what about all those product commercials? These are primary activities. Just as important are support activities: Human Resources, Accounting, Finance. These functions support the primary functions of Production, Shipping, and Sales and Marketing. The value chain model that Laudon and Laudon discuss in the text will help an organization focus on these activities and determine which are critical to its success.

Information System Products and Services

Cybernuts uses a better recipe for making chocolate than any other candy bar. We know that from our Knowledge Worker System. Sales and Marketing can use that information in promotional campaigns to advertise how much better and different Cybernuts is than any candy bar the consumer has ever eaten. Since our Office Automation System is top-notch and the clerical workers processed the patent information so quickly, our competition can't duplicate the recipe. They are left with the old, icky, bad-tasting chocolate everyone is tired of. Product differentiation allows you to bury the competition by making your product and service so different that your competitors can't match them.

Systems to Focus on Market Niche

Through the use of datamining, WorldWide's Product Research Department determined that most moms wanted a candy bar that
didn't melt so fast and mess up kidsÕ clothes or the furniture. Since our Information Systems are integrated throughout the company, our Knowledge Workers were able to alter the recipe for Cybernuts to keep the chocolate in a more solid state. Now we can use focused differentiation in our promotional advertising by telling potential customers that the chocolate won't melt so fast.

We also have useful information from our integrated Information Systems that tells us consumers want a bigger candy bar for the same or a lower price. We can now differentiate Cybernuts as being bigger than the competition's candy bars, therefore better, while the price is the same as the competitor's smaller candy bar.

Supply Chain Management and Efficient Customer Response Systems

Because of the tight link WorldWide has developed with SugarSweet Refiners, WorldWide has significantly reduced the cost of its product. Because of the integration of Information Systems throughout the organization, it can reduce costs and price Cybernuts well below the competition's candy bar. And because of the Information System WorldWide has developed with the convenience stores, the stores never have to worry about running out of Cybernuts because WorldWide will know to ship more product when the stock falls to a preset level. Supply chain management offers new opportunities for companies to integrate with suppliers and customers and lower costs for everyone.

Since WorldWide Candy doesn't grow its own sugar cane, it must purchase the refined sugar from a supplier, SugarSweet Refiners. WorldWide buys a lot of sugar, as you can imagine. If it develops some kind of link with SugarSweet that is mutually beneficial to both sides, then each one can reduce costs but also develop a pricing policy that gives WorldWide significant cost savings. So WorldWide and SugarSweet decide they will use an integrated Information System that replaces the old-style purchasing paperwork with electronic billing and shipping.

WorldWide Candy now places sugar orders via an electronic system that is tied directly to SugarSweet's electronic shipping system.
Neither company has to process paperwork for orders or deliveries. Look at all the time and money both sides are saving, not to mention the reduction in errors that are inherent in any manual system. However, by tying into this method of ordering and delivering, it will be very expensive for WorldWide to find another sugar supplier. It will also be a significant loss to SugarSweet if it loses WorldWide as a customer because now it will have to find another company and set up the same system. So both sides are locked into this mutual system.

On the flip side, WorldWide knows that it costs five times as much money to get a new customer as it does to keep an old customer. It decides to lock in its customers (in this case convenience stores that stock Cybernuts candy bars) by making it more expensive for that customer to switch to the competition. WorldWide offers to keep all the sales statistics for products on its Information System and to give that information to customers when it's convenient and in the format they require. That way the store doesn't have to track data and spend the money to process them into useful information. Through WorldWide's information system it, and not the convenience store, can keep track of stock levels and know when more products are needed. Through this agreement, WorldWide develops a link to customers that the customer finds extremely useful.

You see, **switching costs**, as described in this section, works both ways: between suppliers and companies, and from companies to customers.

**Firm-Level Strategy and Information Technology**

Think of a picture puzzle with all its separate pieces scattered on the table. Separately, the pieces don't make a very pretty picture. But if you fit them together, they make quite a beautiful piece of art. So too for businesses. Separately, the various units of a business don't function well and certainly aren't successful on their own. But if you fit them all together, so they work in conjunction, you can create a successful business. Information technology can help you do this.
What does a business do better than anyone else? Does it make the best jeans in the world? Do they produce the best movies? Does it deliver flowers faster and fresher than any of the competition? Whatever its main product or service is, that's its core competency. Successful companies can use information technology to improve their core competencies by sharing information across business units. They can also use technology to expand their core competencies by using knowledge stored in their information systems.

**Industry-Level Strategy and Information Systems:**
**Competitive Forces and Network Economics**

Look at the relationship between America OnLine and Microsoft. On one hand, they are fierce competitors, going head to head in attracting Web users to their respective Web sites. On the other hand, they work together to supply Web users with desktop icons for accessing the Web. How is it that they can compete so vigorously in one area and yet cooperate so well in another? Because both make sense and make money for each company.

**Information Partnerships**

Many times it's more productive and cheaper to share information with other companies than to create it yourself. Information partnerships between companies, even competitors, can enhance a company's products by aligning them with an industry-wide standard. Vehicle tire manufacturers form information partnerships to share information about standard widths and sizes of tires. Can you imagine how difficult it would be for consumers and other businesses if each tire maker built tires differently?

Other companies form information partnerships to add extra elements to their products which they couldn't offer on their own. Lots of companies offer credit cards with their logo and company information. They then share customer information with the credit card companies. Both companies win because they can offer extra services and products not available if they had to act alone.
The Competitive Forces Model

One way you can help your company compete is to have more information in a better form than the competition does. If WorldWide happens to know that the price of sugar usually falls in mid-summer, it can plan ahead and get a better price for the ingredient. Simply put, good information in a timely manner can help you win the game.

Figure 2.1

The competitive forces model.

Figure 2.14 shows the competitive forces model. The text describes five external threats and opportunities:
Threat of new entrants into its market. The upstarts can give you fits when you least expect it - Amazon.com is a good example.

Pressure from substitute products or services. Even if they aren't better than your product, substitutes may be cheaper and customers will be enticed by the lower price.

Bargaining power of customers. The Internet offers customers a unique opportunity to quickly and easily compare prices.

Bargaining power of suppliers. New technology offers suppliers the chance to integrate information systems that tie them closer to their customers.

Positioning of traditional industry competitors. Efficient business processes can give companies the edge they need to place themselves in the lead.

Network Economics

You decide to throw a big party and invite a hundred of your closest friends. You buy tons of food and beverages-lots more than you really need. At the last minute, Sam calls and asks if he can bring his brother who unexpectedly dropped by. You agree since you won’t have to purchase more food. The marginal cost of one more guest at your party is zero.

That’s how network economics work. If you build a network for a thousand users, adding one more probably won't cost you anything. However, if you add the second thousand users, you'll incur the cost of adding those extra users. The more users you add, the more your community is enriched. Allowing Sam's brother to attend your party enriched the experience for all, since he is a very popular rock star who plays excellent guitar!

Many companies doing business on the Internet are realizing the value of network economics. They build Web sites to attract customers and then keep them coming back by providing chat rooms and other services for the customers. It doesn't cost much more to
add these extra features, since they’ve already built the Web site and have the hardware available. However, the additional customer information they gather from the chat rooms and information forums is invaluable.

**Bottom Line:** Using Information Systems can help a company beat the competition through differentiation and providing services that are valuable to both customers and suppliers. Companies can also use Information Systems to reduce costs below those of the competition and to improve core competencies.

### 2.3 Using Systems for Competitive Advantage: Management Issues

Using Information Systems to beat the competition and increase the value of your product is not easy at all. It requires changing processes and methods that probably have been in the organization since time began. The responsibility for successfully developing and then using an integrated Information System will usually fall to the managers throughout the organization.

**Managing Strategic Transitions**

The changes taking place in an organization affect both the social element and the technical element of the organization and are **strategic transitions**. When your company installs a new information system, some people will lose their jobs, managers may be reassigned, hopefully you'll gain new customers, and your relationship with your old customers may change. At the very least, when a company installs a new system, the business processes should metamorphose to accommodate the new technologies.
Retail businesses realize the value of **vender-managed inventory** and are eager to embrace it. Convenience stores and grocery stores give the responsibility for stocking shelves to their vendors. Tying those vendors into the store's information system gives the vendor critical information about stock levels and the pace of sales. Inventory costs for both retailer and vendor are reduced and the quality of information improves for both.

**What Managers Can Do**

The important thing to remember is the need to pay attention to the industry to which your business belongs. Look at what others are doing and how they're doing it. What are they doing right? What are they doing wrong. What can you do better than your competitors? What technologies can you exploit that the rest of your industry isn't using? Laudon and Laudon have an excellent list of questions on page 62 that managers should ask when identifying and developing a successful Information System. Take a moment to review them.

What are some of the forces at work in the industry?
How is the industry currently using information systems?
Which organizations are the industry leaders in the application of information systems technology?
How is the industry changing?
Should the firm be looking at new ways of doing business?
Are significant strategic opportunities to be gained by introducing new information systems technology?
Is the organization behind or ahead of the industry?
What is the current business strategic plan, and how does that plan mesh with the current strategy for information services?
Does the firm have the technology and capital required to develop a strategic information systems initiative? (Kettinger et al., 1994)
Where would new information services provide the greatest value to the firm?
Bottom Line: A well-developed strategic Information System that is integrated throughout the company can be used to lower costs overall and provide greater value to the company, the supplier, and the customer.

Discussion Questions:

Click on the Discussion icon in the top toolbar to answer the following Discussion Questions.

1. How can a Transaction Processing System help an organization's strategic level planning?

2. Determine the type of questions that the various information systems can answer for the differing organizational levels in a company.

3. How can managers use Information Systems to develop tighter relationships with suppliers and customers?

4. How can managers use Information Systems to play a strategic role in their organization?

5. Explain how a company can use Information Systems to improve its core competencies.

Chapter 3: Information Systems, Organizations, and Business Processes

3.1 The Relationship Between Organizations and Information Systems
3.2 Salient Features of Information Systems
3.3 How Organizations Affect Information Systems
3.4 How Information Systems Affect Organizations

Discussion Questions

3.1 The Relationship Between Organizations and Information Systems

Chapter 3 describes how organizations and information systems work together, or sometimes against each other. The idea of course is to keep them in sync, but that's not always possible. We'll look at the nature of organizations and how they relate to Information Systems.

The Two-Way Relationship

FIGURE 3.1
This figure shows the complexity of the relationship between organizations and information technology. Installing a new system or changing the old one involves much more than simply plunking down new terminals on everyone's desk. The greatest influence, as the text points out, could simply be sheer luck!

What Is an Organization?

An organization is very similar to the Information System described in Chapter 1. Remember the figure from Chapter 1? Compare it to the figure from Chapter 3.

FIGURE 1.2
Figure 1.2 Functions of an information system
These figures have many things in common. Both require inputs and some sort of processing, both have outputs, and both then depend on feedback for successful completion of the loop.

Information Systems use data as their main ingredient. Organizations rely on people. However, the similarities are remarkable. They are both a structured method of turning raw products (data/people) into useful entities (information/producers).

Think of some of the organizations you've been involved in. Didn't each of them have a structure, even if it wasn't readily apparent? Perhaps the organization seemed chaotic or didn't seem to have any real purpose. Maybe that was due to poor input, broken-down processing, or unclear output. It could very well be that feedback was ignored or missing altogether.

Often times an organization's technical definition, the way it's supposed to work, is quite different from the behavioral definition, the way it really works. For instance, even though Sally is technically assigned to the Production Department with Sam as her supervisor on paper, she really works for Tom in Engineering. When a company is developing a new information system, it's important to keep both the technical and behavioral definitions in perspective and build the system accordingly.
3.2 Salient Features of Organizations

This section gives you a perspective on how organizations are constructed and compares their common and uncommon features.

Why Organizations Are So Much Alike: Common Features

The class you're enrolled is an organization of sorts, isn't it? Think about it. Look at the table describing the characteristics of an organization:

When you hear the term bureaucracy, you immediately think of government agencies. Not so; bureaucracies exist in many private and public companies. Bureaucracies are simply very formal organizations with strict divisions of labor and very structured ways of accomplishing tasks. They are usually thought of in a negative way, but they can be positive.

Standard Operating Procedures

How many of these characteristics fit your college class? How many fit any organization you're in? Some of the Standard Operating Procedures (SOPs), politics, and culture are so ingrained in organizations that they actually hinder the success of the group. Think about your experiences in groups. You had a leader (hierarchy), a set of rules by which you operated (explicit rules and procedures), and people appointed to perform certain tasks (clear division of labor). You probably voted on different issues (impartial judgments), and you decided on the best person to fill various positions within the group (technical qualifications for positions). Hopefully, the organization was able to fulfill its goals (maximum organizational efficiency), whether winning a softball game or putting on an award-winning play. If your organization wasn't successful, perhaps it was because of the SOPs, the politics, or the culture.

The point is, every group of people is an organization. The interesting question you could ask yourself would be "How would the world look and function without some kind of organization?"
Organizational Politics

Everyone has their own opinion about how things should get done. People have competing points of view. What might be good for Accounting may not be to the advantage of Human Resources. The Production Department may have a different agenda for certain tasks than the Shipping Department. Especially when it comes to the allocation of important resources in an organization, competition heats up between people and departments. The internal competition can have a positive or negative influence on the organization, depending on how it's handled by management. The fact remains that politics exist in every organization and should be taken into account when it comes to the structure of the information system.

Organizational Culture

Just as countries or groups of people have their own habits, methods, norms, and values, so too do businesses. It's not unusual for companies to experience clashes between the culture and desired changes brought about by new technologies. Many companies are facing such challenges as they move toward a totally different way of working, thanks to the Internet.

**Why Organizations Are So Different: Unique Features**

Would you consider the same organizational structure for a softball team as you would for a theatre production group? While there would be some similarities, the two groups would probably have some major differences. An automobile dealership would have some similarities to a department store (both sell products) and yet they would have major structural differences. We talked about virtual organizations in Chapter 1. Organizations that enter into collaborative partnerships tend to seek out companies with similar structures. It is much easier for the employees to work together if they aren't required to learn a whole different work structure on top of learning new tasks.

Different Organizational Types
<table>
<thead>
<tr>
<th>Organizational Type</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entrepreneurial structure</td>
<td>Young, small firm in a fast-changing environment. It has a simple structure and is managed by an entrepreneur serving as its single chef executive officer.</td>
<td>Small start-up business</td>
</tr>
<tr>
<td>Machine bureaucracy</td>
<td>Large bureaucracy existing in a slowly changing environment, producing standard products. It is dominated by a centralized management team and centralized decision making.</td>
<td>Midsized manufacturing firm.</td>
</tr>
<tr>
<td>Divisionalized bureaucracy</td>
<td>Combination of multiple machine bureaucracies, each producing a different product or service, all topped by one central headquarters.</td>
<td>Fortune 500 firms, such as General Motors.</td>
</tr>
<tr>
<td>Professional bureaucracy</td>
<td>Knowledge-based organization where goods and services depend on the expertise and knowledge of professionals. Dominated by department heads with weak centralized authority.</td>
<td>Law firms, school systems, hospitals.</td>
</tr>
<tr>
<td>Adhocracy</td>
<td>&quot;Task force&quot; organization that must respond to rapidly changing environments. Consists of large groups of specialists organized into short-lived multidisciplinary teams and a weak central management.</td>
<td>Consulting firms such as the Rand Corporation</td>
</tr>
</tbody>
</table>

**TABLE 3.2**
This table shows some common organizational structures. Think about your own experiences, in your workplace or your daily life, and try to list some organizations that fit into each category. They're all around you. Remember, just as organizations affect you in many different ways, so too do you affect the organizations.

Organizations and Environments

Some organizations are able to respond faster and better than others. Look back 10 years: The minivan didn't exist. But because of changing consumer requirements and tastes, the minivan is now one of the most popular and best selling vehicles on the road. If the organizations called automobile manufacturers hadn't responded to the changing environment, they wouldn't have been able to capitalize on new car sales. Notice that Chrysler responded faster than the others and gained tremendous market share in the meantime. Its organization is almost as big as those of Ford and GM. Yet those two weren't able to respond as rapidly to environmental changes and hence lost potential sales.

Organizations differ because their ultimate goals differ. Some organizations are small by nature or small by design. Using the same thought process as you did for recognizing the different structures in organizations around you, think about the differences in those organizations. Why are they different: size, goals, environmental factors that restrict their growth?

For instance, contrast a real estate company with an insurance company. The real estate company is constantly looking for new customers (buyers and sellers) and new products (houses or commercial properties) to sell. It may choose to stay small or to go with a nationwide conglomerate. The environmental factors that are likely to influence it are the state of the national economy or the nature of the local economy. Many external factors are out of its control. The employees of the company must respond quickly to potential customers or they simply won't make any money. This type of organization must be creative in the way it generates business and in the systems it uses.
On the other hand, the insurance company has relatively stable customers. People sign up with the insurer and pay their premiums on a regular basis. While customers may come and go, turnover is fairly low. Because most state governments require people to carry insurance, the company and its agents have a stable stream of income from premiums. While the parent company may suffer large losses from a sudden influx of customer claims, the small agency is not as heavily influenced by environmental factors. It doesn't have to devise ingenious ways of using or generating data, and its systems needs are very ordinary.

Both businesses are small and entrepreneurial. But they must respond to employees, customers, and potential customers in very different ways. Each has different business processes it must use to meet the goal of staying in business.

Other Differences among Organizations

The external forces on an organization are tremendous. You're living in a time when these forces are causing many organizations—public, private, and governmental—to reevaluate and alter their organizations because of the Internet. Some organizations are responding faster and easier than others. Why? Much of the cause can be attributed to the structure of the organization.

If the structure and culture of the organization promotes new ideas, new products, and new methods, the organization can deal with environmental changes faster than a more staid organizational structure. Some companies are simply so big that they can't change their structure as fast as technology demands.

**Business Processes**

What would happen if you walked into work one day to find the management telling employees they could do anything, anything at all, they wanted to do that day. If Jimmy from Production decided he wanted to work in Sales and Marketing, he could. If Sally, who normally works in Accounting, wanted to spend the day in Shipping,
she could do that too. No one would have to follow any rules, or any set procedures. They could accomplish the work any way they chose.

Mary decides she doesn't want to use FedEx to ship out products that day even though the company has a contract that saves lots of money. She decides to use an alternate shipping service which will cost the company more and slow down the shipment significantly. She doesn't see a need to tell Accounting about the change.

Jimmy decides not to use the same old packing materials when he's preparing glass bowls for movement across the country. He determines that it is faster if he just plops the bowls into a box, closes the lid, and sends it down the line. Unfortunately, his co-worker Tim (who doesn't know anything about Jimmy's decision) is responsible for answering customer complaints.

Bill in Accounting decides that he needs a pay raise to help pay for his upcoming vacation. Normally he would be required to get his supervisor's approval to change any pay record, but since there aren't any established procedures he can just go ahead and enter the new salary data in the system. While he's at it, he gives ten of his best friends pay raises also. While Bill's friends may like the idea, the rest of the employees in the company are pretty upset.

You can imagine from this scenario how quickly chaos would reign without established **business processes**. Processes that deliver the best product for the lowest cost in the most efficient manner are imperative to success. The way a business organizes its workflows, the methods it uses to accomplish tasks, and the way it coordinates its activities among employees, customers, and suppliers determines its business processes. Organizations, from the smallest one- or two-person group to the largest you can imagine, must have orderly processes that all divisions can understand. No part of the organization can work in isolation from any other part.

Some processes may have contributed to the organization's success and now outgrown their usefulness. Information Systems can help an organization recognize processes that need to be changed. An Information System could be used to automate some of those
processes or determine that they are no longer needed. And a successful organization will use an Information System to determine which processes are working well.

The key to using Information Systems to analyze, change, automate, or delete processes is that the organization must determine the appropriateness of the recommendations. In other words, if the system says a process should be changed but it truly doesn't make sense to change it, then don't make the change. The system supplies recommendations; humans still have the ultimate decision-making responsibility.

**Levels of Analysis**

As we found out in Chapter 2, every organization has many separate functions and different levels of management. It wouldn't make good sense for an executive to use a Transaction Processing System to determine whether the company should merge with another. The Production Manager wouldn't want the external data contained in a Decision Support System to help her count the number of candy bars produced.

As you move up the management levels of an organization, the span of consideration widens to include not just a single entity, but multiple departments or divisions. The Information System must respond to this widening circle of interest and supply increased information useful to the level of management using it.

**Bottom Line:** Each organization shares common characteristics. On the other hand, each organization has unique characteristics that should be taken into account when incorporating technology. Let the organization drive the system, not the other way around.

3.3 How Organizations Affect Information Systems

Change is the only constant in the relationship between information systems and organizations. You need to consider:
How have organizations actually used information systems?
How has the organizational role of information systems changed?
Who operates information systems?
Why do organizations adopt information systems in the first place?

*Decisions about the Role of Information Systems*

Years ago Information Systems consisted of a huge mainframe computer with a few terminals connected to it. You had to schedule a specific time to use the computer if your company had one at all. All data were kept on one machine, and in some respects the data were available to whoever could access them.

When personal computers were introduced in the early 1980s, it became the norm for most people to have individual computing islands on their desks. The computers weren't connected, so if you wanted to exchange data or information, you had to somehow get the data from your desk to the other person's desk. It wasn't easy.

Now it seems we've come full circle: we've combined the storage and data processing on a central machine with personal computing available on desktops. The data are available to anyone who can use them or has authorized access through a network with links literally all over the world.

The changes that have taken place in computing have affected the business environment in a big way. Over 40% of the equipment investment in the last decade has been for computing equipment. Organizations are finding more efficient ways to accomplish tasks via networking, either through internal networks or by connecting to external networks. Technology has caused many changes in the way businesses connect to customers and suppliers. We'll examine many of these changes throughout this course.

*Information Technology Services*
Many new jobs have been created because of technology. **Information Systems departments**, previously a tiny group of people usually assigned to the financial group, have moved into the mainstream of most companies. **Programmers** have taken on more important positions within organizations. They must understand not only the technical side of computing, but also the business processes within the company so they can adapt the technology to the needs of the business. **System analysts** serve as the bridge between the techies and the non-techies. Heading this group of people are the **information systems managers**. Their importance to businesses has grown as the emphasis on technology’s role within organizations has grown. Just as most organizations have a **Chief Financial Officer**, the position of Chief Information Officer has been created to handle the problems and opportunities businesses face in today’s technologically driven environment.

Perhaps the most important role of all is the **end user**. The responsibility for successful integration of Information Systems has extended past the "techies" and become part of everyone’s job. No one is isolated from the effects of computers and technology any more.

*Why Organizations Build Information Systems*

**FIGURE 3.9**

The systems development process.
Organizations incorporate technology for many reasons. The most obvious reason should be to save money through improved work processes and reduced manpower requirements, and to beat the competition. Unfortunately, some organizations adopt the latest technology just because the competition has it. The company may not fully understand all the implications of incorporating the new technology into its core business and fail dismally. Some companies use Information Systems to help them create a better mousetrap. That is, they use the advantages of Information Systems to create new services, build better products more efficiently, or invent new products altogether.

But there is more to an organization that what happens internally. Much of what drives change in an organization, good or bad, are external forces (environmental factors). Over the last decade or so, government entities and the public at large have demanded more and more information. Consumers want more information about the products or services companies produce, and the government requires more and more paperwork.

It can be prohibitively expensive for a company to use pencil and paper to gather, process, disseminate, and store all the required information. Information Systems make the whole process easier and more efficient. Ease in dissemination of information is most evident in the many informational Web sites companies have set up.

The very nature of a business may change in such a way that it is possible to carry on only by incorporating an Information System (institutional factors). For instance, all the major airlines offer programs that give customers incentives for flying with their company instead of the competition. The airlines couldn't afford to offer these programs if it weren't for Information Systems. Imagine the number of workers it would take, not to mention the time and paper, to track every customer earning and using the incentives.

3.4 How Information Systems Affect Organizations
Laudon and Laudon discuss two major types of theories about how Information Systems affect organizations: economic theories and behavioral theories.

**Economic Theories**

It’s sometimes cheaper to hire a computer than to hire a person. We may not like the idea that machines can replace human beings, but when you think about it, they have been doing this for thousands of years *(microeconomic model)*.

To better illustrate this concept, let’s take a look at how a company can find it cheaper to use an Information System to develop and disseminate a Human Resources policy regarding dress codes for employees. The HR assistant may write the first draft of the policy and give it to the HR director on paper. The director will review it and make changes. The assistant then must incorporate the changes and reprint the document. Wait! If there is an Information System, the assistant can submit the draft to the director electronically and the director can make changes to the electronic version of the file and return it to the assistant. Already we’ve saved part of a tree!

Of course others in the organization must review the new dress code policy. The proposed policy can be printed in fifteen copies, a person can manually send the copies out, track where they went and when, and then track all the changes made to the proposal. Or, the proposed policy can be sent electronically to reviewers who will electronically collaborate on necessary changes. Each of the reviewers can see in "real time" what the others think and the changes they would like to make. We’ve saved another part of the tree in reduced paper use, but we’ve also saved a lot of time and effort.

Once the policy is set, it has to be sent to each employee. We could do that through the old method of printing hundreds of copies. Or we could send the policy to each person electronically (email). Everyone would have a personal copy stored on computer. There no need to print it out on paper since it will be stored electronically and can be
accessed whenever it is convenient. By acknowledging receipt of the policy via email, the HR department knows everyone has received it.

So what about the people who don't have their own personal computer? You could post the new policy to the company Intranet, which would be available to all employees whenever they find it convenient. Again, time and resources are cut drastically through the use of an Information System. If the policy needs to be revised, the same process can be used to make and send out changes. The revised policy can be posted on the Intranet for all to see.

This is just one example of how technology is helping organizations reduce the costs of doing business. The transaction cost theory supports the idea that through technology, businesses can reduce the costs of processing transactions with the same zeal that they use to reduce production costs.

One way that technology in general, and information systems in particular, save companies a lot of money is in the reduced number of managers needed to oversee larger numbers of workers. The technological changes support agency theory, which says that owners hire agents to do work but then must have others supervise the agents to be sure they work in the company’s interest. Technology allows a manager to supervise more employees, thus reducing agency cost.

Behavioral Theories

Technology doesn't automatically transform organizations. There is no magic wand companies can wave and have all their problems solved just because they install the latest information system.

People using technology efficiently and effectively, however, can transform organizations. Communications up and down the organization and from one department to another on the same managerial level can be enhanced and increased by using technology. As our example with the dress code policy shows, communications are much faster and better using technology. The lines of communication are shorter, clearer, and more concise.
Technology makes virtual organizations more feasible, cheaper, and easier to set up and tear down than before. If you had a small group of people from each functional area of the company collaborating on a new production method, you can bring them together, hammer out the new methodology, and then return them to their regularly assigned units.

Let's say your company decides to develop a new method of shipping hammers. You would need to draw people from the Production department, the Shipping department, the Packaging department, and the Accounting department to help develop the new procedures. Without an Information System, you would need to have a clerical worker available to record and send out all the information to everyone before and after the meetings. You would have to set up a time and place for team members to meet. Scheduling everyone's time is often a nightmare! Because of the political nature of organizations and people, which we'll talk about later in this chapter, most of those assigned to this team would probably have to be middle managers.

If your company had the proper Information System, much of the hassle and expense of this scenario could be eliminated. By using technology, most of the collaboration and communication throughout the organization, top to bottom, side to side, could be accomplished quicker and cheaper.

One of the biggest benefits would be the fact that the decision-making process can be pushed to lower levels, and management can check progress electronically. Perhaps the managers wouldn't be as afraid to delegate responsibility because they can keep an eye on the committee throughout the process. Everyone in the entire organization could have access to the work of the committee. What about those people not physically located in the same place? No problem: electronically they have the same access to the process as everyone else.

The behavioral theory of the integration of Information Systems in an organization says that the political structure of an organization changes through access to information. The common status symbol
in an organization used to be the corner office. Now the status symbol is how much information a person has access to.

When a company introduces change to the organizational structure because of a new or revamped information system, political changes will occur at the same time. Some people will gain and some will lose. Naturally people will resist changes that affect them negatively. It's human nature.

**The Internet and Organizations**

The example used earlier of posting personnel policies to the company Intranet is but one small example of how businesses are using network technologies to reduce costs and enhance their business processes. Business-to-business commerce is growing at a tremendous pace because of the cost savings the Internet allows. The Internet provides an open platform technology which allows transaction processing between businesses at much cheaper cost plus an easy-to-use interface. The innovative ways organizations are using the Internet, Intranets, and Extranets to improve their business processes are simply amazing.

**Implications for the Design and Understanding of Information Systems**

The integration of an Information System into an organization naturally causes change for the organization. Sounds simple enough. What isn't so simple to manage is the very fact that many people do not readily accept change. No matter how much technology you employ, it is still the people of an organization who will make or break it. Remember the triangle introduced in Chapter 2, when we discussed hardware, software, and persware? It's back!

Change can be so traumatic to some organizations that they find it easier to keep doing business the same old way for as long as they can get away with it. That's why some organizations seem to be stuck doing business the way they did in 1969.
The text has a comprehensive checklist of organizational factors you should consider when developing a systems plan. We'll examine each of these factors in greater detail in the next chapter.

**Bottom Line:** For some jobs, it's better to employ technology than to employ a person. Companies need to tailor their Information System uses to the needs of the organization, instead of letting the "wonders of technology" drive the organization. Technology can reduce costs and increase the amount of information people have access to. The changes brought about by the introduction of new technology and new methods must be managed carefully. No successful manager can lose sight of the effect change will have on the people of the organization.

**Discussion Questions:**

Click on the Discussion icon in the top toolbar to answer the following Discussion Questions.

1. Look at an organization you belong to. How are decisions made in this organization?
2. Describe the difference between the economic theory and the behavioral theory of how information systems affect organizations.
3. Examine the political structure of an organization to which you belong. Determine how the structure would change if it installed a new information system.
4. How has the Internet affected the way you interact with businesses or companies with which you do business, personal or professional.

**Chapter 4: Information, Management, and Decision Making**

4.1 What Managers Do
4.2 Introduction to Decision Making
4.3 Individual Models of Decision Making
4.4 Organizational Models of Decision Making
4.5 How Information Technology Has Changed the Management Process
Discussion Questions

4.1 What Managers Do

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.

An organization's success is built around its managers, but also relies on technical competence, adaptability to its environments, and a thorough knowledge of its product and production processes. Some companies seem to "get it," while others companies just seem to get lost! Why? Management is the answer: management of the employees, management of the product, and management of information.

Three Schools of Management

Let's take a close look at the three schools of management (technical-rational perspective, behavioral, and cognitive), and see how they fit into different organizations. As we discuss the management theories you should concentrate on how they would use various
information system configurations to enhance their characteristics.

**FIGURE 4.1**

The evolution of management theory.

**The Technical-Rational Perspective**

The technical-rational or classical perspective basically views people as machines. The manager's job is to keep the machine running smoothly and in concert with all the other machines. The manager is also responsible for creating an administration that keeps the machine well-oiled and fixes any broken parts.

Henri Fayol's classic theory of management says managers perform five distinct functions:

- Planning
- Organizing
Coordinating
Deciding
Controlling

In order to fulfill each of these functions, a manager must communicate. Think about it. If a manager devises a plan, doesn't she have to tell someone what that plan is? If the manager coordinates a new plan, doesn't he have to communicate with someone about the new plan? If the manager makes a decision, doesn't someone have to know what that decision is?

The people a manager communicates with, regardless of the action, are all around him/her. They could be at a lower or higher management level. They could be inside or outside the organization. It doesn't matter.

The role of information systems, using the technical-rational perspective, is to improve the mechanical operation of the organization.

**Behavioral Perspective**

We all know that humans aren't machines. They don't work in isolation from other humans, and there are many more factors to take into consideration when managing humans rather than machines. The behavioral perspective takes these important characteristics into account. Just as humans are living, breathing, ever-changing beings, so too are organizations.

The manager's role is to assist the organization in continually changing and adapting to its environment.

This management theory gives you insight into the use of information systems to enhance the effectiveness of the organization. It has had a powerful influence on the field of information systems:

User acceptance literature emphasizes the sociological and psychological aspects of the system success.
Strategic IS literature emphasizes the importance of responding to and dominating the environment. Network organization and virtual organization literature emphasizes organizing labor without traditional hierarchies.

Managerial Roles: Mintzberg

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

- **Interpersonal.** Managers act as representatives 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.

How Managers Get Things Done: Kotter

Kotter argues that managers are always looking out for themselves. They establish agendas and goals, build interpersonal networks, and then execute their own personal agendas.

What Managers Decide: Wrapp

Wrapp's theory of management describes managers not as dictators but as guides. They guide the people and the organization as a whole toward consensus goals. They understand that no part of the organization can work in isolation from other parts and that it takes the whole team to win the game.

**The Cognitive Perspective and Postmodern Era**

To be successful, the **cognitive perspective** says an organization must create and use information to its utmost advantage. The organization must gather, create, store, disseminate, and use information and knowledge. The effective manager will make sense of the situation, help the organization act in its best interest, and
create the proper infrastructure for information- and knowledge-processing to the advantage of the organization.

This management theory has evolved in and from the computer revolution of the last few decades as information systems proliferated and improved. The organization can now get a better sense of its environment, internal and external, and how to create and use information through and from the Internet.

Managerial Sense-making

**FIGURE 4.2**

Managerial sense-making.

**Managerial sense-making** is the philosophy of managers’ properly defining a situation for both the employees and the organization. The old adage "Let's make sense of it all" are the operative words. Some managers are more successful at this than others. As depicted in Figure 4-2, the successful manager:

- Creates knowledge structures by filtering information from the environment. Not every tidbit of information is worthwhile.
- Solves problems and makes decisions. If the manager is successful, then the organization triumphs.
Processes information. The information may be internal or external. Creates information-processing structures, programs, and routines. The manager decides what information is needed based on his/her definition of the situation.

The Knowledge-Based View of the Firm

Managerial sense-making focuses on the individual manager. The knowledge-based view focuses on the organization's ability to gather, produce, maintain, and disseminate knowledge. Some organizations require more intense information and knowledge gathering in order to produce their products and services than others. For instance, the Research and Development department of a candy manufacturer has more need for knowledge-based information systems than would the Production Department. That's not to say the Production Department has no need for knowledge or for information, but its tasks are less dependent on knowledge-based systems and more dependent on transaction processing systems.

Regardless of the management model followed, managers spend most of their time communicating: listening, talking, reading, writing. The use of email 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. Remember the Human Resources Department policy on dress codes that the HR manager posted to the Intranet? Communication at its finest!

**Bottom Line:** Management theories abound. An organization must examine the theory it most closely follows and then design the information system to fit. Above all, managers communicate. Make that process easier, cheaper, faster, and more efficient and you've increased the worth of that manager tremendously. Increase the number of people and entities the manager can communicate with, and you reduce the number of managers required.
4.2 Introduction to Decision Making

Everybody makes decisions. It's a natural part of life, and most of the time we don't even think about the process. In an organization, decisions are made at every level. The level at which the decision is made can also determine the complexity of the decision in relation to the input of data and output of information.

Levels of Decision Making

In Chapter 2 we discussed the various types of Information Systems and how they relate to the levels of an organization. We can also relate those Information Systems to the types of decisions managers make.

Strategic Decision Making. These decisions are usually concerned with the major objectives of the organization, such as "Do we need to change the core business we are in?" They also concern policies of the organization, such as "Do we want to support affirmative action?"

Management Control. These decisions affect the use of resources, such as "Do we need to find a different supplier of packaging materials?" Management-level decisions also determine the performance of the operational units, such as "How much is the bottleneck in Production affecting the overall profit and loss of the organization, and what can we do about it?"

Knowledge-Level Decision Making. These decisions determine new ideas or improvements to current products or services. A decision made at this level could be "Do we need to find a new chocolate recipe that results in a radically different taste for our candy bar?"

Operational control. These decisions determine specific tasks that support decisions made at the strategic or managerial levels. An example is "How many candy bars do we produce today?"
**Types of Decisions: Structured versus Unstructured**

Some decisions are very structured while others are very unstructured. You may wake up in the morning and make the structured, routine decision to get out of bed. Then you have to make the unstructured decision of what clothes to wear that day (for some of us this may be a very routine decision!). Structured decisions involve definite procedures and are not necessarily very complex. The more unstructured a decision becomes, the more complex it becomes.

**Types of Decisions and Types of Systems**

![Diagram](image)

**FIGURE 4.4**

Information systems support different decisions at different organization levels.

One size does not fit all when it comes to pairing the types of systems to the types of decisions. Every level of the organization
makes different types of decisions, so the system used should fit the organizational level, as shown in Figure 4.4.

It's easy to develop an information system to support structured decision making. Do you increase production on the day shift or hold it to the swing shift; do you purchase another piece of equipment or repair the old one? What hasn't been so easy to develop is a system that supports the unstructured decision making that takes place in the upper echelons of a company. Do we expand into foreign markets or stay within the confines of our own country; do we build a new plant in Arizona or Alabama; do we stop production of a long-time product due to falling demand or boost our marketing? The ability to create information systems to support the latter decisions is long overdue.

**Stages of Decision Making**

Some people seem to make sudden or impulsive decisions. Other people seem to make very slow, deliberate decisions. But regardless of appearances, the decision-making process follows the same stages of development and implementation. Let's use the example of purchasing a new television, using Figure 4.5.
**FIGURE 4.5**

The decision-making process.

*Intelligence.* You identify the facts: You don't have a television or the one that you do have isn't any good. You intuitively understand what the problem is and the effect it's having on you. You missed your favorite show last night.

*Design.* You design possible solutions: You could watch the television in your neighbor's apartment or you could purchase a new one for yourself. Your neighbor will get annoyed if you keep coming over. On the other hand, you won't be able to go on vacation if you use your money to buy a new television.

*Choice.* You gather data that helps you make a better decision: Your neighbor doesn't like the same shows you like or she's getting rather tired of you being there. You also determine that televisions cost a lot of money so you figure out how you can
afford one. You choose to purchase a new television instead of watching your neighbor's.

*Implementation.* You implement the decision: You stop at the appliance store on your way home from work and carry out your decision to purchase a new television.

*Feedback.* You gather feedback: You're broke but you can watch anything you want!

Of course this is a simplified example of the decision-making process. But the same process is used for almost every decision made by almost every person.

Information Systems help improve the decision-making process by

- providing more information about the problem
- presenting a greater variety of possible alternatives
- showing consequences and effects of choices
- measuring the outcome of different possible solutions
- providing feedback on the decision that is made

**Bottom Line:** Different types of decisions require different types of systems. All decisions follow the same pattern although some may be more complex and require several iterations of the decision-making stages.

### 4.3 Individual Models of Decision Making

No matter how much you know, you can't possibly know everything. No one can possibly know all the input to a decision, process all the possible outcomes, and know every output from the final decision. Neither can an Information System. However, it can gather more input, process it faster, and output more alternatives than a human can.

What a machine can't do is make decisions in context. That could be a positive aspect or a drawback. Humans make decisions based on
experience and in very distinct ways based on their frame of reference. For instance, some people won't buy a certain type of television because they haven't had "good luck" with that brand before. Based on their experience, they choose a different alternative than another person would. Some people will do careful, extensive research into all the possible models of televisions and make a decision based on that data. Some people will purchase the same brand as the one they already have. Others simply walk into the store and point to the model they want.

**The Rational Model**

The rational model of human behavior says that people will evaluate the situation and determine what they want the result to be. They will determine the alternative courses of action, know the consequences of each course, and then pick the course with the biggest payoff. If it were only that easy! Think about some of the decisions you've made recently. Did you have an absolutely clear understanding of the situation and know exactly what you wanted the end result to be? Probably not if you did not evaluate the decision closely and thoroughly. Did you examine every possible solution? Probably not. Did you fully comprehend the consequences of every possible solution? Not likely. Was there only one possible outcome to your decision or were there several?

**Bounded Rationality and Satisficing**

Sometimes people will follow the rational model to a certain extent, with a lot of compromising throughout the decision-making process, by using bounded rationality. That is, they will look at several alternatives, briefly evaluate the consequences of the alternatives, and then pick the solution that will get them closest to where they want to be (satisficing). If they've experienced a similar situation, they'll probably go with the decision most like the previous decision.

**Muddling Through**

Compromise is a very common occurrence in decision-making. Your club needs to raise dues to pay for a new piece of equipment. Some
of your members don’t want to purchase the equipment and others want the best brand on the market. A spirited discussion takes place with each side presenting conflicting opinions. After a while, you agree to purchase a used piece costing only half of the original price. You **muddled through** the decision-making process until everyone agreed on the solution. As it turns out, the decision was similar to one made several years before. By following the previous decision, your group practiced **incremental decision making**.

**Psychological Types and Frames of Reference**

The **cognitive style** theory supports the idea that people make decisions based on their experiences and values. Why are there so many different types and styles of automobiles and trucks? After all, isn’t the basic idea of owning a vehicle simply a matter of how you get from one location to another? Why do you choose a red car over a blue car? Why do some people own a pickup truck in the heart of a major metropolitan area? Isn’t the reason for owning a truck simply to haul things? Major studies have confirmed that people decide the color of their vehicles based on personality type. People choose the type of vehicle, car or truck or minivan, based on their experiences and psychological needs more than for the absolute need for a particular type of transportation.

People are people. Sounds simplified and silly, but it’s one of the best explanations for why people make decisions the way they do. Laudon and Laudon point out that some people use a **systematic decision-making** process, while others use an **intuitive** process. You could argue that one method is better than the other, but it’s an argument you could carry on forever.

**Bottom Line:** You should remember that every decision causes change and that people react to change in many different ways. Some people embrace change; others abhor it. But you can’t make a decision without causing a change somewhere.
4.4 Organizational Models of Decision Making

If it's tough for an individual to make a decision, think how hard it is in an organization with many people all used to making decisions their way! The organizational decision-making process must take into account the various wants and needs of the people who make up that organization. Let's look at various models of organizational decision-making.

Bureaucratic Models

According to the bureaucratic model, the main goal of an organization is the preservation of the organization itself. Change is very slow and difficult because the structure isn't designed for change. Change causes uncertainty, and this type of organization isn't strong on changing anything.

Change is difficult in the bureaucratic organization because most use Standard Operating Procedures to determine how tasks will be accomplished. These SOPs have developed over a long period of time and are usually based on previous decisions and work habits. To some members of the bureaucratic organization, changing the SOPs is to say that the previous methods were inferior or wrong. That's not necessarily the case, since changing environments can bring the need for changing the organization. Nonetheless, changing the bureaucratic organization is a slow and sometimes painful process.

A word of caution: Everyone automatically associates "bureaucratic" with government organizations. Private organizations can be just as interested in preserving their structure. Many private companies could use some drastic changes and improvements, but they don't make them because they are more interested in keeping the status quo.

Political Models of Organizational Choice
The decision-making process in the political model is based not necessarily on what's good for the organization, but on what's good for the players involved. Compromise is more the norm than clear-cut decisions. The goal of this type of organization is to blend the interests of the players into a decision that satisfies as many people or entities as possible.

"Garbage Can" Model

Garbage can model sounds like a funny label, but it's very apt. "Oops" is the operative word in this organization. Too often the people involved in this type of decision making process develop the wrong answer to the wrong question. Any success is purely accidental.

Bottom Line: Understanding how an organization makes decisions can help increase the success of the decisions made.

4.5 How Information Technology Has Changed the Management Process

Times have changed and so have the methods by which managers make decisions. Information technology has helped speed the change in methods.

Traditional and Contemporary Management

Technology has enabled companies to flatten their hierarchies. The last few years has seen an exodus of middle managers. Companies simply didn't need the extra layers because of technological advances that allow lower levels of employees to communicate and collaborate easier and faster than ever before. Managers in these newly flattened organizations are now responsible for making sure employees know the environmental influences on the organization, know the goals of the organization, and adjust the organization to meet the new influences. Managers then free their employees to meet not only the organization's goals, but also their personal goals.
Information systems can help managers and employees work more efficiently and effectively in this new environment by increasing the amount of information available to all employees. Communications are faster and more widespread with new technologies that enable employees and managers to collaborate more closely and work better in teams. New information systems also enable virtual organizations and geographically dispersed teams and groups to work together to meet personal and organizational goals.

**Implications for System Design**

The decision-making process is much different in today's organization than it was just a few years ago. The danger of building a system to accommodate today's process is that it will not take these changes into account. Understanding how people and organizations make decisions will help build a system that can accommodate the organization and the employees.

Information systems should be created not only to help managers and employees make decisions, but also help them better communicate between all levels and units of the organization. Remember, decisions are not made in isolation. More important, decisions affect a wide range of people, and the system should accommodate this fact.

The real danger in using information systems to help make decisions is that the decision-making process will be based on the wrong information. Because managers may assume that the situation is similar to one they experienced before, they may not be as careful as they would be if it were an entirely new situation. For instance, management may decide that the new packaging materials are as good as the old ones because they are the same color.

Therefore managers won't be as careful in studying all the data, all the possible outcomes and the alternatives when making the decision to change suppliers. They make the decision based on the first available alternative that moves them toward their ultimate goal. They find out too late that the packaging materials are not as good as the old ones and they end up with more damaged goods and irate customers.
Information systems should have these characteristics:

They are flexible and provide many options for handling data and evaluating information.
They are capable of supporting a variety of styles, skills, and knowledge.
They are powerful in the sense of having multiple analytical and intuitive models for the evaluation of data and the ability to keep track of many alternatives and consequences.
They reflect the bureaucratic and political requirements of systems.
They reflect an appreciation of the limits of organizational change and an awareness of what information systems can and cannot do.

**Bottom Line:** Using information systems in the decision-making process should be a positive exercise. That is, the system should help managers at all levels make better decisions, more efficiently, to the benefit of a greater number of people, and to improve the organization.

**Discussion Questions:**

**Click on the Discussion icon in the top toolbar to answer the following Discussion Questions.**

1. Why does the technical-rational perspective seem outdated in many organizations?
2. How does the behavioral perspective correct the flaws in the technical-rational perspective?
3. Describe how your organization can or cannot use the knowledge-based view of management.
4. Following the stages of decision making as described in the text, make a decision. Write down each stage of the decision.
5. Analyze your organization according to the three models of organizational decision making. Which one comes closest to describing how your organization makes decisions?
Chapter 5: Ethical and Social Impact of Information Systems

5.1 Understanding Ethical & Social Issues Related To Systems
5.2 Ethics in an Information Society
5.3 The Moral Dimensions of Information Systems

Discussion Questions

5.1 Understanding Ethical & Social Issues Related To Systems

It probably goes without saying that the security and ethical issues raised by the Information Age and specifically the Internet are the most explosive to face our society in decades. It will be many years and many court battles before socially acceptable policies and practices are in place.

You may love the idea that a gardening Web site or a mail order catalog gives you information about what grows best in your backyard (literally your backyard). You might even love the idea that you can sign on to Amazon.com and there's information about a book or CD by your favorite author or artist. If you're not especially interested in Stephen King or Frank Sinatra, don't worry; Amazon.com knows that and so won't bother you with products from those artists.

You are 22 years old, drive a Mazda, like hip-hop music, shop at Macy's at least once a month around the 15th, wear a size 10 dress, live in a small 2 bedroom apartment, have friends or relatives who live in Texas, like eating at Red Lobster, go on a skiing trip to Colorado every Spring Break, missed one semester of school last year due to medical problems, and spend lots of time at the ivillage.com Web site chatting with other females your age. Would it surprise you to know that this information can all be gleaned from various computer records?

On average, each American is listed in about 60 government and 80 private sector databases. On a typical day, each person's name is passed between computers 10 times. A lot of personal information about us has always been available, just not as easily and as readily as today. Massive databases maintained by commercial companies
and governments at all levels now allow profiling like that above to be accomplished easier and faster than ever before.

**A Model for Thinking about Ethical, Social, and Political Issues**

Many of these issues not only touch our society as a whole, but also raise lots of questions for organizations, companies, and the workplace in general. We hear arguments for free speech, personal responsibility, and corporate responsibility. There are discussions about the government's role in all this. At the beginning of Chapter 5, Laudon says: "Suddenly individual actors are confronted with new situations often not covered by the old rules. Social institutions cannot respond overnight to these ripples... Political institutions also require time before developing new laws and often require the demonstration of real harm before they act. In the meantime, you may have to act. You may be forced to act in a legal Ôgray area.Ô"

How you act, individually and as groups, in this gray area may well define the future of our society. Though that may sound a bit dramatic, you must understand that you are part of the development of "acceptable usage" of this new medium and will help define the direction in which it goes. That's no exaggeration: You use the Internet frequently (and be assured the frequency will increase), therefore you are...!
**Five Moral Dimensions of the Information Age**

**FIGURE 5.1**

Ethical, moral, political issues in an information society.

This figure from the text shows the relationship between ethical, social, and political issues in an information society. You could change this diagram somewhat to avoid the impression that the five dimensions are separate. You'd show significant overlap of each area, and most of the diagram would be in shades of gray. The five dimensions we'll discuss are: information rights and obligations, property rights, accountability and control, system quality, and the quality of life.

**Key Technology Trends That Raise Ethical Issues**

Information technologies pose problems and threats to established societal rules, and new advances pose new situations and possible threats to privacy and ethics. In addition to the technologies in the
book, you need to understand the most recent technological threats to your privacy in cyberspace: "Intel announced on January 20 (1999) that it was planning to include a unique Processor Serial Number (PSN) in every one of its new Pentium III chips. According to Intel, the PSN will be used to identify users in electronic commerce and other net-based applications." (http://www.bigbrotherinside.com/, Jan 31, 99) This quote came from a Web site maintained by the Electronic Privacy Information Center (http://www.epic.org), an organization devoted to privacy issues associated with the use of new technologies tied to networks in general and the Internet specifically.

EPIC's concern with the new Intel chip is the pure threat it poses to your private use of the Internet. Intel claims that the serial number will allow easier information gathering by Internet merchants. EPIC claims a much more sinister threat: everything you do and everywhere you go can be tracked by anyone wanting the information. Access the Big Brother Web site, read the article, and judge for yourself.

You say to yourself, "Hey I don't really care. Nobody will ever care about what I do or where I go on the Internet." Well, you might want to think twice about that. There have been reported instances of companies accessing databases from various sources as part of the screening process to determine what chatrooms, Web sites, etc., prospective employees have visited. How can that be, you ask? The technological trends Laudon and Laudon discuss, such as advances in data storage, will give you one clue. The scenario at the beginning of this section about a personal profile is possible through the technique called datamining. It can and has been done, so you should be concerned and you should care.

**Bottom Line: Technological trends are posing new situations and questions we haven't had to deal with before. Since it's your world and your future, you should be concerned and become involved in their resolution.**
5.3 The Moral Dimensions of Information Systems

This section examines the five moral dimensions (information rights, property rights, accountability, liability, and control, system quality, and the quality of life) by asking you to examine them from a personal standpoint.

Information Rights: Privacy and Freedom in an Information Society

There have been some attempts to regulate the collection and use of information about individuals, as the table shows.

Table 5.1 Fair Information Practices Principles

1. There should be no personal record systems whose existence is secret.
2. Individuals have rights of access, inspection, review, and amendment to systems that contain information about them.
3. There must be no use of personal information for purposes other than those for which it was gathered without prior consent.
4. Managers of systems are responsible and can be held accountable and liable for the damage done by systems for their reliability and security.
5. Governments have the right to intervene in the information relationships among private parties.

Table 5.1

Many of us take our privacy and freedom for granted. You should be aware of how technology is changing and challenging our basic assumptions about these issues. Video rental records are more protected from misuse and prying than are your medical records. It's a fact.

We all assume that the Constitution guarantees by our personal privacy and freedom from surveillance. If someone set up a video
camera inside your dorm room or on your front porch to monitor your every movement, what would you do? In some cases, that's similar to what happens when you access some Web sites. So how do we protect our privacy and freedom from surveillance in a high-tech world?

The text provides some information regarding privacy rights protected by law and established practices. But before you jump up and say, "Hey, the Privacy Act of 1974 says you can't spy on me," remember that law applies only to the federal government's actions. If Macy's or Playboy or Buy.com wants to collect information about your surfing habits and sell it to other companies, there is nothing to stop them. Absolutely nothing!

Think about this: If information is supposedly collected for one purpose, is it ethical for that information to be used for a totally different purpose without you knowing it? Is it fair to require you to provide medical information that is primarily intended to be used to pay your insurance bills and then have that same information used against you when the insurance company deems you too expensive and cancels your policy? Is it fair to have that same information used against you in denying you employment because you're too expensive to hire?

Spamming (unsolicited emails) has been challenged in the courts by Internet Service Providers (ISP) as an unfair practice. The ISPs say the thousands of emails clog their systems and no one wants them anyway. The spammers argue their right to Freedom of Speech is violated if they can't send emails to anyone they want. Which side are you on?

Property Rights: Intellectual Property

Intellectual property issues have been around for hundreds of years. Some of the laws and policies in place to settle disputes about copyrights, patents, and trade secrets have to be rewritten to apply to the Internet. Intellectual property is a result of someone's
effort to create a product of value based on their experiences, knowledge, and education. In short, intellectual property is brain power.

What if you wrote the next great American novel, hoping to cash in big time? Maybe you could retire to the Bahamas and drink lemonade on the beach all day. But then you find out that someone posted your next great American novel to the Internet and everyone is reading it free of charge. Now you're back in your hometown drinking lemonade at the local mall while you decide whether to look for a job at MacDonald's or Burger King. The good news is everyone loves your book!

Unfortunately, that sort of thing happens too often in cyberworld. You're pretty excited to get that free copy of the newest game software while the poor guy who spent hours of his time and effort writing it is not so excited to realize he's not getting any compensation.

Everything on the Web is considered to be protected under copyright and intellectual property laws unless the Web site specifically states that the content is public domain. The Web site doesn't need to carry the copyright symbol © in order for it to be protected. President Clinton signed a law in January 1998 making it a federal offense to violate copyright laws on the Internet, punishable with a fine up to $250,000.

Copyright laws and intellectual property rights cannot be violated on the Internet any more than they can in other mediums. While this isn't a law class, you should be aware of the fine line between acceptable and legal usage of materials and the illegal theft of materials. When it comes to copyright material, the underlying ideas are not protected, just the publication of the material. On the other hand, a patent grants a monopoly on the underlying concepts and ideas. Before you use anything, especially any material on the World Wide Web, make sure you are using it legally and ethically.

Get past the idea that because everything on the Web is free, easy, and available 24 hours a day, it must be okay to use it however you
want. The question you should be asking yourself is "Is it ethically right and legal?"

**Accountability, Liability, and Control**

Many of our laws and court decisions establishing precedents in the area of **accountability**, **liability**, and **control** were firmly in place long before computers were invented. Many of them date back to the early 1900s, and some simply don't make sense in this day and age. That's what we were referring to when we talked about new questions for organizations, companies, and the workplace in general. No issue makes this subject more important than the Internet laws our government has tried and still tries to pass.

One tenet of the Communications Decency Act (struck down by the courts) and the Child Online Protection Act (currently in the courts) is that Internet Service Providers should somehow be liable for content placed on the Internet through their users. Ask yourself these questions: "If you receive an obscene phone call, is the telephone company responsible and liable for the problem?" "If you receive a threatening letter in the mail, is the U.S. Post Office responsible for reading every piece of mail on the chance that there might be a problem in one of the letters?"

**System Quality: Data Quality and System Errors**

As we rely on Information Systems more, data quality issues are gaining importance. These issues affect you as a consumer and as a user.

When the credit reporting agencies mess up your credit record and you can't get a car loan, whose fault is it? Yours or the credit agency's? If the Electric Company doesn't get its Y2K bug fixed and you lose power on January 1, 2000, whose problem is that? What if you're driving down the road, the computer chip controlling your
brake system fails, and you have a rather nasty crash? Who is at fault? You, the car company, or the company that made the computer chip?

Most of us use software that the manufacturer knows has bugs. Once in a while these bugs will affect our computer usage. Usually they are nothing more than an aggravation. If you review Table 5.3 below, you'll see some instances of data quality problems that can severely affect businesses and corporations.

As more and more companies do business on the Internet, will Internet Service Providers be held accountable for equipment outages rendering those businesses unable to process transactions?

---

**Table 5.3 Illustrative Reported Data Quality Problems**

An airline inadvertently corrupted its database of passenger reservations while installing new software and for months planes took off with half-loads.

A manufacturer attempted to reorganize its customer files by customer number only to discover the sales staff had been entering a new customer number for each sale because of special incentives for opening new accounts. One customer was entered 7000 times. The company scrapped the software project after spending $1 million.

A manufacturing company nearly scrapped a $12 million data warehouse project because of inconsistently defined product data.

J. P. Morgan, a New York bank, discovered that 40 percent of the data in its credit-risk management database was incomplete, necessitating double-checking by users.

Several studies have established that 5 to 12 percent of bar code sales at retail grocery and merchandise chains are erroneous and that the ratio of overcharges to undercharges runs as high as 5:1, with 4:1 as a norm. The problem tends to be human error in keeping shelf prices accurate and corporate policy that fails to allocate sufficient resources to price checking, auditing, and development of error-free policies.

Quality of Life: Equity, Access, Boundaries

Invariably, when discussing online technology, some students mention their concern about losing the face-to-face contact with other human beings. We hear stories about children who haven't developed normal social skills because they spend all their time in front of a computer. No discussion about the quality of life issues would be complete without mentioning "on-line love affairs." Of course, many people lose their jobs and their way of life because of technology. These are all valid concerns.

What, in your opinion, is the impact of all this wired stuff on children? How should we protect them against the threats, real or perceived? The Communications Decency Act of 1996 was ultimately ruled unconstitutional by the Supreme Court. Did you realize it's back? This time it's called the Child Online Protection Act (COPA) and it was passed into law in the Fall of 1998. "At issue is the constitutionality of the Child Online Protection Act (COPA), the statutory successor to the Communications Decency Act (CDA), which the Supreme Court struck down in June 1997. Check the EPIC COPA Page for updates and more details." (EPIC Web page, Jan. 31, 1999)

One quality of life issue that affects more and more people personally is the ability to work from home. Most telecommuters used to have a "regular day job" 9 to 5, five days a week in a typical office setting. If they didn't get their work done today, they would wait until they were back in the office tomorrow or Monday. Now because of technology they can work seven days a week, all hours of the day, at home. And sometimes they do. The impact on personal and family life can be considerable.

There is an upside to the jobs issue, though. Many parents like telecommuting because they can stay home with, or at least be nearer, their children. More and more people are leaving the big cities and moving to small towns for the quality of life, yet they can still keep their well-paying jobs. Many small companies are able to expand their customer base because of technology, which in turns helps the employees immensely. Completely new businesses are born because of technology.
Some people think we've reached the limit when they learn that we can now buy groceries online. Hungry Moose Groceries in Big Sky, Montana, offers the service for people coming in for vacation. After all, when you have everything loaded into the car, trying to find your way around a strange town, anxious to get on the ski slopes, have three screaming kids in the back seat, and everyone is stressed out from the travel, the last thing you want to do is hunt down a grocery store. Why not email ahead and have your food and treats waiting for you when you check into your accommodations? What a terrific idea.

**Computer crime** is one area that has been extremely hard for our society and our governments to keep up with. Many laws have to be rewritten and many new laws must be implemented to accommodate the changes. **Computer crime and abuse** extends to any wrongdoing involving equipment and Internet usage, as Table 5.4 shows. We spoke earlier about anonymity not being a license for socially unacceptable behavior. You should remember that everything you do on a network or the Internet is recorded and can be tracked. Many people committing computer crimes and abuse have been caught and prosecuted.

<table>
<thead>
<tr>
<th>Table 5.4</th>
</tr>
</thead>
</table>

Other issues affecting our society include job losses and career changes caused by technology. You can argue the positive or negative effects, but one thing is clear: you'll be a part of the evolution of technology for the rest of your life. You will have to continually update your skills and knowledge in order to remain competitive in the job market. As companies continue to embrace new technology and new methods of using it, you'll be responsible for ensuring your skills and education remain current.
Our government recognizes the danger of allowing unequal access to technology to continue. It has enlisted the help of private individuals and corporations in an effort to install computers and Internet access in public schools and libraries across the nation. Most schools are now wired for networks and are learning to incorporate technology into the curriculum.

**Health Risks: RSI, CTS, and Technostress**

As managers, you should be acutely aware of the health issues caused by computer usage. Why? Because these health issues cost businesses huge amounts of dollars each year in medical treatment claims and lost productivity. **Carpal tunnel syndrome (CTS)** is the most serious health issue plaguing businesses. It doesn't take much to avoid the problems associated with computer usage. Ergonomics, the study of the relationship between humans and machines, has helped determine that it's cheaper to purchase equipment that reduces the health risks associated with computers such as different keyboards, monitors that reduce eye strain, and desks that allow proper body positions.

Too much of a good thing can be bad. You've heard of road rage, the anger people experience when driving. We are now experiencing road rage on the Information Superhighway, where it is called **technostress**. Managers should encourage employees to take frequent breaks from their computer and to recognize and understand the dangers of isolation. We may be a wired nation, but we still need the human touch.

How has all this technology affected you? Think about it. Ultimately, there is a positive and a negative side to everything. How you handle it determines how it affects you.

**Management Actions: A Corporate Code of Ethics**

Many firms have not established a Code of Ethics or a policy for employee conduct when computing in today's workplace. Some
corporations are confused about what to include and how to approach this new dilemma. Following Laudon and Laudon's five moral dimensions would be a good start! Businesses and their managers should recognize:

The information rights to privacy and freedom

The property rights to individual ideas and efforts

The accountability, liability and control issues involved in using technology

The system quality requirements of businesses and individuals

The quality of life impact of technology

Companies can no longer ignore the necessity of establishing rules for technology usage. The issue will only continue to grow. If you work for a company that doesn't have a policy, you should encourage it to establish one immediately. If you're a manager in a company, you should get busy and establish a policy for your employees - it's the only fair thing to do.

**Bottom Line:** If it sounds too good to be true, it is. If it's illegal or immoral or unethical outside the computing.
arena, it's probably illegal, and immoral and unethical in the computing arena. If you are aware of a problem or are a victim of unethical, illegal actions, and you don't do something about it, you're part of the problem. Managers have an obligation to ensure policies are in place to help guide their employees in the ethical and legal use of technology. It's your new world - use it wisely.

**Discussion Questions:**
Click on the Discussion icon in the top toolbar to answer the following Discussion Questions.

1. Write a computer usage policy for your school or workplace incorporating the moral and ethical guidelines discussed in this chapter.
2. Briefly describe your Internet Service Provider's usage policy regarding email. If you are on campus, your school should have a usage policy.
3. Describe how your quality of life has improved or declined with the technological advances in the last five years.
4. How do you think our government should handle the political issue of Internet decency and access limitations?
5. To what extent should Internet Service Providers be held liable and accountable for the use of their equipment?

**Chapter 6: Computers and Information Processing**
6.1 What is a Computer System?
6.2 The CPU & Primary Storage
6.3 Computers & Computer Processing
6.4 Secondary Storage
6.5 Input and Output Devices
6.6 Information Technology Trends
Discussion Questions
6.1 What is a Computer System?

This chapter and Chapter 7 are overviews of the hardware and software elements of an Information System. The material covers the larger computer systems used in many businesses along with information about the personal computers many of us use at our desks or at home.

How Computers Represent Data

Everything in a computer, from the biggest supercomputer to the smallest handheld machine, is ultimately reduced to a series of zeros and ones. The words you see on this page are nothing more than combinations of zeros and ones when they reach the brains of the computers. That's because the processor in any computer only understands whether the signal is turned off - 0 - or on - 1. Each zero or one is called a bit. Combinations of eight of these zeros and ones are bytes and represent one character. You see the character "A"; the computer sees 01000001.

Combinations of zeros and ones are converted to languages that we can understand through the use of the EBCDIC (Extended Binary Coded Decimal Interchange Code) or ASCII (American Standard Code for Information Interchange).

The pictures or graphics that you see on a computer screen are composed of just three colors: red, green, blue, or combinations of these three. The computer determines the appropriate color by the amount of light or color in conjunction with a numeric representation of the color. The technical name used to represent every color bit in a computer is pixel or picture element. The pixel is a very small square of color. Used in conjunction with millions of other pixels, it gives us an image that our eye can recognize.

Time and Size in the Computer World

Quick, quick, blink your eye. Oops, sorry, but you're really slow compared to a computer. Now blink your eye a million times in one second. Sorry, but the computer beat you again. There is literally
nothing you can do faster than the typical computer. Computers operate on milliseconds and nanoseconds and perform millions of operations per second. You just can't beat them. And every year they get faster and faster, and able to process more and more operations per second. Every time we think manufacturers have maximized the computer's capabilities, they surprise us and create even faster, more powerful machines.

Table 6.2 defines speed and storage capacity for computers. Speed ranges from microseconds to nanoseconds. Storage capacity ranges from kilobytes to terabytes.

<table>
<thead>
<tr>
<th>Table 6.2</th>
<th>Time and Size in the Computer World</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Time</strong></td>
<td></td>
</tr>
<tr>
<td>Millisecond</td>
<td>1/1000 second</td>
</tr>
<tr>
<td>Microsecond</td>
<td>1/1,000,000 second</td>
</tr>
<tr>
<td>Nanosecond</td>
<td>1/1,000,000,000 second</td>
</tr>
<tr>
<td>Picosecond</td>
<td>1/1,000,000,000,000 second</td>
</tr>
<tr>
<td><strong>Storage Capacity</strong></td>
<td></td>
</tr>
<tr>
<td>Byte</td>
<td>String of eight bits</td>
</tr>
<tr>
<td>Kilobyte</td>
<td>1000 bytes*</td>
</tr>
<tr>
<td>Megabyte</td>
<td>1,000,000 bytes</td>
</tr>
<tr>
<td>Gigabyte</td>
<td>1,000,000,000 bytes</td>
</tr>
<tr>
<td>Terabyte</td>
<td>1,000,000,000,000 bytes</td>
</tr>
</tbody>
</table>

*Actually 1024 storage positions

Table 6.2

In 1965 an engineer named Gordon Moore determined that the processing capability of computers would double every year. Keep in mind that he figured this out about 10 years before the first personal computer was even invented. To this day, his theory is still correct and has been named Moore's Law. From Intel Corporation's Web site:

*Moore is widely known for Moore's Law, in which he predicted that the number of transistors that the industry would be able to place on*
a computer chip would double every year. In 1995, he updated his prediction to once every two years. While originally intended as a rule of thumb in 1965, it has become the guiding principle for the industry to deliver ever-more-powerful semiconductor chips at proportionate decreases in cost.


**Computer Generations**

You can see from the text how far we've come in computing just in the last 50 years: there have been four manor stages or generations of both hardware and software. The interesting, and sometimes scary, part is to think of how much farther we can go. We used to laugh at the Jetsons cartoons or think much of the advanced technology in StarTrek was beyond our grasp. When you really look at what is happening today, you realize a lot of that technology is with us already or will be tomorrow.

**Bottom Line:** Everything in a computer ultimately ends up as a zero or a one in order for the computer to process it. The pace of that processing gets faster and faster every year.

**6.2 The CPU and Primary Storage**

See that box sitting next to your computer (if you're using a personal computer)? There's a lot of neat stuff in there that makes all your computing possible. The most important part of that box is the **Central Processing Unit (CPU)** or the "brains" of the computer. Every computer, no matter how big or small, has one, just like every person and animal has one.
Primary Storage

Every time you use a personal computer, the Operating System software and Applications software that you use must be moved from the hard drive (secondary storage) to the primary storage area called Random Access Memory (RAM). The text does an excellent job of explaining how this storage area works: see page 166.

You should be aware that the software necessary to operate your computer gets bigger and bigger all the time. While not every instruction included in a program is moved into RAM when you first open the program, many instructions are. The rest of the instructions are stored in the secondary storage area (hard drives or floppy drives) until you need them. If you never use them, they aren't moved into RAM. We'll cover this concept more in Chapter 7.

If your personal computer starts to run slower and slower over time, it could be because your programs are requiring more space in the RAM memory than you have available. The slang term is "RAM Cram." That is, you're trying to cram too many instructions into too little RAM and your computer just slows down as it moves instructions back and forth between primary and secondary storage. Sometimes, instead of buying a whole new computer, you can significantly improve the performance of your current computer by increasing the amount of RAM. It's relatively cheap and easy to do so.

Types of Semiconductor Memory

Read Only Memory (ROM) is the part of the computer that holds instructions necessary to start your computer. The instructions located in this part of the computer are set when your computer is built, and you can't change them. That's why it's called "Read Only." ROM chips are used in more products than just computers: cars, hand-held calculators, microwave ovens, stereos, alarm clocks, and cellular telephones have them. Most of these chips are either of the PROM or EPROM sub-class of ROM chips.

The important characteristic that distinguishes ROM memory from RAM memory is demonstrated by what happens when the computer
is turned off or suddenly loses power. Instructions contained in ROM are non-volatile, which means they aren't lost when the computer is turned off. Instructions contained in RAM are volatile, meaning that they are erased from the primary storage area when the power is turned off. That's why your computer must reload the operating instructions and software programs whenever you turn the computer back on. If you haven't saved data to the secondary storage area (hard disk drive or floppy disk), you'll lose it from RAM also.

**The Arithmetic-Logic Unit and Control Unit**

![Figure 6.6](image)

Steps in the machine cycle.

The **Arithmetic-Logic Unit (ALU)** does one of two things: it performs mathematical calculations or it compares things. The **Control Unit** does most of the rest of the work by telling other components of the computer what to do and when to do them. It tells the components what to do through a series of instructions that are processed one at a time. That may sound slow, but remember the speed we discussed earlier. Even though the instructions are
processed one at a time through the **machine cycle**, they are processed so fast that we can't keep up. Remember computers are capable of processing a million instructions per second!

Figure 6.6 shows the machine cycle that every instruction goes through every time it's processed. The machine cycle is very methodical, very precise, and very fast!

**Bottom Line:** The CPU consists of two types of primary storage, RAM (volatile) and ROM (non-volatile). The Arithmetic-Logic Unit is also located in the CPU and provides the ability to perform mathematical calculations and comparisons. Coordination and control for other parts of the computer are the responsibility of the Control Unit.

### 6.4 Secondary Storage

We've talked mostly about the primary storage areas of ROM and RAM. Secondary storage includes the hard disk drives in almost every computer, floppy disks, and magnetic tape storage. The kind of storage necessary is dictated by the size of the computer and how it's used. As with most other components, the cost is dropping significantly while the technology is improving all the time.

**Magnetic Disk and Tape**

The most common form of secondary storage is the **magnetic disk**. **Magnetic tape** is still used on larger mainframe computers for data that don't require fast access, such as historical records maintained by credit card companies. If you want fast, direct access to data, use the magnetic disks that are most common in personal computers.

Just about every personal computer has a **hard disk** drive located in the box that sits beside the monitor. All the operating system software and application program software resides on the hard disk drive for long-term storage. Data files are also saved to the hard disk (or floppy disk). When you start your personal computer, the
operating system instructions most commonly used are moved from the hard drive to the RAM memory. Whenever you open an application program, the most frequently used instructions are also moved to the RAM memory for quick retrieval. The instructions that aren't currently being used remain on the hard drive.

The common 3 1/2" floppy disk that we are used to seeing is becoming outdated because of size limitations. Most of these disks can only hold 1.44 million bytes of data. Zip disks can hold anywhere from 100 million to 250 million bytes. They operate basically the same way a floppy disk does, but you need a special zip disk drive in order to use them. When you create or use files with lots of graphics, you'll need the larger type of disk in order to hold the data.

**Optical Disks**

We've probably all seen a compact disk (CD-ROM) that holds music. This same type of disk is becoming more common with personal computers because of the amount of data it can hold. Many software programs are on compact disks (CD). Otherwise, you'd have to use 20-30 floppy disks to install the software. The drawback to this type of disk is that it can usually be used only once because the data are stored on the disk by literally burning pits into its surface.

Machines that allow the average user to record CDs (compact disk-recordable) are starting to show up on store shelves, but they are still rather pricey. The WORM (Write Once/Read Many) technology gives the user the technique of writing to a CD once but reading it many times. And some machines now allow you to rewrite a CD (CD-ReWritable) by using a combination of magnetic and optical writing techniques.

Digital video disks (DVD) can be used on either computers or with televisions. You can rent DVDs from your local video store and watch a movie on either device.

It's safe to say that the 3 1/2" floppy disks are on their way to the museum, but because of convenience and sheer numbers, it will be a while before they are gone altogether.
Bottom Line: Secondary storage devices maintain the bulk of the programs and data needed to complete tasks. There are many different types of secondary storage; you should select according to your needs.

6.5 Input and Output Devices

Data go in and information comes out of computer systems via peripheral devices. The speed, capacity, and ease of use of these devices is constantly improving.

Input Devices

You're pretty familiar with the keyboard and mouse input devices. Keyboards and mouse pointers are becoming more comfortable to use through ergonomically improved designs. However, many people find these input devices cumbersome and slow. They are turning to pen-based input, which uses a tablet device and a pen stylus. Companies such as Federal Express and UPS use the technology for customers to accept packages. The data are then transferred directly to a mainframe computer which allows packages to be tracked from the sender to the recipient.

The latest trend for input devices is voice recognition. This technology allows you to put data into a computer using a combination of a microphone headset and software on your
computer that recognizes your voice. You speak into the microphone and the software interprets your voice and records your words. You can also use this technology to execute commands on your computer, such as "Save this file" or "Print this document."

The software associated with voice recognition technology is very complex because no two people speak alike. We all have accents, voice inflections, slang words, or even headcolds that change the tone of our voice. When you initially use voice recognition software, you have to "train" the computer to recognize your voice and all of its characteristics. It typically takes 2 to 3 hours for the initial training with additional training as you continually use the software. In essence, you build your own dictionary of words that are unique to you.

This is one of the greatest inventions for people with physical disabilities, since they can rely on voice to control the computer. Executives find this technology especially useful. It is also great for people who do a lot of typing and could possibly or do suffer from repetitive stress injuries. In fact, these computer files were generated using voice recognition software to reduce the amount of typing necessary to create them!

Unfortunately voice recognition doesn't work very well in some corporate settings. It can be very distracting to the workers around you if you are constantly talking into a microphone. The background noise of most office settings can also interfere with the voice input.

**Touch screens** are also becoming more common for general usage. Touch screens have been used in ATM banking machines for years. Now they are coming to a screen near you - computer or television or household appliances. The advances in processing technology that we've talked about through this whole chapter are largely responsible for the ability of small computers to use these new devices and methods.

**Source data automation** is popular with businesses because the technology reduces the chance of input error. A human may type in 2345 instead of 2354Ña simple error that could have significant
consequences. **Optical character recognition** software or **scanner** software will always read the number correctly.

**Digital scanner** technology extends far beyond the page scanners attached to personal computers or used in offices. The scanners grocery stores use at the checkout counter are a great example of this technology. The vast number of hand-held scanners used by other retailers are also typical of the ability of technology to increase human productivity. The biggest benefit of this technology lies in the fact that input errors are greatly reduced. The computer reads what is there and processes it. If an error occurs, which does happen in groceries about 5 % of the time, it isn't because of the computer. It's because the human programming the computer made a mistake.

Banks have used **magnetic ink character recognition** (MICR) technology for years to process checks. If you still receive cancelled checks from your bank, take a look at the bottom right hand corner of the check. You'll notice that the amount of the check and the date it was processed is imprinted in block style numbers. The computer added this information to ensure that your account was properly credited.

**Batch and On-Line Input and Processing**

Whether a business uses **batch processing** or **on-line processing** depends:

- On how soon the data must be input
- On how fast the updates must be made
- On how accessible the data must be

If the data are not needed immediately, batch processing is usually the chosen method. If the data must be immediately available, the required method is on-line processing.
FIGURE 6.12

Batch and on-line processing.

Figure 6.12 shows the difference between the two methods of processing and accessing data. Note the different uses of the transaction file and the master file. Many companies are switching to on-line processing even for data that have traditionally been batch processed because they don't want to maintain two different processing methods.

Output Devices

What goes into a computer eventually needs to come out of the computer. Typically we think of printers as the main form of output. But more and more often, the output of a computer merely extends to the monitor screen. A good example of this is the Web. We surf the Web looking for information or entertainment. We access a good Web site that has information about our favorite sports team or gardening in the West. We read the information, process it through
our "personal processor" (commonly called a brain), and then we're on to another Web site. Or, we save it to our disk drive to access at a later time.

The quality of the **cathode ray tube (CRT)** is determined by the number of pixels on the screen. The higher the number of pixels, the better resolution you'll have. **Bit mapping** is the technique the computer uses to manipulate the pixels on your screen.

In addition to being an input device, voice recognition is also an output device. If you call a major corporation on the telephone, it would be unusual for you to actually talk to a human being. More often, the company uses voice recognition technology to guide you through menus of services or answer your questions.

The cost of laser and ink-jet printer devices (nonimpact printers) has dropped significantly in the last few years so they are affordable for home use. You should be aware that the cost of using these devices extends past the price of the device itself. When considering the cost of printing you should include the cartridges and paper. The cartridges usually cost $25 to $30 each, while the paper can be twice the cost of regular bond paper.

Impact printers, such as the dot matrix, are much cheaper to own and operate. The paper is less costly than bond paper and the printer ribbons are approximately $5 each. However, the quality is significantly lower.

**Bottom Line: Input and Output technology now extends far past the typical devices we're used to. Voice technology is one of the fastest growing mediums for input and output and offers many advantages beyond those of the methods we have traditionally used.**
6.6 Information Technology Trends

The speed and computing capacity of technology continues to advance at dizzying speeds and in ways we can hardly imagine. Star Trek is no longer a vision for the 24th century but for next week.

Interactive Multimedia

One trend highly touted by the experts is that of the "information appliance." Do we need to have a separate device for watching television, another one for listening to music, a different one called a telephone, and yet a whole separate device for computing? Some people say we can do all of that with one central appliance with a variety of input and output devices.

If you watch the mergers taking place in the corporate world between the telephone companies and cable TV companies, you can start to understand another major change that may be in store for us. The companies are working toward a convergence of the "entertainment outlets" we know as television and the Internet. Why can't we download a movie off the Internet whenever we're ready to watch it instead of having to follow a TV channel's set schedule? This idea may be a reality in a few years.

The music industry is struggling with the issue of music downloaded from Web sites. How do the musicians protect their copyrighted work while making the music more accessible to the public? How do the music publishing companies protect their business from disintermediation, the process of eliminating the middleman from transactions?

Superchips and Fifth-Generation Computers

Computers promise to get easier to use. Some of you may seriously doubt this, especially if you've ever been frustrated by a sudden crash or an error message that tells you absolutely nothing about the real problem and how you can fix it. But if you look back you realize that computing has become easier and easier. The industry understands that if more people are going to be enticed into using
computers and helping the industry grow, they have to make them easier to handle.

Earlier in the chapter we discussed supercomputers, which use parallel processing techniques to process data simultaneously through multiple processing chips. **Massively parallel computers** use hundreds or thousands of processors at the same time; think of a thousand people tackling a problem, each working on one small part, and arriving at the solution all at the same time.

**Smart Cards and Microminiaturization**

Take a credit card out of your wallet and look at the magnetic strip on the back. The strip may seem too small to hold much data. You might be surprised to learn that through microminiaturization, virtually all of your personal information, from health records to school records to credit records, can be stored on that small area with room to spare. Some states are now including vital medical information on the back of driver's licenses which can be accessed by paramedics if you're ever in an accident and need medical attention. The technology has already saved lives.

**Social Interfaces**

Bill Gates, Microsoft Corporation, has a vision of the future of computing. Speaking to a reporter for Business Week magazine, May 17, 1999, he says: "Desktop PCs have been incredibly successful. Most businesses have them, and 50% of homes do. And for most people, the PC will remain their key computing tool, but it will also work alongside a lot of other cool devices. That's why we've expanded our vision to giving people the power to do what they want, where and when they want, on any device. That means on PCs, handheld PCs, phones, or smart TVs such as WebTV."

When asked what he saw on the horizon that will dramatically change people's lives, he replied: "I'm optimistic about what the industry can achieve, but the word 'dramatic' will mean different things to different customers. If you're a large enterprise customer, being able to connect your employees with on-demand
videoconferencing for collaboration would be dramatic. If you are head of IT for a large corporation and can deploy software, do updates, and change users on a companywide network of PCs, and never visit a desktop, ever - that's dramatic. If you have a PC at home and use the Web to buy products, such as a car, a TV, or a dishwasher, and if you can use your PC to track the warranties, find the nearest repair center, and have your PC store remind you of all that information - that would be dramatic."

**Bottom Line:** So where are we going with all this technology? Computers that are easier to use and incorporated into our everyday lives are in the near future. Improved technologies for business computing are being introduced each day. Faster and smaller information appliances are coming to a store near you. When it comes to the future of computing, your imagination is the only thing holding us back.

**Discussion Questions:**
Click on the Discussion icon in the top toolbar to answer the following Discussion Questions.

1. Determine the TOC (total cost of ownership) associated with the technology in your workplace or classroom, even if it is your own home. Use your hourly wage or salary as a basis to figure the persware cost.
2. Describe a client/server network with which you are associated. Remember, Internet Service Providers such as AOL or your local service provider can be part of your personal client/server network.
3. What is the difference in how primary and secondary storage handle storage for application program instructions?
4. If you could change anything about computer hardware, what would it be? Be as specific as you can and use your imagination.
Chapter 7: Information Systems Software

7.1 What Is Software?

7.2 System Software

7.3 Application Software

7.4 New Software Tools and Approaches

7.5 Managing Software Assets

Discussion Questions

7.1 What Is Software?

Chapter 6 concentrated on computer hardware. This chapter reviews information about software that helps you get the most out of your hardware. Figure 7.1 explains visually how the two interact.

You can also see from Figure 7.1 how software is divided into two categories: system software and applications software. The system software manages the basic operations of the computer and controls the equipment associated with it. The applications software helps you turn raw data into useful information. Basically the type of hardware you use determines the type of software you use.

In Chapter 6 we discussed RAM memory, the primary storage area that contains all the software necessary for the tasks you are doing.
at the current time. The operating system and application software programs you are currently using must temporarily reside in RAM. That may include the whole program or just parts of it. Your computer will slow down significantly if your RAM memory size is too small to store the programs. As these programs continue to grow in size, you should make sure your RAM memory is sufficient to handle them.

**Bottom Line:** You need software in order to use hardware. Simple as that!

### 7.2 System Software

Basic computer operations are controlled by the **operating system** and enable you to get the computer started initially, and to complete tasks such as printing, saving, viewing, managing files, and monitoring system activities.

**Functions of the Operating System**

Let's take a look at the three basic software functions:

**Allocation and Assignment:** System software helps the computer decide what hardware resources will be used to accomplish the task at hand. When you want to print and insert new data, this part of the program will decide how much of the computer resources will be devoted to input and how much to output.

**Scheduling:** System software helps the computer decide when to use the input and output devices. Let's assume you are talking on the phone and cooking dinner apparently at the same time. But are you really doing two things at once, or does it just appear that way? After all, if you're holding the phone in your left hand, it's kind of hard to stir the soup with that hand. You may switch the phone to your right hand and then stir the soup with your left hand. It's about the same with a computer. It may appear that it is printing your letter while
you are inserting new data, but what the computer is really doing is switching back and forth between output and input.

**Monitoring:** System software keeps track of everything that is going on inside the computer. Some people have the impression that everything they do on the computer system, especially on larger systems, is anonymous. No one really knows you were using the computer on Saturday morning because no one was there to see it. Wrong! The system software program knows that you accessed the computer, for how long, and what you did. This part of the program monitors, and if programmed correctly, records everything that was done on the system.

**Multiprogramming, Virtual Storage, Time Sharing, and Multiprocessing**

When you really think about it, computers are unbelievable in the sheer number of tasks they can accomplish and the speed with which they can accomplish them. When it comes to larger computer systems such as mini-computers and mainframes, with huge numbers of users all working at the same time, their capacity is literally mind-boggling.

**Multiprogramming**

Think about putting on a play: This involves thousands of tasks and many, many people, all trying to finish their assigned tasks at the same time. You might have five people working on painting the set, five other people rehearsing a song, five people making the costumes, five people developing the printed program for the audience, etc. Everyone is working on a different task at the same time, probably in the same place. How does everything get done by opening night?

Computers do basically the same thing only much faster and in a more orderly way in a **multiprogramming** environment. A computer can have several different programs open at the same time. Only one program may be executing its instructions, but the leftover resources can be taking input from another program at the same time it's printing documents from a different program.

Ebook_mis.doc
Multitasking

Multitasking became very popular with the introduction of Windows 95 for PCs. It usually refers to a single-user operating system on a single computer. With the old DOS (Disk Operating System) and Windows 3.1, if we wanted to use our word processing program to write a letter and include a spreadsheet chart of the latest sales information, we had to first open and use the word processing program to write the letter. We closed that program, opened the spreadsheet program, developed the chart, and then closed that program. Then it was back to the word processing program. We got worn out just opening and closing programs.

Windows 95/98 allow more efficiency in how we use multiple programs in that we can have many different programs open at once and move information back and forth between the program files with ease. Depending on the amount of computing capacity in your PC, you can have 2 or 10 programs open at one time. Now you can have the word processing program open to create your letter, move to the open spreadsheet program to create the chart and then slip right back into the word processing program to finish the task.

Virtual Storage

Earlier we noted that all the software programs you are using must reside in primary storage, RAM, in order for the computer to use them. When you start your computer, parts of the operating system software are moved from the hard drive into RAM. When you open an application program such as Word 97, parts of that application program are also moved from the hard drive into RAM. Notice we're saying parts of the program. Most programs are so huge that you can’t possibly use all of the instructions at one time - or ever, in fact.

For example, when you are writing a letter in Word 97 you don't need the instructions for printing the document until the very end of your input. So the computer leaves the printing instructions (in pages or segments) on the hard drive until they are needed. Then, when you click on the Print button, the instructions for that task are moved from the hard drive into the RAM memory, and the print
operation is executed. Another example: How often do you use the Help function in Word 97? If you're like most people, not very often. The computer determines that since this function isn't used very often, there is no sense taking up valuable space in RAM with the instructions. They are left on the hard drive until they are called for.

That's **virtual storage**.

**Time Sharing**

No we aren't talking about vacation condos! **Time sharing** in computers is very similar to the multiprogramming concept except that an established, set amount of time is allocated to each user. The block of time can be as small as several milliseconds - a millionth of a second - but the computer moves around to each user so fast that humans can't detect the difference.

**Multiprocessing**

In Chapter 5 we discussed parallel processing on mainframe systems by giving you the example of Gary Kasparov playing chess against a computer with more than one processor. **Multiprocessing** system software ties the multiple processors together and gets them working in concert. This setup is similar to multiprogramming, but with a distinct difference: Multiprogramming uses one CPU and multiprocessing uses multiple CPUs.

**Language Translation and Utility Software**

When we discussed bits and bytes, we mentioned that everything is reduced to either a zero or a one because that's all the computer understands. So instead of the words you see on this page, the computer sees

```
00100001 01010001 01100001 00100110
```

Language translators in the system software allow the conversion of zeros and ones into characters people can understand, and translate the characters people understand into the zeros and ones that the
computer understands. Think of it as an English-German or French-English translation dictionary.

**FIGURE 7.4**

4 The language translation process.

Figure 7.4 gives you a visualization of the language translation process using **source code** at the beginning of the process. The source code is passed through a **compiler** program that changes the source code into **object code** (also known as machine code). All of the object code is linked together through the **linkage editor**. After the object code modules are combined, the computer executes the program.

Depending on which programming language you use, an **interpreter** will replace the compiler in this process. Because the interpreter gives immediate feedback on errors in the program, beginning programmers find the interpreter more helpful.
Have you ever formatted a floppy disk? Most of them come pre-formatted now, but sometimes you have to perform this function before you can use the disk. That function isn't part of Word 97 or your favorite email program. It's a utility function. So is deleting old files. If you use a PC, you have to use the area called Windows Explorer to delete an old file. (We know you can do so inside some of the application programs, but only because those programs now include the utility instructions that allow you to do so.)

Years ago, you had to buy separate programs that would allow you to perform all the utility tasks necessary to keep your machine running smoothly. **Utility programs** are now integrated into the operating system and appear as one program.

**Graphical User Interfaces**

When someone wants to move a file from their hard drive to a floppy disk, which is easier:

- Type the following command at the prompt:
  
  MOVE C:\My Documents\Letters\momdcltr.doc A:\momdcltr.doc

  or

- Open the Windows Explorer graphical user interface:
  click on the file name **momdcltr.doc**, hold down the mouse button and drag the file name to the A:\ disk icon

It's a well known fact that people understand pictures better and faster than the written word. That's the beauty of **graphical user interfaces (GUIs)**. They use icons (graphical pictures) to represent actions, instead of having the user type in long commands that they have a hard time remembering. Everyone used to have "cheat sheets" beside their computer terminals so they could remember how to do such simple things as move a document from one disk to another. Now they just look at the pictures, use the mouse, and it's done.
To be sure, many, many computer systems still rely on the typed, command-driven method of completing tasks.

**PC Operating Systems**

The text describes the various operating systems offered for PCs. Some people are surprised to learn there is more on the market than just Microsoft Windows! What you should keep in mind is that many of these operating systems are incompatible. Files created on a PC using Microsoft operating systems are not easily imported to Apple computers using the Mac OS. This incompatibility creates quite a few headaches for larger Information Systems in companies that use different computer platforms. At the end of this chapter we'll discuss a new language that is resolving this problem.

**DOS** (Disk Operating System) is the forerunner to Windows software. Because of its limitations, it is slowly being phased out of the operating system software inventory, although support for it is still included in **Windows 95** and **Windows 98**. **Windows NT** is the system software used on networks. It has more features than Windows 95/98 and has the same GUI look. **Windows CE** is a new, stripped-down version of system software used primarily on handheld computers. Windows CE is also moving into the WebTV appliance and other nontraditional computer equipment.

Even though **OS/2** is a powerful operating system used primarily for desktop computers on networks, it’s never gained widespread acceptance. **UNIX**, on the other hand, is a very popular operating system for scientists and techies. More recent versions have a GUI interface, but non-techies find it somewhat difficult to use because it relies on text-driven commands instead of the point-and-click icons.

**Linux**, a new operating system, was created by a computer science student, Linus Torvalds from the University of Helsinki in Finland. He gave away the software and urged other people to improve upon it. Thousands of software developers took him up on his offer. Estimates of users range from 10 to 20 million ([Smart Computing](https://www.smartcomputing.com) magazine, August 1999). Linux is not for the faint of heart though: It's a derivative of UNIX with text-based commands and is not as
user-friendly as Windows or Mac OS. Corporations are using it because it seems to be more stable and less crash-prone than other operating systems. If you're interested in more information go to the Linux Web page at http://www.linux.org.

The term **platform** describes the hardware and operating system used in a particular configuration. For instance, an Intel Microprocessor that uses Microsoft Windows is a different platform from the Apple MacIntosh that uses its own operating system software, **Mac OS**.

When you are trying to decide whether to upgrade to a new version of the Windows operating system, keep in mind that it takes some time to update the application programs that can take advantage of the new features. Sometimes it's better to wait a few months after the initial release so the bugs can be eliminated. You should also keep in mind that each new edition tends to be much bigger than previous versions. You need to make sure your hardware (RAM memory and hard drive) can handle the new operating system.

**Bottom Line:** Managers should understand how various software configurations affect the way computers are used to process data into useful information. Many different types of operating systems can fit an organization's needs; each offers advantages and disadvantages.
7.3 Application Software

We've come a long way, baby! Early versions of application software made it difficult to use. It wasn't easy to move data from one file to another, if it was possible at all. When you finally learned how to use one application program, you had to start from scratch if you moved to another. This section takes you on a time trip from the very early days of programming languages to the most recent software suites.

Generations of Programming Languages

As the text describes, we started out having to communicate with computers in machine language using strictly zeros and ones. Can you imagine having to type a sentence or read a sentence that was written strictly in a series of zeros and ones? Over the years, thank goodness, we've progressed to using more English-like words (second-generation languages) and then to sentence-like statements (high-level languages).

Now we have application programs the average person can use without extensive training in computer science (fourth-generation languages). The hardware improvements discussed in Chapter 6 have gone hand in hand with the vast improvements in software programs.

Popular Programming Languages

Most programmers working on today’s computer systems haven't been trained in old high-level languages such as FORTRAN and COBOL. Unfortunately that problem is coming back to haunt us now that we face the Y2K bug in some of the older systems that have been around for 30 years. Much of the programming that was done on the old systems was written in these older languages, and today’s computer programmers don't know how to go back and fix the old coding to accommodate a four-digit year.
The most popular language today is C and its derivative C++. These two languages are very easy to use and create some pretty dynamic programs. They can also be used to create programs for various platforms, but the programs have to be changed to "fit" each type of computer system.

Managers should be aware of the limitations and advantages of the various programming languages, since many older systems still use them. Managers should also be aware that integrating the older languages with the newer languages can be extremely difficult. Perhaps that's why many companies tend to hang onto the old systems long after the newer systems have been developed.

Fourth-Generation Languages and PC Software Tools

FIGURE 7.9

Fourth-generation languages.
The most important point of this section is to make you aware of the tools available with the fourth-generation languages, so that you can best fit them to the job at hand. Figure 7.9 shows some of the categories and products available. Fourth-generation languages have advanced to the point that they are easy for nonprogrammers to use. Some applications created with these languages don't require as many steps and as much technical input to the computer as previous languages. Most of them are used on larger mainframe systems or networks of PCs, rather than on individual PCs.

The text has an excellent description of the Query Languages, Report Generators, Graphics Languages, Application Generators and Very High-Level Programming Languages shown in Figure 7.9.

Many PC software tools are sophisticated enough that we can construct commands in sentences that emulate our natural language. PC software tools differ from most of the other languages described in this section in that they are easily installed on personal computers and used by the average person with little or no assistance from professionals. Thus, their popularity.

Application Software Packages

In the past most application programs were totally separate. Moving data between them was extremely difficult, if not impossible. With integrated software packages and software suites, it is much easier to use data from one program in another without having to re-create it in every program. So you can enter data only once and use it many times. This concept eliminates input redundancy and the natural human tendency to make errors.

A serious problem can arise if too many users create their own islands of information. For instance, Mary in Accounting uses her software suite to create a quarterly sales report.
Sally in Marketing also uses her software suite to create a quarterly sales report. Unfortunately, Mary is not sharing her data with Sally. Sally, on the other hand, is not sharing her data with anyone else either. Over time, each user will have a separate base of information, with the strong potential that the information will not be compatible between users and probably will conflict in validity.

PC Software Tools

This category of fourth-generation languages includes the tools targeted to the nontechnical end-user and encompasses

- word processing (MS Word, WordPerfect)
- spreadsheets (Excel, Lotus 1-2-3)
- data management (Access)
- presentation graphics (PowerPoint, Presentations)
- integrated software packages (Office 97, Corel 8)
- email (Eudora, Outlook)
- Web browsers (Netscape, Internet Explorer)
- Groupware (Notes, Exchange)

Email has become the most popular component of the Internet. Remember, though, that email is not very private and can be available for years even though you may have deleted it from your PC or terminal. The advantages of increased, quicker and easier communications between people far outweigh these disadvantages. It is quite easy to attach files to an email message and transmit them from one location to another via the Internet. No longer do we have to print a document on paper, put it in an envelope, drop it in snail mail, and then wait several days for the recipient to get the document.

Various free email Web sites have sprung up on the Internet over the last few years. The beauty of these free sites is that you can access them from literally anywhere in the world via a regular Web browser. So if you are traveling, you don't
have to lose contact with those you communicate with on a regular basis. Nor do you need a particular email software program; you can use a regular Web browser to read your messages. Remember that these sites do not guarantee as much privacy or anonymity as may be advertised. The hidden cost is having to wade through all the ads on the page and the junk mail.

Web browsers were not created until the early 1990's and were first commercialized by Mark Andreeson, who started Netscape, Inc. He actually created the software while he was still a college student. The name came about because the software allows you to "browse" the various documents stored on the Internet. The other popular browser is Microsoft's Internet Explorer. If you are an America Online subscriber, you probably use the AOL browser.

Browsers are integrated in operating systems such as Windows 98 and easy access to them is available in most of the desktop software application programs such as Word 97 and Excel 97.

As the book explains, groupware supports teams of people working together on a particular project. This style of software has probably done more to advance telecommuting and to create the "death of distance" by enabling people from any geographical location to work together via networks. We'll discuss groupware in more detail in future chapters.

Bottom Line: Software application programs have progressed significantly through the years. They are easier to use now than ever before. Many of the programs don't require computer professionals and can easily be used by the average end-user. Most of the PC software tools available for nontechnical users are tightly integrated with the Internet and can share information much better.
7.4 New Software Tools and Approaches

It seems that no matter how many people work in the information technology department, there just aren't enough of them to satisfy the demand for businesses. And some businesses are too small to have their own information technology department. So what are they to do when they need special applications for their work processes? They can take advantage of new software tools designed for easier, quicker program development work.

Object-Oriented Programming

One tool they can use to accomplish their tasks is object-oriented programming. This programming language has become much simpler for nontechnical people to use. This type of programming treats text, tables, pictures, or groups of data as an object that can be manipulated and programmed to do special functions. It requires some in-depth training and time to learn, but this kind of programming is very functional for small businesses or a particular department. It can save time and money by allowing the end user to develop a whole program without computer professionals.

Just as Graphical User Interfaces made it easier to use software, program development is being revolutionized through the use of visual programming. Programmers don't have to write code; they can point and click, drag and drop, or draw to create programs.

However, managers need to be careful that they understand the hidden cost of having end-users develop their own applications. Take into account the time necessary to learn the program language. You also run the risk of creating islands of information that may not be compatible with other areas or departments of the company. Some programs that may be created with object-oriented programming could easily be incompatible with other departments or the whole system and the rest of the business. In some cases, though, having the end-users develop their own programs with object-oriented
programming could be the right solution to a shortage of professional programmers within a company or department.

Object-Oriented Programming Concepts

The terms used in this section, **classes** and **inheritance**, describe how object-oriented programming uses objects to develop a program. It may sound complicated but it really isn't. This figure shows you how class, subclasses, inheritance, and overriding works. Take a few minutes to study it.

![Diagram of classes, subclasses, inheritance, and overriding.](image)

**FIGURE 7.13**

Classes, subclasses, inheritance, and overriding.

**Java**

**Java** is a new programming language that has come on strong in the last four or five years. What makes this language so enticing is that it is platform-independent. What we mean is that you don't need to worry about compatibility between separate operating systems such as Windows, Macintosh, or UNIX. Regardless of the hardware or software you use, this language will fit them all. Many businesses and individuals have long lamented the closed systems that caused incompatibility between different platforms. It's been nearly impossible to share data between various hardware and software
platforms. Many large mainframes couldn't pass information to small PCs without special programs. Data used in smaller, individual PCs couldn't pass information to larger Information Systems. Java solves these problems.

Java can be used to create miniature programs called "applets". Applets perform very small, specialized, one-at-a-time tasks. When a user wants to perform the task, the coding is moved from the server where it's permanently stored and then executed on the client computer. When the task is completed, it's deleted from the client and reverts to the server computer. In essence, you use an applet once and then literally throw it away. Using applets reduces storage needs on client computers and PCs. Again, it doesn't matter whether the client is a PC or a terminal attached to a network. In fact, Java applets are being used on hand-held computers, and on many other non-computer appliances.

Java also reduces the "bloatware" problem of huge software application programs with more functions than the average person could ever hope to use. You don't need a large application program to do a simple task. If you want to calculate the monthly payments for a car loan, you can use a simple Java applet instead of a huge spreadsheet program.

Java threatens to unseat Microsoft as the software king because people won't have to buy an entire software program to get just one functional piece. Microsoft is trying to establish its own version of Java through the ActiveX programming language. Unfortunately, that may lead to the same platform dependency problem we had before, because Microsoft's version will run differently than the pure version of Java.

To be sure, Java still has lots of bugs. It takes extra time to download a Java applet from a Web site and it runs slower on a PC than does a regular program. The issue raised in the text about alternative versions of Java was somewhat resolved by a recent court injunction that prevented Microsoft from diluting the pure Java code created by Sun Microsystems Inc. However, software developers are still hesitant to support one language over the other.
It's becoming quite common for the average computer user to create Web pages using the **Hypertext markup language (HTML)**. In fact, by using the PC Software Tools we discussed earlier (Word 97, Lotus 1-2-3, PowerPoint), you can as easily create a Web page as you can a letter, chart, or database. While you don't have to be an expert in HTML, you should be familiar with how the coding works.

The language is one of the easiest to learn and you can do it by getting a good book that explains how the code works. You can also access various free Web sites that will teach you the basics of the language. Combining HTML language into everyday applications is further integrating the Internet into everything we do.

If you'd like a quick look at HTML code, use the page you're currently reviewing on the Web and follow these steps:

*If you're using Netscape Navigator as your browser:*

- Click on View in the Menu Bar
- Click on Page Source

*If you're using Internet Explorer or AOL:*

- Click on View in the Menu Bar
- Click on Source

Now you see a much different view of the page you were looking at. You see all the funny symbols such as `<` and `>` and the operative command tags such as **title, body, and P.** All of those are commands which the HTML language uses to display a Web page.

**Bottom Line:** Java holds the greatest promise for cross-platform compatibility in computing. It promises to break down many of the barriers to simpler and less expensive computing. With the increasing use of the Internet, Java and HTML hold the keys to our computing future.
7.5 Managing Software Assets

At some point in your career you're likely to be involved in making decisions about the type of software your organization uses. While the software programs will change, the basic principles upon which your decision is based probably won't.

Software Trends

The computer software industry continues to create products based on how humans work instead of requiring people to work the way computers do. Methods of communicating with the machines are becoming more human-like with voice and touch input. Many of the improvements are being driven by the need to decrease the number of people employed by corporations and increase each worker's productivity. Stand-alone computers in the workplace are almost a thing of the past as networks become cheaper, faster, and easier to install and maintain.

The most popular trend in corporations is to rely more and more on enterprise resource planning (ERP) systems as organizations move toward increased integration and team-based work processes. ERP systems allow the company to work as a whole instead of in separate bits and pieces or by relying on islands of information.

Software Maintenance and the Year 2000 Problem

Just as you have to maintain any piece of equipment to keep it working at its best, whether it's a car, bicycle, or your own body, you must maintain computer systems, both hardware and software. The Year 2000 problem (Y2K) has made this fact even more apparent. While most of the focus and fear has been on huge corporate systems, individual PC users must be aware that they too may have problems with the Y2K bug. Small businesses using just one or two computers may be as vulnerable as the larger companies. Many Quicken Small Business accounting programs widely used by Mom-and-Pop businesses aren't compatible with the date change and never will be.
You don't have to purchase expensive software in order to check your own system. Many software and hardware manufacturers have lots of information about their products on Web sites. Many of the software fixes are free for the downloading. Check these software sites for more information:

- Microsoft Operating Systems and application programs: http://www.microsoft.com/technet/year2k/
- General information: http://headlines.yahoo.com/Full_Coverage/Tech/Year_2000_Problem/

The most feared Y2K breakdowns are in the banking and utility systems. The facts support the idea that these industries are the ones most ready for the Y2K change. The Federal Reserve is more worried about scams preying on peoples' fears of the Y2K bug than it is about problems with the computer systems. Don't be a victim of the hype: thoroughly check out any offer that sounds strange or too good to be true.

The most intriguing question regarding Y2K could be: When does the new millennium actually occur; January 1, 2000 or January 1, 2001?

Selecting Software for the Organization

It's easy to get swept up in the excitement of a new software program coming to market promising huge gains in productivity or ease-of-use for a low price. Managers must make sure that the software is right for the organization before they spend thousands of dollars for a product that will sit on the shelf.

When you are purchasing new software for yourself or your organization, answer the following questions:

- What is the organizational use of the software?
- Is the software easy to maintain and change?
- Is the software flexible enough to grow with the organization?
How efficient is the software in terms of machine time?
Is the software compatible with the current hardware?
Can the current staff fully support the new software?
Is the software widely used by other organizations, especially customers and suppliers?
Is sufficient support available outside the organization if needed?

**Bottom Line:** Managers must be aware of issues surrounding the management of software resources: compatibility, support, maintenance, and efficiency. Software is another resource that can enhance an organization or drag it down.

**Discussion Questions:**
Click on the Discussion icon in the top toolbar to answer the following Discussion Questions.

1. What are the advantages of using object-oriented programming in small businesses and individual departments?
2. Explain the difference between multiprogramming system software and multiprocessing system software.
3. What is a platform and how does this concept affect computing between different platforms?
4. What is Java and how is it changing the computing environment?
5. How can managers effectively integrate fourth-generation languages and PC Software Tools into their work environments?
6. Does the new millennium begin on January 1, 2000 or January 1, 2001?

**Chapter 8: Managing Data Resources**
8.1 Organizing Data in a Traditional File Environment
8.2 The Database Environment
8.3 Designing Databases
8.4 Database Trends
8.5 Management Requirements
Discussion Questions
8.1 Organizing Data in a Traditional File Environment

Information is becoming as important a business resource as money, material, and people. Businesses are realizing the competitive advantage they can gain over their competition through useful information, not just data.

Why should you know about organizing data? Because it's almost inevitable that some day you'll be establishing or at least working with a database of some kind. As with anything else, understanding the lingo is the first step to understanding the whole concept of managing and maintaining information. It all comes down to turning data into useful information, not just a bunch of bits and bytes.

File Organization Terms and Concepts

FIGURE 8.1

The data hierarchy.
The first few terms, **field, record, file, database**, are depicted in Figure 8.1, which shows the relationship between them.

An **entity** is basically the person, place, thing, or event about which we maintain information. Each characteristic or quality describing an entity is called an **attribute**. Each record requires a **key field**, or unique identifier. The best example of this is your Social Security number: there is only one per person. That explains in part why so many companies and organizations ask for your Social Security number when you do business with them.

Suppose you decide to create a database for your newspaper delivery business. To succeed, you need to keep accurate, useful information for each of your customers. You set up a database to maintain the information. For each customer, you create a record. Within each record you have the following fields: customer name, address, ID, date last paid. Smith, Jones, and Brooks are the records within a file you decide to call Paper Delivery. The entities then are Smith, Jones, and Brooks, the people on whom you are maintaining information. The attributes are customer name, address, ID, and date last paid. The key field in this file is the ID number; perhaps you'll use their phone number, since it will be unique for each record. This is a simplistic example of a database, but it should help you understand the terminology.

**Accessing Records**

When we were describing secondary storage, we talked about magnetic tape and disk storage for computer data. To understand how information is accessed from these mediums, think about the difference between a music cassette tape and a music CD. If you want to get to a particular song on a cassette tape, you must pass by all the other songs sequentially. If you want to get to a song on CD, you can go directly to that song without worrying about any of the others. That is the difference between sequential and direct access organization for database records.

**Sequential file organization**, in conjunction with magnetic tape, is typically used for processing the same information on all records at
the same time. It is also good for processing many records at once, commonly called batch processing.

Direct or random file organization is used with magnetic disks. Because of increased speed and improved technological methods of recording data on disks, many companies now use disks instead of tapes. The other advantage that disks have over tapes is that disks don't physically deteriorate as fast as tapes do. There is less danger of damaging the surface of the disks than there is of breaking a tape.

Indexed Sequential Access Method

To explain the indexed sequential access method (ISAM), let's go back to the example of the cassette tape. A cassette tape label has a printed list of the songs contained on it which gives you a general idea of where to go on the tape to find a particular tune. So too with computer records on a sequential access tape using the key field. It gives the computer a pretty accurate idea of where a particular record is located. That's why it's so important to have a unique ID as the key field. You and your customer could have a difficult time if the key field is duplicated among several records. Each key field and the ultimate location of that record on the storage device is maintained in the index.

Direct file access method

This access method also uses key fields in combination with mathematical calculations to determine the location of a record. If you order something by phone from a mail order catalog, the person taking your order does not have to wait for the computer to randomly select your record; using the direct file access method, the computer can find you very quickly.
The direct file access method.

Figure 8.4 shows that records are not stored sequentially but at random. The **transform algorithm** uses the value in the key field to find the storage location and access the record.

**Problems with the Traditional File Environment**

Many problems, such as data redundancy, program-data dependence, inflexibility, poor data security, and inability to share data among applications, have occurred with **traditional file environments**.

We've spoken about "islands of information" before. Building and maintaining databases is where this situation is most evident and most troublesome. Usually it begins in all innocence, but it can quickly grow to monstrous proportions.

For instance, after you move and change addresses, you notify everyone of your new address, including your bank. Everything is going smoothly with your monthly statements. All of a sudden, at the end of the year, the bank sends a Christmas card to your old address. Why? Because your new address was changed in one database, but the bank maintains a separate database for its Christmas card list and your address was never changed in it.
If you received two Christmas cards, you're probably a victim of data redundancy. That is, your information is now in two separate databases with duplicate records. In this instance, each database file has different data on the same record. That can be a nightmare on Main Street!

Even more troublesome is when several departments or individuals decide to set up their own islands of information. This usually happens because they find the main system inflexible or it just doesn't fit their needs. So they set up their own fields and records and files and use them in their own programs to manipulate data according to their needs. Now each department is spending dollars and time to establish and maintain separate islands of information.

Even worse, the fields and records for Marketing probably don't have the same structure and meaning as the fields and records for Accounting, or those for Production. Each record describes basically the same entity (customers or products), but it is very possible that each database file will have different information, or attributes, in records concerning the same entity.

All of this may have happened with the best of intentions. All the departments began with the goal of making their part of the organization more efficient. Eventually these good intentions can cost big dollars to bring the islands together, resolve data conflicts between them, and retrain people to understand the new database structures.

**Bottom Line:** Managers and workers must know and understand how databases are constructed so they know how to use the information resource to their advantage. Managers must guard against problems inherent with islands of information and understand that sometimes resolution of short-term problems is far costlier in the long term.
8.2 The Database Environment

The key to establishing an effective, efficient database is to involve the entire organization as much as possible, even if everyone seemingly will not be connected to it or be a user of it. Perhaps they won't be a part of it in the beginning, but they very well could be later on.

Database Management Systems

You've heard the old saying, "Don't put all your eggs in one basket." When it comes to data, just the opposite is true. You want to put all your corporate data in one system that will serve the organization as a whole.

A **Database Management System (DBMS)** is basically another software program like Word or Excel or Email. This type of software is more complicated: it permits an organization to centralize data, manage them efficiently, and provide access to the stored data by application programs. A DBMS has 3 components, all of them important for the long-term success of the system.

**Data definition language.** Marketing looks at customer addresses differently from Shipping. So you must make sure that all users of the database are speaking the same language. Think of it this way: Marketing is speaking French, Production is speaking German, and Human Resources is speaking Japanese. They are all saying the same thing, but it's very difficult for them to understand each other. Defining the data definition language itself sometimes gets shortchanged. The programmers who are creating the language sometimes say "Hey, an address is an address, so what." That's when it becomes critical to involve users in the development of the Data Definition Language.

**Data manipulation language.** This is a formal language used by programmers to manipulate the data in the database and make sure they are formulated into useful information. The goal of this language should be to make it easy for users. The basic idea is to establish a single data element that can serve multiple users in different
departments depending on the situation. Otherwise, you'll be tying up programmers to get information from the database that users should be able to get on their own.

**Data dictionary.** Each data element or field should be carefully analyzed to determine what it will be used for, who will be the primary user, and how it fits into the overall scheme of things. Then write it all down and make it easily available to all users. This is one of the most important steps in creating a good database.

![Sample data dictionary report.](image)

**FIGURE 8.7**

Sample data dictionary report.

Figure 8.7 shows a properly constructed data dictionary report. You can see exactly who owns the data element and all the business functions that use the data element. It also lists the people who have access to the data element.
Why is it so important to document the data dictionary? Let's say Suzy, who was in on the initial design and building of the database, moves on and Joe takes her place. It may not be so apparent to him what all the data elements really mean, and he can easily make mistakes from not knowing or understanding the correct use of the data. He will apply his own interpretation, which may or may not be correct. Once again, it ultimately comes down to a _persware_ problem.

**Logical and Physical Views of Data**

**Physical views** of items are often different from the **logical views** of the same items when they are actually being used.

For instance, assume you store tablets of paper in your lower right desk drawer. You store your pencils in the upper left drawer. When it comes time to write your request for a pay raise, you pull out the paper and pencil and put them together on your desktop. It isn't important to the task at hand where the items were stored _physically_; you are concerned with the logical idea of the two items coming together to help you accomplish the task.

The physical view of data cares about where the data are actually stored in the record or in a file. The physical view is important to programmers who must manipulate the data as they are _physically stored_ in the database.

Does it really matter to the user that the customer address is physically stored on the disk before the customer name? Probably not. However, when users create a report of customers located in Indiana they generally will list the customer name first and then the address. So it's more important to the end user to bring the data from their physical location on the storage device to a _logical_ view in the output device, whether screen or paper.

---

**Bottom Line: Database Management Systems have three critical components: the data definition language, the data manipulation language, and the data dictionary. Managers should ensure that all three receive attention. Managers**
8.3 Designing Databases

Every tool has its job. You wouldn’t use a screwdriver to pound a nail in the wall (or maybe you would), nor would you use a hammer to turn a bolt. Each type of database that we discuss in this section has its own advantages and disadvantages, so you should choose the right type of database for the job you want to do.

Hierarchical Databases

The hierarchical data model presents data to users in a treelike structure.

Think of a mother and her children. A child only has one mother and inherits some of her characteristics, such as eye color or hair color. A mother might have one or more children to which she passes some of her characteristics but usually not exact ones. The child then goes on to develop its own characteristics separate from the mother.

![Diagram of a hierarchical database for a human resources system.](image)

**FIGURE 8.10**

A hierarchical database for a human resources system.
In a hierarchical database, characteristics from the parent are passed to the child by a **pointer** just as a human mother will have a genetic connection to each human child. You can see how this database pointer works by looking at Figure 8.10.

**Network Database**

A **network data model** is a variation of the hierarchical model.

Take the same scenario with one parent and many children and add a father and perhaps a couple of stepparents. Now the parents aren't restricted to only one (the mother) but to many parents. That is, a parent can have many children and a child can have many parents. The parents pass on certain characteristics to the children, but the children also have their own distinct characteristics.

![Diagram of network data model](image)

**FIGURE 8.11**

The network data model.

As with hierarchical structures, each relationship in a network database must have a pointer from all the parents to all the children and back, as Figure 8.11 demonstrates.

These two types of databases, the hierarchical and the network, work well together since they can easily pass data back and forth. But because these database structures use pointers, which are actually additional data elements, the size of the database can grow very quickly and cause maintenance and operation problems.
**Relational Data Model**

A relational data model uses tables in which data are stored to extract and combine data in different combinations. The tables are sometimes called files, although that is actually a misnomer, since you can have multiple tables in one file. (Make sure you review the description of fields and records in the text.)

In a relational database, each table contains a primary key, a unique identifier for each record. To make sure the tables relate to each other, the primary key from one table is stored in a related table as a secondary key. For instance, in the Customer table the primary key is the unique Customer ID. That primary key is then stored in the Order Table as the secondary key so that the two tables have a direct relationship.

<table>
<thead>
<tr>
<th>Customer Table</th>
<th>Order Table</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Field Name</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>Customer Name</td>
<td>Self Explanatory</td>
</tr>
<tr>
<td>Customer Address</td>
<td>Self Explanatory</td>
</tr>
<tr>
<td><strong>Customer ID</strong></td>
<td><strong>Primary Key--- --&gt;</strong></td>
</tr>
<tr>
<td>Order Number</td>
<td><strong>Secondary Key</strong></td>
</tr>
</tbody>
</table>

Use these three basic operations to develop relational databases:

- Select: create a subset of records meeting the stated criteria
- Join: combine related tables to provide more information than individual tables
- Project: create a new table from subsets of previous tables

The biggest problem with these databases is the misconception that every data element should be stored in the same table. In fact, each data element should be analyzed in relation to other data elements with the goal of making the tables as small in size as possible. The
ideal relational database will have many small tables, not one big one. On the surface that may seem like extra work and effort, but by keeping the tables small, they can serve a wider audience because they are more flexible. This setup is especially helpful in reducing redundancy and increasing the usefulness of data.

**Advantages and Disadvantages**

Hierarchical and network databases can be very efficient as long as you plan ahead. But as you know, needs change, and neither one of these databases offers a lot of flexibility to change with business needs. It's sort of like parents and children; once you establish the tie, it's pretty hard to amend.

Relational database management systems are more flexible, especially if you keep the tables small. It is much easier for non-techies to create the query language in a relational system. It's also easier to add new data elements, although if you do, you'll have to go back and fill in the missing information for the old records or just forget them altogether.

<table>
<thead>
<tr>
<th>Type of Database</th>
<th>Processing Efficiency</th>
<th>Flexibility</th>
<th>End-User Friendliness</th>
<th>Programming Complexity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hierarchical</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Network</td>
<td>Medium–high</td>
<td>Low–medium</td>
<td>Low–moderate</td>
<td>High</td>
</tr>
<tr>
<td>Relational</td>
<td>Lower but improving</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
</tbody>
</table>

**TABLE 8.1**

Table 8.1 compares these alternatives on several dimensions to show you the advantages and disadvantages of each.

What you should remember is that none of these databases is very good if you don't keep the end user in mind. If you're not careful, you'll wind up with lots of information that no one can use.
Creating a database

Don’t start pounding on the keyboard just yet!

First, you should think long and hard about how you use the available information in your current situation. Think of the good and the bad of how it is organized, stored, and used. Now imagine how this information could be organized better and used more easily throughout the organization. What part of the current system would you be willing to get rid of and what would you add? Involve as many users in this planning stage as possible. They are the ones who will prosper or suffer because of the decisions you make at this point.

Determine the relationships between each data element that you currently have (entity-relationship diagram). The data don't necessarily have to be in a computer for you to consider the impact. Determine which data elements work best together and how you will organize them in tables. Break your groups of data into as small a unit as possible (normalization). Even when you say it's as small as it can get, go back again. Avoid redundancy between tables. Decide what the key identifier will be for each record. See, you've done all this and you haven't even touched the computer yet!

Give it your best shot in the beginning: it costs a lot of time, money, and frustration to go back and make changes or corrections or to live with a poorly designed database.

Bottom Line: There are three types of databases: hierarchical, network, and relational. Relational databases are becoming the most popular of the three because they are easier to work worth, easier to change, and can serve a wider range of needs throughout the organization.

8.4 Database Trends

Recent database trends include the growth of distributed databases and the emergence of object-oriented and hypermedia databases.
Distributed Databases

Distributed databases are usually found in very large corporations that require multiple sites to have immediate, fast access to data. As the book points out, there are lots of disadvantages, so you should be careful in determining if this is the right way for you to run your business.

Object-Oriented and Hypermedia Databases

Many companies are steering away from strictly text-based database systems. Data as objects can be pictures, groups of text, voice, audio, etc. Object-oriented databases bring the various objects from many different sources and get them all working together.

As we move away from strictly text-based information systems and incorporate video and sound, graphics and text, the hypermedia database will become more common. Figure 8.18 helps explain the concept of a hypermedia database by showing how the various elements are networked. The attraction to this type of database is that it allows the user to decide which path to follow from one node to another.
**FIGURE 8.18**

Hypermedia database

**Multidimensional Data Analysis**

As technology improves, so does our ability to manipulate information maintained in databases. Have you ever played with a Rubik Cube - one of those cute little multicolored puzzle boxes you can twist around and around to come up with various color combinations? That's a close analogy to how multidimensional data analysis or **on-line analytical processing (OLAP)** works (see Figure 8.19). In theory, it's easy to change data around to fit your needs.
FIGURE 8.19
Multidimensional data model.

Data Warehouses

As organizations want and need more information about the company, the products, and the customers, the concept of data warehousing has become very popular. Remember those islands of information we keep talking about? Unfortunately, too many of them have proliferated over the years, and now companies are trying to rein them in using data warehousing.

No, data warehouses are not great big buildings with shelves and shelves of bits and bytes stored on them. They are huge computer files that store old and new data about anything and everything a company wants to maintain information on.

Since the data warehouse can be cumbersome, a company can break the information into smaller groups called data marts. It's easier and cheaper to sort through smaller groups of data. It's still useful to have a huge data warehouse, though, so that information is available to everyone who wants or needs it. You can let the user determine how the data will be manipulated and used. Using a data warehouse correctly can give management a tremendous amount of information that can be used to trim costs, reduce inventory, put products in the right stores, etc.
Linking Databases to the Web

Even though Web browsers have been around for only a few years, they are far easier to use than most of the query languages associated with the other programs on mainframe computer systems. That's why many companies are starting to link their databases to a Web-like browser. They are finding out that it's easier to provide their "road warriors" with Web-like browsers attached to the computer at the main office. Employees anywhere can have up-to-the-minute access to any information they need. It's also proving cheaper to create browser applications that can more easily link information from disparate systems than to try to combine all the systems.

Bottom Line: There are many ways to manipulate databases so that an organization can save money and still have useful information. With technological improvements, companies don't have to continually start from scratch but can blend the old with the new when they want to update their systems.

8.5 Management Requirements

8.5 Management Requirements

FIGURE 8.21

Ebook_mis.doc
Key organizational elements in the database environment.

Nothing is ever as easy as it sounds. As Figure 8.21 shows, there is a lot more to a viable, useful database than just its structure.

**Data Administration**

Ask any manager what her resources are and she's likely to list people, equipment, buildings, and money. Very few managers will include information on the list, yet it can be more valuable than some of the others. A **data administration** function, reporting to senior management, can help emphasize the importance of this resource. This function can help define and structure the information requirements for the entire organization to ensure it receives the attention it deserves.

Data Administration is responsible for:

- Developing information policies
- Planning for data
- Overseeing logical database design
- Data dictionary development
- Monitoring the usage of data by techies and non-techies

No one part of the organization should feel it owns information to the exclusion of other departments or people in the organization. A certain department may have the primary responsibility for updating and maintaining the information, but that department still has to share it across the whole company. Well-written **information policies** can outline the rules for using this important resource, including how it will be shared, maintained, distributed, and updated.

**Data planning**

At the beginning we said that as many users as possible should be brought together to plan the database. We believed it so much then that we'll say it again here. By excluding groups of users in the planning stages, no matter how insignificant that group may seem, a company courts trouble.
**Database Technology, Management, and Users**

Change isn’t just something you experience by chance; in all likelihood, it will be required throughout the corporate structure. You need to get the non-techies talking and working with the techies. Users will take on more responsibility for accessing data on their own through query languages if they understand the structure of the database. Users need to understand the role they play in treating information as an important corporate resource. Not only will they require a user-friendly structure for the database, but they will also need lots of training and hand holding up front. It will pay off in the long run.

**Database administration** functions can:

- Define and organize database structure and content.
- Develop security procedures to safeguard the database.
- Develop database documentation.
- Maintain the database management software.

**Bottom Line:** As with any other resource, managers must administer data, plan their uses, and discover new opportunities for the data to serve the organization through changing technologies.

**Discussion Questions:**

*Click on the Discussion icon in the top toolbar to answer the following Discussion Questions.*

1. Given what you know so far, how would you structure a database for an organization to which you belong? You could use a sorority, fraternity, social group or work group you’re currently involved with.

2. Why do relational database management systems appear to be a better than a hierarchical or network database management system?
3. What do you see as the benefits of using a Web-like browser to access information from a data warehouse?

4. What is a data mart? What are the advantages of having one?

5. What should managers focus on when building a database?

Chapter 9: Telecommunications and Networks

9.1 The Telecommunications Revolution
9.2 Components and Functions of a Telecommunications System
9.3 Communications Networks
9.4 Electronic Commerce and Electronic Business Technologies
9.5 Management Issues and Decisions

Discussion Questions

9.1 The Telecommunications Revolution

Anytime, anywhere, any way, is the mantra of many computer users. Improving telecommunication technologies, the process of electronically communicating information, are making it possible.

The Marriage of Computers and Communications

You simply can't pick up a newspaper or magazine or watch television without hearing about the explosion of telecommunications and networks. Some experts point to the early 1990s and the breakup of the AT&T monopoly as the turning point in this revolution. That one incident, along with the growth in personal computers since then, could very well be how all this started. Those two forces now seem to be changing every facet of our lives.

The growth in jobs related to telecommunications and networks has been phenomenal. Webmasters, network managers, Internet service providers, and Web graphic designers are some of the jobs that
didn't exist ten short years ago. Now they are the hottest jobs on the market.

Looking for an example of how much this revolution is touching every aspect of how we work, live, play, and learn? Look no further than this page - you wouldn't be reading this if it weren't for telecommunication networks!

The exciting part is that we probably haven't seen anything yet.

**The Information Superhighway**

You can hardly keep up with the mergers and acquisitions in the telecommunications and entertainment industries. Many people compare the present-day Information Revolution to the Industrial Revolution at the turn of the 20th century. You can easily draw many parallels between the two.

You could also look at the development of our interstate highway system and the changes it brought as another example of how the information superhighway is changing things. Whole towns have sprung up around the interstate highway exchanges. Other towns have literally disappeared because they weren't located close to the interstate. Some businesses make it a corporate strategy to locate only at busy highway intersections.

When most people think of the information superhighway, they immediately think of the Internet. But the many networks developed by private corporations and public entities are also part of the superhighway. All these networks together are creating what some pundits call "the death of distance." People and companies are developing whole new ways of working, playing, learning, and communicating.

This chapter shows you how these networks are actually constructed and discusses the various elements involved in connecting all these computers. Knowing how it all works can give you insight into the changes that have taken place and an idea of what the future holds.
You can also get ideas about how you can take advantage of the future now!

**Bottom Line:** To understand the changes to our society because of the Information Superhighway, you can draw an analogy between it and the interstate highway system or between it and the Industrial Revolution.

### 9.2 Components and Functions of a Telecommunications System

Figure 9.1 shows the hardware and software components of a telecommunication system. We'll be explaining how the pieces fit together throughout this chapter.

**FIGURE 9.1**

Components of a telecommunications system.
Remember that data moving across the Internet and other networks are not limited to text, but also include video, audio, and pictures. This fact alone explains many of the mergers between telecommunications companies and entertainment companies. They are starting to understand that there is a whole new way of delivering not just information, but also entertainment via networks.

**Telecommunications System Components**

Some people look at networks simply as one computer hooked to another by a piece of wire. Networks are a little more involved than that: There are many, many pieces of equipment between those two computers: look again at Figure 9.1. We'll dissect and examine the equipment and the functions each element serves.

The major element that gets all the hardware and software working together is the **protocols**. Let's say you attend a football game between the Denver Broncos and the Dallas Cowboys. Can you imagine how confusing the game would be, not to mention unfair to one side or the other, if the Broncos followed one set of rules while the Cowboys used a totally different set? It's the same for computer networks.

Protocols are used to tell the hardware components how to transmit data within a network and between networks. They can also be thought of as a set of rules and procedures for exchanging information between computers in networks. They define how the various communication links are established, how information is transmitted, and how errors are detected and corrected between networks. Most important, the use of protocols allows different makes and types of computers to talk to each other.

Protocols are usually embedded in the software for the particular application that you want to use to complete a function on the network. If you've used the Internet at all, you've used protocols but probably didn't even realize it. Do these sound familiar?

- Hypertext Transfer Protocol or http, used for the Web
- Simple Mail Transfer Protocol or SMTP, used for email
File Transfer Protocol or FTP, used to transfer files between one computer and another computer
Transmission Control Protocol/Internet Protocol or TCP/IP, used to connect networks

The last one might have tripped you up a bit because it's not as obvious as the others. TCP/IP is the protocol that allows you to access the Internet itself through your Internet service provider or a direct connection through your school or workplace.

In Chapter 8 we noted that many companies are building interfaces to their databases that allow employees to pull data from dissimilar systems and assimilate them into a coherent output form. The use of the Internet Protocol within software programs is what allows that to happen.

**Types of Signals: Analog and Digital**

As we've said many times throughout this course, the computer understands only zeros and ones. Everything going into a computer system must be transformed into digital signals. In the networking world, however, most of the data are transmitted over telephone lines. These lines don't recognize zeros and ones. They only understand what are called analog signals. To change the signals back and forth between analog and digital transmission methods, you need a modem.

The purpose of a modem (modulator/demodulator) is to:

- Change digital signals from computers to analog signals that telephone lines can carry
- Change analog signals back to digital signals that the computer can understand

**Communication Channels**

A channel is the facility through which information is transmitted between physical locations in a network. That's just a fancy way of saying that a channel is the highway on which data travel. Think
again about the interstate highway systems. The road surface on which you drive is a good analogy to a channel. The road can be built from concrete, blacktop, or combination of the two. The channels on the Information Superhighway can be built using combinations of materials such as wires, microwave stations, and satellites.

Twisted Wire, Coaxial Cable, Fiber-optic Cable

**Twisted wire** and **coaxial cable** are common transmission media that have been around for years. Twisted wire is used in your telephone. If you've ever hooked up a stereo system or connected a VCR to a television, you've used coaxial cable. **Fiber-optic cable** is the newest type of transmission medium. The text explains its advantages and disadvantages. One other major difference between them is in the area of security. Signals transmitted over twisted wire and coaxial cable can be intercepted easily because they use electrical and magnetic impulses to transmit data. Fiber-optic cable uses pulses of light. So far, no one has figured out a way to intercept light pulses in order to intercept data.

Wireless Transmission

Some experts call us a wired nation. If you consider all the methods we use to communicate, we should be referred to as wireless. Our **pagers** and **cellular phones** use **microwave** and **satellite** technologies to transmit voice and data communications from one place to another. We have **personal communication services (PCS)**, mobile data networks, and **personal digital assistants (PDAs)** to help us compute on the go. Now when people say they are "going to the office," it could just as well be their car or truck!

Wireless communications are becoming extremely popular because they offer people the "freedom to roam." The most interesting demonstration that shows how common this technology is becoming is the case of expectant parents. The husband can carry a beeper and know instantly when the wife needs to leave for the hospital. Have you seen the commercial that shows the expectant father carrying a cell phone on an oil rig hundreds of miles out to sea? He's telling his wife, "Now is not a good time to start your labor."
An interesting promise of what the future holds is the telecommunications companies' plan to combine the various communication appliances into one with only one phone number. Many of us have a phone number at home, a separate cell phone with its own number, and yet another phone at work with a third number. Then we have a computer connection at work, one at home, and possibly a portable computer. The plan is to combine all of these into a single connection with a single phone number that travels with you wherever you go.

One of the most difficult and troublesome aspects for industries is called the "last mile." It's actually cheaper to run a fiber-optic cable from one central location to another in a straight line. But it is extremely expensive to run a wire from the main fiber-optic cable to each individual house, especially in suburbs or rural areas. There is more labor involved in the last mile than in great distances serving masses of people.

When the telecommunication companies want to wire a building, generally they run one major line from the main fiber-optic cable to the building. Then they can hook up individual computers and telephone lines within that building. When you do the same thing with individual homes, costs increase dramatically.

All the transmission channels discussed in this section combine to give you what seems to be a single clear channel from one physical location to another physical location. In fact, it is very likely that when you access the Internet and call up the Gardening Web site, you are using a combination of twisted wire, fiber-optic cable, microwave stations, and satellites to get from your computer to the other computer.

When you transmit the latest information from the Garden.com Web site to your personal computer, the speed at which it moves across all the transmission media is measured in bits per second (BPS) or the baud rate. The bandwidth of a communication channel is measured by the difference between the highest and lowest frequencies that can be transmitted by that channel.
Table 9.1 shows the speeds of the transmission media that we've covered in this section so you can compare one to another.

**Table 9.1**

<table>
<thead>
<tr>
<th>Medium</th>
<th>Speed</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twisted wire</td>
<td>300 BPS–10 MBPS</td>
<td>Low</td>
</tr>
<tr>
<td>Microwave</td>
<td>256 KBPS–100 MBPS</td>
<td></td>
</tr>
<tr>
<td>Satellite</td>
<td>256 KBPS–100 MBPS</td>
<td></td>
</tr>
<tr>
<td>Coaxial cable</td>
<td>56 KBPS–200 MBPS</td>
<td></td>
</tr>
<tr>
<td>Fiber-optic cable</td>
<td>500 KBPS–10 GBPS</td>
<td>High</td>
</tr>
</tbody>
</table>

BPS = bits per second  
KBPS = kilobits per second  
MBPS = megabits per second  
GBPS = gigabits per second

**TABLE 9.1**

*Communications Processors and Software*

In most cases you won't use front-end processors, multiplexers, concentrators, or controllers on your personal computer. These pieces of equipment are used on larger networks and are reserved for the techies. They are interesting pieces of the puzzle, though, so let's go ahead and look at them.

Sometimes the host computer on a large network gets overloaded processing data, monitoring transmissions, controlling the system, etc. That's where **front-end processors** come in handy. Front-end processors don't store data or application programs. You can't use them for general computing. This type of computer does nothing but process the electronic transmissions between computers on a network system. It's there to relieve the host computer from transmission processing so the host can serve your basic computing needs.

A **Concentrator** is a telecommunications computer that collects data signals and holds them. When enough signals are collected, the computer sends them on to the host as a batch. A **controller**
computer simply processes signals between the CPU and terminals, printers, or other peripheral devices attached to the network.

**Multiplexers** are similar to front-end processors, but their location inside the network is different. Let's use a hypothetical situation that is becoming more and more common in businesses throughout the world. Suppose your local bank was bought out by a big bank in New York City. New York City, you scream. How can that be? Oh well, you sigh, how will I be affected? Probably not much. The local branch will still exist but will be electronically connected to the big bank. The home office will install a small network of computers, let's say 10 terminals, in the local branch.

Remember that each computer in a network must be connected to the other computers in the network and in turn, each computer must be connected to the host computer in the center of the network. Does it make sense for each of the 10 terminals to be separately wired to the host computer in New York? You'd have to use a separate telephone line for each computer - that's 10 telephone lines. Typically each terminal will only be used a small portion of the day. So if terminal 1 is transmitting only a few times a day, and terminal 2 is transmitting only a few times a day, and terminal 3 is ..... well, you get the idea.

What the New York bank will do is install a multiplexer component in the branch to which each of the 10 terminals will be connected. The multiplexer gathers the signals from each terminal and transmits them to the New York bank over a single transmission line. Now you're talking efficiency.

**Routers**

How does your Internet Service Provider manage to send your email to the right place? We're talking millions and millions of people sending email every day. How in the world do you keep from getting Mary's email intended for Billy in Atlanta? If you ever noticed, each computer user connected to a network has a separate, individual address. No two addresses are exactly the same. All of these addresses are stored on various computers placed around the
networks. Software stored on **routers** uses these addresses to route the data to the right location. Routers use protocols to help route data around the many networks to get them to their correct destination.

Routers also allow different types of computers on the various networks to "talk" to each other. If you are using a PC with a Windows 98 operating system, and you want to send an email to someone who is using a Macintosh computer with the MAC operating system, you can do that because of the router. Still puzzled? See if this helps: You own a Magnavox television set hooked up to a cable service. Your neighbor owns a Sony television set and uses a satellite to receive programming. How is it that both of you can receive "Seinfeld" at the same time? "Back-office" technology allows the signals to be adapted to various makes and models of televisions and to the varying methods of sending those signals through to your television. That's what routers do on a data network.

The system of routers and associated transmission media form what's known as a **network backbone**. Think of your own body. Without your backbone, you'd have a tough time standing, sitting and moving. That's similar to a network backbone. All the computers, physical wires, wireless media, processors and software come together in a network backbone to give us a whole new way of communicating.

**Bottom Line:** Protocols are the rules used in networks to ensure that transmissions can pass between the various components. Communication channels consist of wired and wireless media. Processors and software are combined with the protocols and transmission media to form a network backbone. Many small networks can be connected to form larger networks, which in turn can be connected to the Internet.
9.3 Communications Networks

The topology, which is the shape or configuration of a network, can be different for each company depending on its needs. Let's look at several different ways you can configure your network. Network Topologies

One way of describing a network is by its shape: star, bus, or ring. Star network

![Star Network Topology](image)

**FIGURE 9.5**

A star network topology.

The **star network** is usually used in larger companies with lots of communications traffic. The distinct drawback is that if the host computer (sometimes called the server computer) goes down, the whole network goes down. You've experienced this type of situation
if you've tried to access a Web site and you get a message that says the host computer is down.

Bus network

![Bus network diagram]

**FIGURE 9.6**

A bus network topology.

There is no central computer with the **bus network**. Rather, all the computers in the network are linked with cables. This type of network is usually used in smaller companies with few computers and a much lower volume of traffic.

Ring Network
Like the bus network, the **ring network** doesn't have a central host computer either. However, with this topology, if one computer goes down, the other computers can still process data and transactions.

**Private Branch Exchanges and Local Area Networks (LANs)**

Many networks are defined by their geographic scope as either wide-area networks or local networks. Wide-area networks can be several miles wide or thousands of miles wide. Local networks are more confined in distance, covering a very small area.

Private Branch Exchanges (PBX)

In the past, a **private branch exchange (PBX)** was restricted to carrying telephone traffic. Now it's been adapted to carry data also, but only in a very small geographic area. For instance, if you have a
small company with perhaps 15 offices in one geographic location, you could use a PBX to link your computers to shared printers and also use it for telephone traffic. It is a little cheaper to use this setup, although it would limit how much data you could send between the computers and any peripheral devices.

Local Area Networks (LAN)

The **local area network (LAN)** is probably the most common network setup. You can have as few as two computers or as many as you can wire together in the local area. You could also set up a LAN for the local area processing within your company and then connect it to a larger outside network that could be linked to distant locations. The real advantage to a LAN is that you can share expensive peripheral devices such as laser printers. The other advantage is the LAN's ability to process larger volumes of data transactions than a PBX. Generally, larger LANs will use a star topology with a central host computer, although you could use a bus or ring topology as well. Applications software and data can be stored on the server computer and be available to a wider audience of users. This is an excellent setup for collaborative work teams.

Figure 9.8 shows you how a LAN can be configured with the PCs and peripheral devices (printers) connected to a Network **gateway** computer. The gateway is aptly named because it serves as a gateway to a larger network. A business can construct a small network to use within the confines of its operations. It can choose to add the gateway computer to connect its small network to larger ones or to the Internet.
Having a simple operating system such as Windows 98 or Macintosh OS on the computers in a LAN isn't enough. To share network resources, such as printers, and to route communications on a LAN requires special software called a **Network Operating System (NOS)**.

Many small businesses choose to forego a client/server network architecture in favor of a **peer-to-peer** network in which all the computers on the network are equal. Data on one computer can be accessed easily by any other computer. Setting up a small network with this configuration saves the cost of having a separate server computer.

### Wide Area Networks (WANs), Value-Added Networks (VANs), and Network Services

**Wide Area Networks (WANs)**

A **wide area network (WAN)** is basically the same thing as a LAN, only for a broader geographic setting. This network is not limited by
space and distance, and WANs use a combination of technologies to connect all the distant locations.

Value Added Networks (VANs)

So you're an entrepreneur or a very small company just starting out and don't have a lot of money to sink into computers, processors, and transmission media. You still want the capabilities offered by the technology, though. No problem; hook up with a **value-added network (VAN)** and you're in business. VANs offer the processing capabilities and latest technologies on a contract, pay-as-you-go basis. They are private, multipath, data-only, third-party managed networks used by many organizations. Outsourcing your network hardware requirements to another company can save you a lot of upfront money. Later on, when you're successful and growing, you can increase your processing capabilities with the VAN or go ahead and purchase the technologies on your own. The value added through a VAN is the technical expertise they offer in addition to the hardware capabilities.

Network Services

Think of going to the grocery store and buying a week's worth of food. For some of us that may be 20 packages of Ramen noodles; for others that could be quite a lot of food. You buy all the things, load them all in to your cart, and head for the checkout line. You pay for your food while it is being bagged. Assuming you bought lots of items, not all of them are packed into the same bag. You probably will have four or five bags, maybe more. You take them home, unpack the bags, and reassemble all your goods in the cupboard. You've just experienced packet switching.

**Packet switching** is a method of breaking large blocks of text into smaller chunks of data and routes them in the most economical way through whichever communication channel is available.

When you access this lecture file on the Web, it appears as though all the data came into your client computer together. But they didn't. The data were broken into small packets on their way out of the
server computer and then sent to and reassembled on the client computer. It happens so quickly and so efficiently that you don't even notice. Packet switching also checks transmission errors when data travel from one location to another. Make sure you read the text to understand the technical aspects of how packet switching operates.

**Frame relay** is a cheaper and faster way of sending data. It packages data much like packets but doesn't check for transmission errors. Therefore, you'd want to use frame relay only on very reliable transmission lines.

Many of us complain about the slowness of the transmission lines on our computers, especially if we are using the computer at home. Most telephone lines are slow, and the modems on our home computers are even slower. The telecommunication companies are working hard to remedy this problem and create technologies that will greatly increase the speed at which we access data on the Internet. One of the most promising technologies now is the **Asynchronous Transmission Mode (ATM)**. ATM ties all the disparate parts and pieces of a network into what will appear to the user as one. It is able to process transmissions and all kinds of data more efficiently and at a higher speed.

A few years ago, **Integrated Services Digital Network (ISDN)** was the Holy Grail of fast data transmission. It is a complicated technology to install on computers, especially personal computers, so its appeal has lessened.

The other emerging technology is the **Digital Subscriber Line (DSL)** which will increase the capabilities of the regular telephone lines to process more than just voice data. DSL will be able to carry voice, data, graphics, and video at a greater capacity than the current ISDN lines.

Since many home computer users already have cable TV installed in their homes, the telecommunications industry is using cable modems to pump data into the home via cable TV. Because the technology limits the data flow to one way, cable modem users still need a regular modem to send data out to networks.
Larger organizations, such as universities and corporations, can afford a **T1 line**, which support extremely high rates of data transmission. These lines are capable of carrying voice and data transmissions over 24 channels, which makes them ideal for larger networks. Because T1 lines are expensive, they are not something you'd install in your home.

The important thing to remember with all this new technology is that nothing is standing still. The telecommunications and computer industries are working at breakneck speed to improve and expand the networking experience not just for companies, but also for home users.

**Enterprise Networking and Standards**

It's likely that as a company grows, so will its networking capabilities and needs. Through **enterprise networking**, a company can build a new network and connect it to existing, separate networks. We noted earlier how different types of computers can be connected through the use of software so that you don't have to replace your current computers.

One way that companies are increasing and improving their current system technology without purchasing all new information systems is through the use of **TCP/IP protocols**. Remember we mentioned before that companies can create interfaces for different databases to access information without actually combining the data physically in one huge computer. They do so through the use of the Internet protocol (IP). Using this protocol, they can reduce the disruption to the organization and decrease the overall costs of adding to their networks.

**Connectivity and Standards**

Typically, individuals connect to the Internet through an Internet service provider. However, businesses have to create their own networks. In order to compete, organizations must create their own proprietary networks and measure how well their computers and
computer-based devices communicate and share information. This measurement is called **connectivity**.

Computer users often lament the fact that it's difficult to share data between different platforms. Most of this problem is resolved through **open systems**: nonproprietary operating systems, user interfaces, and networking protocols. Open systems allow users to exchange data and information easily and efficiently without worrying about the type of hardware used on the individual computers.

**Models of Connectivity for Networks**

The most popular model for connecting networks is the **Transmission Control Protocol/Internet Protocol (TCP/IP)**. It provides the easiest methodology for communicating between computers through standardized protocols which ignore the hardware and software platforms of the individual pieces of equipment.

Figure 9.11 shows you how TCP/IP works.
The **Open Systems Interconnect (OSI)** is similar to TCP/IP in that it supports any hardware and software connected to the network. OSI was developed as an international reference model.

**Bottom Line:** There are many different types of network hardware configurations. Which one is best for your organization depends on your situation.

### 9.2 Components and Functions of a Telecommunications System

Figure 9.1 shows the hardware and software components of a telecommunication system. We'll be explaining how the pieces fit together throughout this chapter.

![FIGURE 9.1](image)

**FIGURE 9.1**

Components of a telecommunications system.
Remember that data moving across the Internet and other networks are not limited to text, but also include video, audio, and pictures. This fact alone explains many of the mergers between telecommunications companies and entertainment companies. They are starting to understand that there is a whole new way of delivering not just information, but also entertainment via networks.

**Telecommunications System Components**

Some people look at networks simply as one computer hooked to another by a piece of wire. Networks are a little more involved than that: There are many, many pieces of equipment between those two computers: look again at Figure 9.1. We'll dissect and examine the equipment and the functions each element serves.

The major element that gets all the hardware and software working together is the **protocols**. Let's say you attend a football game between the Denver Broncos and the Dallas Cowboys. Can you imagine how confusing the game would be, not to mention unfair to one side or the other, if the Broncos followed one set of rules while the Cowboys used a totally different set? It's the same for computer networks.

Protocols are used to tell the hardware components how to transmit data within a network and between networks. They can also be thought of as a set of rules and procedures for exchanging information between computers in networks. They define how the various communication links are established, how information is transmitted, and how errors are detected and corrected between networks. Most important, the use of protocols allows different makes and types of computers to talk to each other.

Protocols are usually embedded in the software for the particular application that you want to use to complete a function on the network. If you've used the Internet at all, you've used protocols but probably didn't even realize it. Do these sound familiar?

- Hypertext Transfer Protocol or http, used for the Web
- Simple Mail Transfer Protocol or SMTP, used for email
File Transfer Protocol or FTP, used to transfer files between one computer and another computer

Transmission Control Protocol/Internet Protocol or TCP/IP, used to connect networks

The last one might have tripped you up a bit because it's not as obvious as the others. TCP/IP is the protocol that allows you to access the Internet itself through your Internet service provider or a direct connection through your school or workplace.

In Chapter 8 we noted that many companies are building interfaces to their databases that allow employees to pull data from dissimilar systems and assimilate them into a coherent output form. The use of the Internet Protocol within software programs is what allows that to happen.

**Types of Signals: Analog and Digital**

As we've said many times throughout this course, the computer understands only zeros and ones. Everything going into a computer system must be transformed into digital signals. In the networking world, however, most of the data are transmitted over telephone lines. These lines don't recognize zeros and ones. They only understand what are called analog signals. To change the signals back and forth between analog and digital transmission methods, you need a modem.

The purpose of a modem (modulator/demodulator) is to:

- Change digital signals from computers to analog signals that telephone lines can carry
- Change analog signals back to digital signals that the computer can understand

**Communication Channels**

A channel is the facility through which information is transmitted between physical locations in a network. That's just a fancy way of saying that a channel is the highway on which data travel. Think
again about the interstate highway systems. The road surface on which you drive is a good analogy to a channel. The road can be built from concrete, blacktop, or combination of the two. The channels on the Information Superhighway can be built using combinations of materials such as wires, microwave stations, and satellites.

Twisted Wire, Coaxial Cable, Fiber-optic Cable

**Twisted wire** and **coaxial cable** are common transmission media that have been around for years. Twisted wire is used in your telephone. If you've ever hooked up a stereo system or connected a VCR to a television, you've used coaxial cable. **Fiber-optic** cable is the newest type of transmission medium. The text explains its advantages and disadvantages. One other major difference between them is in the area of security. Signals transmitted over twisted wire and coaxial cable can be intercepted easily because they use electrical and magnetic impulses to transmit data. Fiber-optic cable uses pulses of light. So far, no one has figured out a way to intercept light pulses in order to intercept data.

Wireless Transmission

Some experts call us a wired nation. If you consider all the methods we use to communicate, we should be referred to as wireless. Our **pagers** and **cellular phones** use **microwave** and **satellite** technologies to transmit voice and data communications from one place to another. We have **personal communication services (PCS)**, mobile data networks, and **personal digital assistants (PDAs)** to help us compute on the go. Now when people say they are "going to the office," it could just as well be their car or truck!

**Wireless communications are becoming extremely popular because they offer people the "freedom to roam." The most interesting demonstration that shows how common this technology is becoming is the case of expectant parents. The husband can carry a beeper and know instantly when the wife needs to leave for the hospital. Have you seen the commercial that shows the expectant father carrying a cell phone on an oil rig hundreds of miles out to sea? He's telling his wife, "Now is not a good time to start your labor."**

Ebook_mis.doc
An interesting promise of what the future holds is the telecommunications companies' plan to combine the various communication appliances into one with only one phone number. Many of us have a phone number at home, a separate cell phone with its own number, and yet another phone at work with a third number. Then we have a computer connection at work, one at home, and possibly a portable computer. The plan is to combine all of these into a single connection with a single phone number that travels with you wherever you go.

One of the most difficult and troublesome aspects for industries is called the "last mile." It's actually cheaper to run a fiber-optic cable from one central location to another in a straight line. But it is extremely expensive to run a wire from the main fiber-optic cable to each individual house, especially in suburbs or rural areas. There is more labor involved in the last mile than in great distances serving masses of people.

When the telecommunication companies want to wire a building, generally they run one major line from the main fiber-optic cable to the building. Then they can hook up individual computers and telephone lines within that building. When you do the same thing with individual homes, costs increase dramatically.

All the transmission channels discussed in this section combine to give you what seems to be a single clear channel from one physical location to another physical location. In fact, it is very likely that when you access the Internet and call up the Gardening Web site, you are using a combination of twisted wire, fiber-optic cable, microwave stations, and satellites to get from your computer to the other computer.

When you transmit the latest information from the Garden.com Web site to your personal computer, the speed at which it moves across all the transmission media is measured in bits per second (BPS) or the baud rate. The bandwidth of a communication channel is measured by the difference between the highest and lowest frequencies that can be transmitted by that channel.
Table 9.1 shows the speeds of the transmission media that we've covered in this section so you can compare one to another.

**Table 9.1**

<table>
<thead>
<tr>
<th>Medium</th>
<th>Speed</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twisted wire</td>
<td>300 BPS–10 MBPS</td>
<td>Low</td>
</tr>
<tr>
<td>Microwave</td>
<td>256 KBPS–100 MBPS</td>
<td></td>
</tr>
<tr>
<td>Satellite</td>
<td>256 KBPS–100 MBPS</td>
<td></td>
</tr>
<tr>
<td>Coaxial cable</td>
<td>56 KBPS–200 MBPS</td>
<td></td>
</tr>
<tr>
<td>Fiber-optic cable</td>
<td>500 KBPS–10 GBPS</td>
<td>High</td>
</tr>
</tbody>
</table>

BPS = bits per second  
KBPS = kilobits per second  
MBPS = megabits per second  
GBPS = gigabits per second

**TABLE 9.1**

*Communications Processors and Software*

In most cases you won’t use front-end processors, multiplexers, concentrators, or controllers on your personal computer. These pieces of equipment are used on larger networks and are reserved for the techies. They are interesting pieces of the puzzle, though, so let's go ahead and look at them.

Sometimes the host computer on a large network gets overloaded processing data, monitoring transmissions, controlling the system, etc. That's where **front-end processors** come in handy. Front-end processors don't store data or application programs. You can't use them for general computing. This type of computer does nothing but process the electronic transmissions between computers on a network system. It's there to relieve the host computer from transmission processing so the host can serve your basic computing needs.

A **Concentrator** is a telecommunications computer that collects data signals and holds them. When enough signals are collected, the computer sends them on to the host as a batch. A **controller**
computer simply processes signals between the CPU and terminals, printers, or other peripheral devices attached to the network.

**Multiplexers** are similar to front-end processors, but their location inside the network is different. Let's use a hypothetical situation that is becoming more and more common in businesses throughout the world. Suppose your local bank was bought out by a big bank in New York City. New York City, you scream. How can that be? Oh well, you sigh, how will I be affected? Probably not much. The local branch will still exist but will be electronically connected to the big bank. The home office will install a small network of computers, let's say 10 terminals, in the local branch.

Remember that each computer in a network must be connected to the other computers in the network and in turn, each computer must be connected to the host computer in the center of the network. Does it make sense for each of the 10 terminals to be separately wired to the host computer in New York? You'd have to use a separate telephone line for each computer - that's 10 telephone lines. Typically each terminal will only be used a small portion of the day. So if terminal 1 is transmitting only a few times a day, and terminal 2 is transmitting only a few times a day, and terminal 3 is ..... well, you get the idea.

What the New York bank will do is install a multiplexer component in the branch to which each of the 10 terminals will be connected. The multiplexer gathers the signals from each terminal and transmits them to the New York bank over a single transmission line. Now you're talking efficiency.

**Routers**

How does your Internet Service Provider manage to send your email to the right place? We're talking millions and millions of people sending email every day. How in the world do you keep from getting Mary's email intended for Billy in Atlanta? If you ever noticed, each computer user connected to a network has a separate, individual address. No two addresses are exactly the same. All of these addresses are stored on various computers placed around the
networks. Software stored on routers uses these addresses to route the data to the right location. Routers use protocols to help route data around the many networks to get them to their correct destination.

Routers also allow different types of computers on the various networks to "talk" to each other. If you are using a PC with a Windows 98 operating system, and you want to send an email to someone who is using a Macintosh computer with the MAC operating system, you can do that because of the router. Still puzzled? See if this helps: You own a Magnavox television set hooked up to a cable service. Your neighbor owns a Sony television set and uses a satellite to receive programming. How is it that both of you can receive "Seinfeld" at the same time? "Back-office" technology allows the signals to be adapted to various makes and models of televisions and to the varying methods of sending those signals through to your television. That's what routers do on a data network.

The system of routers and associated transmission media form what's known as a network backbone. Think of your own body. Without your backbone, you'd have a tough time standing, sitting and moving. That's similar to a network backbone. All the computers, physical wires, wireless media, processors and software come together in a network backbone to give us a whole new way of communicating.

**Bottom Line:** Protocols are the rules used in networks to ensure that transmissions can pass between the various components. Communication channels consist of wired and wireless media. Processors and software are combined with the protocols and transmission media to form a network backbone. Many small networks can be connected to form larger networks, which in turn can be connected to the Internet.
9.3 Communications Networks

The topology, which is the shape or configuration of a network, can be different for each company depending on its needs. Let's look at several different ways you can configure your network. Network Topologies

One way of describing a network is by its shape: star, bus, or ring. Star network

![Star network topology diagram](image)

**FIGURE 9.5**

A star network topology.
The star network is usually used in larger companies with lots of communications traffic. The distinct drawback is that if the host computer (sometimes called the server computer) goes down, the whole network goes down. You've experienced this type of situation if you've tried to access a Web site and you get a message that says the host computer is down.

**Bus network**

![Bus network diagram](FIGURE 9.6)

A bus network topology.
There is no central computer with the bus network. Rather, all the computers in the network are linked with cables. This type of network is usually used in smaller companies with few computers and a much lower volume of traffic.

**Ring Network**

![Ring Network Diagram]

**FIGURE 9.7**

A ring network topology.

*Like the bus network, the ring network doesn't have a central host computer either. However, with this topology, if one computer goes down, the other computers can still process data and transactions.*

**Private Branch Exchanges and Local Area Networks (LANs)**

*Many networks are defined by their geographic scope as either wide-area networks or local networks. Wide-area networks can be several miles wide or thousands of miles...*
Local networks are more confined in distance, covering a very small area.

**Private Branch Exchanges (PBX)**

In the past, a private branch exchange (PBX) was restricted to carrying telephone traffic. Now it's been adapted to carry data also, but only in a very small geographic area. For instance, if you have a small company with perhaps 15 offices in one geographic location, you could use a PBX to link your computers to shared printers and also use it for telephone traffic. It is a little cheaper to use this setup, although it would limit how much data you could send between the computers and any peripheral devices.

**Local Area Networks (LAN)**

The local area network (LAN) is probably the most common network setup. You can have as few as two computers or as many as you can wire together in the local area. You could also set up a LAN for the local area processing within your company and then connect it to a larger outside network that could be linked to distant locations. The real advantage to a LAN is that you can share expensive peripheral devices such as laser printers. The other advantage is the LAN's ability to process larger volumes of data transactions than a PBX. Generally, larger LANs will use a star topology with a central host computer, although you could use a bus or ring topology as well. Applications software and data can be stored on the server computer and be available to a wider audience of users. This is an excellent setup for collaborative work teams.

Figure 9.8 shows you how a LAN can be configured with the PCs and peripheral devices (printers) connected to a Network gateway computer. The gateway is aptly named because it serves as a gateway to a larger network. A business can construct a small network to use within the confines of its operations. It can choose to add the gateway
computer to connect its small network to larger ones or to the Internet.

FIGURE 9.8
A local area network (LAN).
Having a simple operating system such as Windows 98 or Macintosh OS on the computers in a LAN isn't enough. To share network resources, such as printers, and to route communications on a LAN requires special software called a Network Operating System (NOS).

Many small businesses choose to forego a client/server network architecture in favor of a peer-to-peer network in which all the computers on the network are equal. Data on one computer can be accessed easily by any other computer. Setting up a small network with this configuration saves the cost of having a separate server computer.

Wide Area Networks (WANs), Value-Added Networks (VANs), and Network Services

Wide Area Networks (WANs)

A wide area network (WAN) is basically the same thing as a LAN, only for a broader geographic setting. This network is not limited by space and distance, and WANs use a combination of technologies to connect all the distant locations.

Value Added Networks (VANs)

So you're an entrepreneur or a very small company just starting out and don't have a lot of money to sink into computers, processors, and transmission media. You still want the capabilities offered by the technology, though. No problem; hook up with a value-added network (VAN) and you're in business. VANs offer the processing capabilities and latest technologies on a contract, pay-as-you-go basis. They are private, multipath, data-only, third-party managed networks used by many organizations. Outsourcing your network hardware requirements to another company can save you a lot of upfront money. Later on, when you're successful and growing, you can increase your processing capabilities with the VAN or go ahead and purchase the technologies on your own. The value added through a VAN is
the technical expertise they offer in addition to the hardware capabilities.

**Network Services**

Think of going to the grocery store and buying a week's worth of food. For some of us that may be 20 packages of Ramen noodles; for others that could be quite a lot of food. You buy all the things, load them all in to your cart, and head for the checkout line. You pay for your food while it is being bagged. Assuming you bought lots of items, not all of them are packed into the same bag. You probably will have four or five bags, maybe more. You take them home, unpack the bags, and reassemble all your goods in the cupboard. You've just experienced packet switching.

Packet switching is a method of breaking large blocks of text into smaller chunks of data and routes them in the most economical way through whichever communication channel is available.

When you access this lecture file on the Web, it appears as though all the data came into your client computer together. But they didn't. The data were broken into small packets on their way out of the server computer and then sent to and reassembled on the client computer. It happens so quickly and so efficiently that you don't even notice. Packet switching also checks transmission errors when data travel from one location to another. Make sure you read the text to understand the technical aspects of how packet switching operates.

Frame relay is a cheaper and faster way of sending data. It packages data much like packets but doesn't check for transmission errors. Therefore, you'd want to use frame relay only on very reliable transmission lines.

Many of us complain about the slowness of the transmission lines on our computers, especially if we are using the computer at home. Most telephone lines are slow, and the
modems on our home computers are even slower. The telecommunication companies are working hard to remedy this problem and create technologies that will greatly increase the speed at which we access data on the Internet. One of the most promising technologies now is the Asynchronous Transmission Mode (ATM). ATM ties all the disparate parts and pieces of a network into what will appear to the user as one. It is able to process transmissions and all kinds of data more efficiently and at a higher speed.

A few years ago, Integrated Services Digital Network (ISDN) was the Holy Grail of fast data transmission. It is a complicated technology to install on computers, especially personal computers, so its appeal has lessened.

The other emerging technology is the Digital Subscriber Line (DSL) which will increase the capabilities of the regular telephone lines to process more than just voice data. DSL will be able to carry voice, data, graphics, and video at a greater capacity than the current ISDN lines.

Since many home computer users already have cable TV installed in their homes, the telecommunications industry is using cable modems to pump data into the home via cable TV. Because the technology limits the data flow to one way, cable modem users still need a regular modem to send data out to networks.

Larger organizations, such as universities and corporations, can afford a T1 line, which support extremely high rates of data transmission. These lines are capable of carrying voice and data transmissions over 24 channels, which makes them ideal for larger networks. Because T1 lines are expensive, they are not something you'd install in your home.

The important thing to remember with all this new technology is that nothing is standing still. The telecommunications and computer industries are working at
**Enterprise Networking and Standards**

*It's likely that as a company grows, so will its networking capabilities and needs. Through enterprise networking, a company can build a new network and connect it to existing, separate networks. We noted earlier how different types of computers can be connected through the use of software so that you don't have to replace your current computers.*

One way that companies are increasing and improving their current system technology without purchasing all new information systems is through the use of TCP/IP protocols. Remember we mentioned before that companies can create interfaces for different databases to access information without actually combining the data physically in one huge computer. They do so through the use of the Internet protocol (IP). Using this protocol, they can reduce the disruption to the organization and decrease the overall costs of adding to their networks.

**Connectivity and Standards**

Typically, individuals connect to the Internet through an Internet service provider. However, businesses have to create their own networks. In order to compete, organizations must create their own proprietary networks and measure how well their computers and computer-based devices communicate and share information. This measurement is called connectivity.

*Computer users often lament the fact that it's difficult to share data between different platforms. Most of this problem is resolved through open systems: nonproprietary operating systems, user interfaces, and networking protocols. Open systems allow users to exchange data and information easily and efficiently without worrying about the type of hardware used on the individual computers.*
Models of Connectivity for Networks

The most popular model for connecting networks is the Transmission Control Protocol/Internet Protocol (TCP/IP). It provides the easiest methodology for communicating between computers through standardized protocols which ignore the hardware and software platforms of the individual pieces of equipment.

Figure 9.11 shows you how TCP/IP works.

**FIGURE 9.11**

The TCP/IP reference model.

The Open Systems Interconnect (OSI) is similar to TCP/IP in that it supports any hardware and software connected to the network. OSI was developed as an international reference model.

Bottom Line: There are many different types of network hardware configurations. Which one is best for your organization depends on your situation.
9.4 Electronic Commerce and Electronic Business Technologies

Probably no other aspect of computing is proving to be as exciting and as challenging as E-commerce. Just a few years ago many corporations and businesses dismissed E-Commerce as a fad. Just the opposite has happened: E-commerce is growing at a tremendous rate. Companies, large and small, are struggling to develop their E-commerce capability and figure out how to do business on the Internet.

Facilitating Applications

What most businesses are starting to realize is that E-commerce is more than just throwing a nice-looking Web page with fancy graphics out on the Internet. You have to build new processes or change your existing methods. But it's extremely difficult to merge the old, traditional methods with the needs of the Internet. For instance, if you take orders for your business through email, who is going to monitor the email and process the orders? If you establish teleconferencing and dataconferencing as a way of reducing travel costs and increasing collaboration with distant locations, what kind of equipment do you need and who will be responsible for maintaining that equipment? In fact, it may very well be more expensive to establish an E-commerce operation than to create or grow an "old-fashioned" business.

More email messages are sent each year than are regular letters through snail mail. Email is the most used Internet service. Free email Web sites are springing up every day. Email has the capability of quickly and efficiently relaying information to one or a hundred people. It's fast, convenient, and easily molded to an individual's needs. You can attach documents destined for an important client, the boss, or Grandma!
**Voice Mail** is available to business and now, to home users. Commercials portray Mom and Dad throwing away the ancient answering machine in favor of a voice mail system which has a separate area for each of the kids. Voice mail is an excellent example of how analog signals (voice) are transformed into digital data, stored on a central computer, and then later transformed back to analog signals when an individual retrieves messages. Just like email, you can keep the message, delete it, or send it to someone else.

With the advent of email and its ability to send documents around the building or around the world, why has the **Fax machine** survived? Because many small businesses and individuals still don't have connectivity to networks or the Internet and find it more convenient to use this technology. Now you can find hyper-machines that combine the technologies of a scanner, printer, copier, and fax machine all in one. They definitely save space on your desk!

We complain of information overload and yet we seek more and more information. Business Week magazine, May 10, 1999, reports: "Internet users at work accessed 69% more content in February, 1999, than they did a year earlier." The average worker spent 100 minutes per month viewing news, information, or entertainment content. **Digital Information Services**, usually supplied through the Internet, are there for just about any type of information you need. Table 9.3 shows the most popular Commercial Digital Information Services.

**Table 9.3**

Often E-commerce and E-business includes the capability of teleconferencing, dataconferencing, and videoconferencing with employees or customers around the world. These may sound like the same technology, but they aren't. Here's the difference:

- **Teleconferencing**: basic technique of conferring simultaneously via telephone or email groupware
Dataconferencing: teleconferencing coupled with the additional capability of working on the same document or data simultaneously

Videoconferencing: teleconferencing with the additional capability of viewing participants via video screens

Groupware, which we discuss in depth in Chapter 14, allows many people to work collaboratively across the room or across the world.

**Electronic Data Interchange and Electronic Commerce**

Electronic Data Interchange (EDI) allows two businesses to send documents to each other electronically instead of using the old-fashioned paper trail. While EDI does decrease the cost of manual systems and greatly reduce the chances of error, it is more expensive to set up than a Web-based system. Both ends of the EDI must have the equipment and software to handle the system and people must be trained in its use. These requirements have made EDI cost-prohibitive for small companies: they are essentially locked out of the opportunity to do business electronically with customers and suppliers. Web-based commerce is much easier for smaller companies because of the use of standard software and because they don't necessarily have to purchase special equipment or software. We'll look at Web-based or Internet-based E-commerce more closely in Chapter 10.

**Bottom Line:** The cost of doing business on the Internet is not easily apparent. Many organizational changes must be made which add to the bottom line. E-commerce and E-business involve more technologies than just computers: tele-, data-, and videoconferencing are vital elements of doing business electronically. Email is the most widely used service on the Internet. Businesses must consider using all available technologies and resources when tackling E-commerce and E-business.
9.5 Management Issues and Decisions

Yep, you guessed it. With all the advantages of networks and E-commerce you still have some serious issues to resolve: look at Table 9.4.

<table>
<thead>
<tr>
<th>Problems Posed by Enterprise Networking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connectivity problems</td>
</tr>
<tr>
<td>Loss of management control over systems</td>
</tr>
<tr>
<td>Organizational change requirements</td>
</tr>
<tr>
<td>Hidden costs of client/server computing</td>
</tr>
<tr>
<td>Network reliability and security</td>
</tr>
</tbody>
</table>

The television commercials make it sound so easy; "Just click here and you can start networking tomorrow." They fail to tell you about all the issues, problems, and opportunities you'll have with managing an Enterprise Network. So we'll tell you about some of them now.

As technology invades every facet of our lives, both at work and personally, the average person is becoming well versed in its use. Most of the time you, as a manager, can leverage this to your advantage. After all, what Joe in Production learns on his home computer can very well be incorporated into his computer use at work. However, you increasingly run the risk of renegades creating databases and programs that are incompatible with the rest of your system. It can cost you and the rest of the company a lot of time and money to rein in their efforts and ensure cohesion throughout the organization.

You do have to give the end users some latitude, though, so they don't feel stifled by the system. You just need to impress upon
everyone the need to stay in touch with the rest of the organization and the fact that information is a companywide resource.

Remember the types of organizations we described in Chapter 3 and how they make decisions:

- Bureaucracy
- Political
- Garbage Can

Organizational issues come into play when you are establishing or changing work methods in conjunction with networks and especially E-Commerce. Organizational cultures are powerful forces that you have to deal with and that have a pervasive influence on any organizational change.

We've alluded to it before, but it becomes very evident with networks that there are a lot of hidden costs. You can't just count the dollar cost of the necessary hardware and software. You have to consider the disruptions to everyday work while you're establishing the network. What about the extra training users require? It's not free! And you have to hire new people who have the expertise to build and maintain the network.

While we're talking about costs, what about the money you could lose if the network quits working (downtime) or its security is compromised? As soon as you hear "Oh this is a piece of cake" regarding networks, you need to grab the aspirin. The more complex your network, the more costly it will be. Not just to build it, but to fix it when it breaks down. You could say that Murphy's Law was created with networks in mind.

You, as a manager, have the responsibility to manage your enterprise networking operations just as you would any other operation. You have to:

- *Manage the changes.* These include reengineering the business processes taking place behind the scenes and the organizational changes affecting the people.
- *Train the people.* Include both the Information Technology staff and the end users in your plan.
- *Manage data as a vital organizational resource.* Determine your organization's vital data, who will be responsible for them, who will have access, and how you will determine accuracy and viability.
- *Plan for the future.* Hopefully your business will grow and so too should your network. Too often managers allow the network to lag behind the rest of the business; don't be one of them.

**The Telecommunications Plan**

Just as you plan for new opportunities in other areas of your company, you should have a telecommunications plan that spells out how technology can enhance your operations, increase your competitiveness and meet your customers' needs and wants. Approaching enterprise networking haphazardly will cost you time and money.

Where do you start? First, inventory your current equipment, your current processes, and your current needs. Determine where you are before you try to figure out where you're going. Then investigate opportunities your organization can take advantage of using networking technologies.

Your plan should mesh with your overall business plan to provide support for your organization. Compare where you are presently in your core business processes and where you want to go. How well does your telecommunications plan meet your business needs? You might be surprised to find through careful analysis and comparison that the two conflict.

Finally, take a look at the potential for telecommunications to affect your organization. By giving your sales force better networking equipment, could you reduce the time it takes to process an order? If you increase the efficiency of your network, is it possible to increase the number of loan applications processed by each employee?

Implementing the Plan
Now that you know where you're going, how are you going to get there? To summarize the text:

- Determine the necessary topology: LAN, WAN, VAN, or Network Services
- Determine the type of services offered: Voice mail, email, teleconferencing, dataconferencing
- Determine the type and level of security: private lines, dedicated leased lines, public lines
- Determine the accessibility: multiple access for a thousand workers or limited access for a small number
- Determine the utilization: high-frequency, high-volume, low-frequency, low-volume
- Determine the cost: include development, operations, maintenance, expansion, and overhead
- Determine the installation difficulties: transmission media, hardware, software, and persware
- Determine the connectivity standards: getting all the pieces to work together

### Table 9.6 Implementation Factors in Telecommunications Systems

| Distance | Range of services
|----------|------------------|
| Security | Multiple access
| Utilization | Cost
| Installation | Connectivity

**Table 9.6**

Assess your needs according to the information presented in this chapter and match the technologies to them. It's extremely hard work. The more planning you do up front, the more you understand
all the issues involved, the less likely you'll later be managing a disaster.

**Bottom Line:** While there are many problems associated with establishing and maintaining networks, they are a necessity in today's business environment. Managers have to understand the requirements of their business and then build a network accordingly. They also have to manage the necessary changes and remember to treat information as a valuable resource.

**Discussion Questions:**

Click on the Discussion icon in the top toolbar to answer the following Discussion Questions.

1. Describe a communication channel. Draw a picture of one showing the various transmission media that might be used.
2. Draw a picture of the three separate network topologies so that you can get a visual picture of the different construction methods.
3. What are the advantages to small businesses in using a VAN?
4. What are some of the issues managers must face when they initially consider doing business on the Internet?

**Chapter 10: The Internet: Electronic Commerce and Electronic Business**

10.1 The Internet: Electronic Commerce and Electronic Business
10.2 The Internet and Electronic Commerce
10.3 Intranets and Electronic Business
10.4 Management Challenges and Opportunities
Discussi
Chapter 10 The Internet: Electronic Commerce and Electronic Business

A few years ago, the computer industry was bragging about 10 million people being connected to the Internet. Now that figure exceeds an astonishing 100 million plus people in the United States alone! The Internet is changing the way we work, play, entertain ourselves, and communicate with people all over the world.

10.1 The Internet

The Internet was developed in 1969 for the U.S. military and eventually spread to universities and civilian researchers. Because of its open structure, interest in its use began to grow beyond these exclusive groups. In 1990 a scientist named Tim Berners-Lee created a software program that he called the World Wide Web which allowed people to find documents on the Internet much more easily. This program allowed for the use of hyperlinks, which connect one document to another. In 1991 commercial use of the Internet was permitted for the first time and that is when its use started to explode. In 1994 the Netscape Communications Company (first named Mosaic) was formed by Marc Andreeson and Jim Clark to market a new software application for the Web called a browser. This graphical user interface allowed users to maneuver around the Web using a point-and-click method instead of text commands.

The Internet is best described by what it isn't. There is:

- No single computer
- No single control source
- No single entry point
- No single type of application

The Internet consists of computers spread all over the world, connected through wired and wireless transmission media, which contain software codes that allow them to talk to each other. That's it.
If you tried to find a single "front door" to the Internet, you'd be looking for a long, long time.

Small businesses and individuals connect to the Internet through **Internet Service Providers (ISP)** such as AT&T World Net or a commercial online service provider such as America OnLine. With recent mergers in the entertainment and Internet industries, some users can now access the Internet through their cable TV companies.

**Internet Technology and Capabilities**

As you can see from Table 10.1, many services are available to you through an Internet connection.

<table>
<thead>
<tr>
<th>Capability</th>
<th>Functions Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-Mail</td>
<td>Person-to-person messaging; document sharing</td>
</tr>
<tr>
<td>Usenet newsgroups</td>
<td>Discussion groups on electronic bulletin boards</td>
</tr>
<tr>
<td>LISTSERVs</td>
<td>Discussion groups using e-mail mailing list servers</td>
</tr>
<tr>
<td>Chatting</td>
<td>Interactive conversations</td>
</tr>
<tr>
<td>Telnet</td>
<td>Log on to one computer system and do work on another</td>
</tr>
<tr>
<td>FTP</td>
<td>Transfer files from computer to computer</td>
</tr>
<tr>
<td>Gophers</td>
<td>Locate information using a hierarchy of menus</td>
</tr>
<tr>
<td>World Wide Web</td>
<td>Retrieve, format, and display information (including text, audio, graphics, and video) using hypertext links</td>
</tr>
</tbody>
</table>

**TABLE 10.1**
Email is the most widely used application on the Internet. America Online alone processes an average of 51 million email messages per day, according to the CNet Web site, April 3, 1999. The text explains the construction of an email address. What you need to remember is that the text input is extremely sensitive, so you must be careful when you enter an address. The best way to cut down on errors is to store addresses in an address book and use them instead of typing in an address every time. If you make it a habit to use the Reply function when responding to an email, you also reduce the chance for error.

In March 1999 a malicious virus called "Melissa" was sent throughout the world via email messages. The Computer Emergency Response Team at Carnegie Mellon University called it one of the worst viruses ever released. It created havoc with network servers and shut many of them down because of the tremendous number of emails it generated. This incident demonstrated how pervasive email is and yet how vulnerable it can be to hackers.

The most useful feature of email is the ability to attach files to an email message and send them to colleagues anywhere in the world. This feature alone makes it a valuable tool for telecommuters and for collaboration with co-workers wherever they may be located.

Information Retrieval on the Internet

We keep complaining about information overload, yet we crave more. The Internet provides access to data about any topic you can imagine. Keep in mind that false information is as readily available as true and correct information. Be careful about the source of the information you access.

Another useful technology for collaborative work is the **File Transfer Protocol (FTP)** application. Many companies and individuals use FTP to share documents among geographic locations. It's a little faster and easier than email, but you do need a special software program to use it. Some Web sites offer FTP as a way to move files from a server computer to client computers.
You can get many free software programs for Internet use from various World Wide Web sites. They are very good programs and are easily installed. In fact, many software production companies no longer stock their programs in retail stores and offer them only through their Web sites. This drastically reduces the cost of distribution, packaging and shipping, and allows the company to offer the very latest editions of their programs. It's much more convenient for consumers too because they can just download and install the programs right to their hard drive.

You can also use Web sites offered by software companies to download "patches" or additional features. A patch is actually software code that fix bugs in programs. An excellent example of how convenient this process is is demonstrated by the Melissa virus mentioned earlier. Within 48 hours after the virus was discovered, many companies had patches to detect the virus or protect their system from it available through their Web sites. If we were doing business the old-fashioned way, these patches wouldn't have been available for weeks. But then some of you will say that if we had continued to do business the old-fashioned way, we wouldn't have needed the patch in the first place!

When you purchase software now, either through a regular retail outlet or on a Web site, make sure you register with the company, because this will allow it to send you email messages regarding new products, improved products, or patches to existing products. You'll also be able to access its Web site for free technical support. Yes, you do give up information when you send the registration in electronically, but the advantages associated with the notifications and other services may be worth it.

Many computer companies have established Web sites that offer free and quick support for problems you may be having with their products - either hardware or software. You don't have to spend hours on the phone waiting for a person to answer. Most of the problems you have are probably common to other users, and the Web sites are a better way for you to get help.
The World Wide Web

The World Wide Web is a vast repository of data and information connected through hyperlinks. When you think about the fact that it didn't even exist ten years ago, it's amazing to realize how much it has permeated everything we do in our personal and business lives.

We discussed protocols before: these are the rules by which data are transmitted over networks. The Hypertext Transfer Protocol (http) is what allows the Web to operate. When you see a Universal Resource Locator (URL) address on a Web site it will always start with http://www. Most software browser programs now automatically insert the http for you so you can simply enter the URL address of the Web site you want to access, beginning with the www.

Hypertext Markup Language (HTML) is the common language with which you create Web documents. It is very easy to use and is now included in most common software applications such as Word, WordPerfect, Excel, etc. As the technology improves to include audio, video, animated graphics, and movies on Web sites, derivative languages such as Dynamic HTML, Java, and ActiveX are becoming more common.

There is a difference between a Web site and a Web page. A Web site has the short domain address such as www.prenhall.com. It is the central repository for many, many Web pages that will be included at the end of the address after the domain name and a slash. For example, www.prenhall.com/index.html is a Web page within the Web site for Prentice Hall. A Web page is a single document stored within the Web site and probably linked to other pages on the site.

Webmasters, people who create and maintain Web sites, are in hot demand because of the limited knowledge and experience most companies have with Web sites. Software application programs such as FrontPage 98 or Macromedia Dreamweaver can help you set up and manage a Web site. You can also use these programs to create single pages and store them on a Web host computer. Many Internet service providers such as America Online and Web sites such as
Geocities also give you the ability to create and store your own Web page on their servers.

Which brings us to the matter of managing a Web site once you've created it. You should never create a page or a site and then forget about it. You must constantly manage the information resource and make sure that not only is the content current, but so are any hyperlinks you have with other pages on your site or other outside sites. Many Web site managers make it a habit to change the site or at least some pages on it monthly, weekly, or even daily, in order to keep it fresh. It's one way you can keep people coming back to your site; they will know that something new has been added.

Searching for Information on the Web

The text gives you the basic information for using search engines and directories. You need to understand and remember that the various search engines use different methods of helping you find information on the Web. You shouldn't restrict yourself to just one or two search engines but should try many different ones. You may be surprised at the different results you'll get using the same topic.

Search engines use special software programs to monitor the Web for new or updated sites or pages. When they reach a new site or page they analyze the contents and determine the category in which it will be listed. They then add it to their database so that it will appear on the search result list when someone enters the appropriate subject. You can also search for FTP sites, Usenet, newswires, business news, stock quotes, and weather using these search engine capabilities.

If you develop a site or page you can add your URL to the search engine so it will know your site is available. Many search engines don't require you to do this since their software programs will eventually find your site, but you can speed up the process by registering with the search engines.
Some innovative entrepreneurs have established businesses that will register your site with all the search engines - over 400 of them - for a price. You can do it yourself with your time as your cost.

When you are searching for information, try using a search site which submits your inquiry to 25 different search engines and returns a complete list of the results. Dogpile.com is the most popular of these services. If you type in a topic such as "horse breeding" on the Dogpile.com Web site, it will submit the topic to popular search directories and engines such as Yahoo, Excite, Lycos, Infoseek, and HotBot. You tell the search service how you want the contents listed and in what priority. It's much easier and faster than visiting each search engine site yourself.

You also should be aware of the individual and business directories on the Web. You could call them the "Yellow Pages of the World." They act just like the Yellow Pages of your telephone book. In fact, most of the information listed in them is gathered from telephone directories. They are easy to use and are cheaper than calling your phone company information service; they are free!

Web Portals

**Portals** are Web sites which serve as a starting point for you whenever you first enter the Web. Portals can be set as the "home page" on your browser, the first page that appears when you open your browser program. The most popular portal at the present time is Netscape Netcenter. This site receives millions of hits per day. You can personalize a portal according to your preferences and get individualized information about the weather, news, stock quotes, and even your daily horoscope. Many also offer you free email accounts.

The Yahoo! portal site reports that it has 35 million registered users. Excite has 20 million. Lycos reports 28 million. At its official launch on Jan. 12, Go Network claimed 9 million registered users.

So what's in it for the portal Web sites? If it's all free, how do they make any money and stay in business? Well, it's free to you, but they make their money by selling advertising space for other companies and by gathering information about you and selling it to other companies. Some portals get a certain amount of money, maybe 10 cents, for every person who clicks from the portal site to an advertiser's site. If that happens a few tens of thousands of times a day, every day, they can make a tidy sum of money. They also give the services away hoping that you'll buy their other products. Some of them simply operate in the red hoping to eventually make a profit.

**Intranets and Extranets**

Net this, Net that, it's almost enough to drive you crazy! **Intranets** and **Extranets** are basically the same thing as the Internet and use the same operating methods. Intranets are restricted to the internal members of an organization and Extranets are limited to certain users outside of an organization who are given special access to the Web site. Access to Intranets and Extranets is controlled through the use of usernames, and passwords, plus **firewalls**, security software programs that keep unauthorized users out of the network.

The beauty of Intranets and Extranets is that they don't require any special software or hardware other than what you would use for the Internet. The easy-to-use software programs to create Web sites and pages gives more people in an organization the ability to use these Nets for very creative purposes. Using these 'Nets can drastically reduce the costs of disseminating information to employees, customers, and suppliers.

Suppose you are the Human Resources Manager of a mid-size company and you are establishing a new employee 401K plan. Of course you need to get the information out to the employees as soon as possible so they can sign up for the plan. Many of them will have questions and will want some help computing the benefits of their enrollment. You can quickly and easily set up a Web page that explains how to enroll and gives them an enrollment form right on the Web. You can have a Frequently Asked Questions (FAQ) page
employees can use to read what other people are asking and also post their questions.

You can answer their questions on the FAQ page, which gives other employees the opportunity to see the information. An especially useful tool would be to include an online calculator to compute contributions and the rate of return on investments. Think of the time you and the other Human Resource Office members will save if employees can do all that on their own and don't have to visit your office.

Extranets are becoming very popular as a way for companies to get information to customers and suppliers quickly and efficiently. It's much less costly to put the information on the Extranet and it's faster to update the information than to have to print and send out paper updates. Some companies are using Extranets to replace EDI systems. Smaller companies that couldn't afford the cost of EDI are using Extranets as a way to allow online product ordering and shipment tracking.

**Internet Benefits to Organizations**

More and more individuals, organizations, and companies are turning to the Internet as an integral company resource for information because of the widespread use and acceptance of the technology, and because of the ease of use and relatively low cost. Table 10.2 gives you an overview of benefits of using the Internet.

<table>
<thead>
<tr>
<th>Table 10.2</th>
<th>Internet Benefits to Organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connectivity and global reach</td>
<td></td>
</tr>
<tr>
<td>Reduced communication costs</td>
<td></td>
</tr>
<tr>
<td>Lower transaction costs</td>
<td></td>
</tr>
<tr>
<td>Reduced agency costs</td>
<td></td>
</tr>
</tbody>
</table>

Ebook_mis.doc
Interactivity, flexibility, and customization

Accelerated distribution of knowledge

TABLE 10.2

To be sure, there are costs associated with using Net technologies. But can you imagine setting up your own private network, which would have to be installed in all the other organizations you do business with? You simply couldn't do it. But you can establish a network that is connected to the Internet, which in turn is connected to the other networks.

The use of Intranets, Extranets, and the Internet is also proving to be the answer to many "road warrior" prayers. They can quickly and easily connect to the home office to receive up-to-date information about products, services, or internal company information. And they can do it from airports, hotel rooms, their own homes, or the ski lifts at Vail. No other technology has ever given companies and individuals so many options.

What started out to be the kingdom of the nerds is now used by millions of people for such things as ordering prescriptions, garden plants, and even Tupperware. Your company or organization can now reach millions of people in ways that were never before possible with reduced transaction costs.

**Bottom Line: The many uses of Intranet, Extranets, and the Internet, are limited only by your imagination! The Nets are open 24 hours a day, seven days a week. The benefits of using these new technologies are a blessing to many companies.**

10.2 The Internet and Electronic Commerce
"Electronic commerce could well be the dominant theme in 1999 in the world of information technology in business, as the Web and its reach, simplicity, and immediacy trigger an explosion in online buying and selling." Bob Evans, Editor-in-Chief, InformationWeek, Dec. 7, 1998.

**Internet Business Models**

The last thing you want to do is throw up a Web site or a Web page, include an email address, and call it done! Regardless of the type of business, you have to determine what you're going to do behind the scenes and how your electronic commerce efforts will fit in with your regular business processes.

There is no simple step-by-step list of things you need to do to establish an E-commerce process, no "one size fits all" method. But remember these facts:

- It's not cheap.
- It's not easy.
- It's not fast.

Some companies have spent millions of dollars only to fold up their E-commerce operations because they just weren't working. Some companies have built a Web site without thinking through the entire process, only to find out they have seriously hurt their normal operations. Some companies have realized that E-commerce was simply not the Holy Grail it was made out to be.

You need to analyze what you want the mission of the Web site to be. Are you going to have a Web site that simply offers information about your company and its products? Are you going to sell only to consumers? What impact will that have on your current retail outlets? How are you going to get people to your Web site in the first place? How are you going to keep them coming back? If you sell business-to-business, do you have the back-end processes in place to handle the increased sales? Who will host the Web site: your company?
internally? a Web host service? Who's going to create the Web site, what services will you offer on it, and how are you going to keep your information secure?

We don't mean to discourage you from electronic commerce; just the opposite. Thousands of businesses are finding new opportunities to connect to customers, suppliers, and employees. After all, when bison ranchers in North Dakota use the Web to sell their products to people all over the world, you have to believe there's something to it!

Table 10.3  Internet Business models

<table>
<thead>
<tr>
<th>Category</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virtual Storefront</td>
<td>Amazon.com</td>
</tr>
<tr>
<td>Marketplace Concentrator</td>
<td>ShopNow.com</td>
</tr>
<tr>
<td>Information Broker</td>
<td></td>
</tr>
<tr>
<td>Transaction Broker</td>
<td></td>
</tr>
<tr>
<td>Auction Clearinghouse</td>
<td></td>
</tr>
<tr>
<td>Digital Product Delivery</td>
<td></td>
</tr>
<tr>
<td>Content Provider</td>
<td></td>
</tr>
<tr>
<td>On-line Service Provider</td>
<td></td>
</tr>
</tbody>
</table>
Travelocity.com

Ameritrade.com

eBay.com

Bluemountain.com

WSJ.com

Tuneup.com

**TABLE 10.3**

Table 10.3 shows some ways companies use the Internet to conduct business. Even more intriguing is the disruption new, upstart companies are causing in traditional industries. MP3.com introduced the Rio music appliance, which uses music downloaded for free from Web sites. Recording companies are jumping through hoops trying to respond to this threat to their business. The real lesson you should learn is that no business can afford to rest on its laurels and assume its business or industry is safe from changes caused by the Internet.

*Customer-Centered Retailing*

Some of the most successful consumer E-commerce companies have found that it isn't enough to set up a Web site to sell products: consumers want information about the products themselves and how to integrate the products into their lives.

Amazon.com, probably the most talked-about consumer retail Web site, doesn't just sell books and CDs. It also offers book reviews from other customers, links to other books related to the one they're purchasing, and the opportunity to purchase gifts for friends and relatives which are then gift-wrapped and sent out. Amazon.com is
moving into other markets such as online auctions and now owns part of an online grocery shopping service.

**Disintermediation**, removing the middleman, has allowed many companies to improve profits while reducing prices. Now we're starting to see a phenomenon called **reintermediation**, the process of creating new middlemen. Many people are concerned about selling products online because of the possibility of fraud.

Let's say you want to sell an antique car through your Web site. A stranger in Ohio emails you with an offer of $10,000. You hesitate to seal the deal because you don't know anything about this individual. You can use an electronic escrow service that will hold the buyer's funds to ensure he receives the merchandise while you make sure you get paid. Online auction services such as eBay.com offer a form of reintermediation through their Web sites to get buyers and sellers connected. That's the great thing about the Internet: One door closes and another door opens!

Many companies have realized that getting customers to their Web site in the first place is the biggest challenge. They still have to advertise in traditional mediums such as television and radio. Information Week magazine (Dec. 7, 1998) reports that Amazon.com lost $25 million on $152.7 million in revenue in the third quarter 1998, and marketing costs were a big part of the loss. It spent more on marketing than on the technology itself!

**Business-to-Business E-Commerce**

When you think of Internet-based business, you probably think of businesses selling to individual customers. It may surprise you to learn that business-to-business is the fastest growing area of E-commerce and outpaces consumer retailing by millions of dollars.

The Internet allows many smaller companies to participate in government and private bids they otherwise would be locked out of by bigger competitors. Governments and companies that let out the bids are finding that they get lower bids through the Internet because of the increased number of bidders.
Other companies are able to reduce costs by getting more competitive prices from a wider range of suppliers. But you still have to make sure you know all the costs associated with this new process. Let's say you've always gotten your office supplies from the store down the street. Suddenly you discover a Web site that offers lower prices. So you fill up your shopping cart and purchase your supplies from the Web site. But then you add in the shipping and handling costs. Did you really come out ahead?

If you're the one selling the product, you should make sure your prices and extra costs are in line with the your competitor's. You also must make sure your company can handle the possible increase in sales. All parts of your organization should be involved in supporting the E-commerce effort, not just one or two departments.

The text describes how Marshall Industries has established a virtual distribution system. We mentioned reintermediation earlier. One company, Asian Sources Online, has combined the two into Asia's largest electronic commerce venture. "Asian Sources established a Web site to connect thousands of mostly small and medium-size Asian exporters of everything from hardware, fashion and giftware to computers and electronic components with big importers such as Kmart, Toys "R" us, Home Depot, Tandy Radio Shack and Texas Instruments. A buyer sitting in, say, Chicago can pay virtual visits to factories all over Asia and see products without leaving his office. This cuts down on trips to trade shows and far-flung factories." Forbes Magazine, May 3, 1999.

A buyer connects to the Asian Sources Web site, views products from over 4,000 manufacturers, orders the products, and arranges for shipment and payment. Of course the buyers don't like the idea that they can't take a two-week business trip to the Orient any more, but that's another story.

Electronic Commerce Support Systems

You don't have to go it alone. Many businesses use companies that supply all of the Web support from designing and developing the Web site to actually storing the Web site pages (Web hosting) on
their servers. Some commercial companies also offer backend services such as credit card transaction processing (**electronic payment systems**)—see Table 10.5.

![Table 10.5 Examples of Electronic Commerce Servers](image)

<table>
<thead>
<tr>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Icat Electronic Commerce Suite</td>
<td>Provides on-line catalog shopping and order placement for sophisticated Web sites; Icat Commerce on-line version available for small business storefronts</td>
</tr>
<tr>
<td>Icat Net.Commerce</td>
<td>Lower priced START version has a store creation wizard for catalog pricing, shipping, taxing, and secure payment processing with business-to-consumer and business-to-business capability; high-end PRO version for more advanced Web site with intelligent catalog capability and tools to integrate the Web site with legacy systems and middleware</td>
</tr>
<tr>
<td>IBM</td>
<td>Supports high-end business-to-consumer site with catalog search tools, order management, tax, payment, and logistics modules and tools to integrate the site with legacy systems</td>
</tr>
<tr>
<td>Netscape MerchantXpert</td>
<td>Open Market Transact Commerce services include on-line customer authentication, order and payment processing, tax calculations, and customer service with multiple language capabilities.</td>
</tr>
<tr>
<td>Open Market</td>
<td>Oracle Internet Commerce Server</td>
</tr>
</tbody>
</table>
Business-to-consumer commerce application that integrates with other Oracle applications for orders, inventory, customer service, call centers, and payment authorizations via third-party payment technology vendors
Oracle

**TABLE 10.5**

Larger corporations can hire companies such as IBM to help them establish a Web presence. One of the benefits of having your Web E-commerce outsourced is that you don't have to hire the expertise in-house and you gain from the supplier's experience with other E-commerce endeavors.

**Bottom Line:** There are many considerations and decisions to make when you're developing E-commerce. It's not easy, it's not cheap, and it's not quick. But done right, it can give you opportunities you never had before.

### 10.4 Management Challenges and Opportunities

The biggest challenge to managers may be keeping up with the changes in technology and with the new services and products. The danger is believing all the hype and taking it at face value without investigating the situation thoroughly. Millions and millions of dollars have been lost because companies didn't fully analyze what they were going to do and how they would incorporate the Internet into their core processes.

If you decide to sell your products directly on line, are you going to ask your traditional retail outlets how they feel about it? You might want to. Compaq Computers decided to emulate Dell Computers and set up an online marketplace. Its retail distributors threatened to quit selling Compaq products and boycott the company. Compaq didn't consider that the online sales would probably cut into its traditional sales, but the retailers were well aware of the **channel conflict**.
Compaq had to pull back after spending a few million dollars on its cyberspace efforts.

Technology hurdles remain a huge problem for businesses and individuals. We seem to be on a merry-go-round: new products require more bandwidth so we demand more bandwidth; the industry responds with increased bandwidth; new products are developed which use the increased bandwidth; we demand more bandwidth because the newer products require more bandwidth. It's definitely a situation of "Build it and they will use it."

There are also lots of legal and public policy issues still to work through. For instance, many documents aren't legally binding without physical signatures. How do we work around this issue? Many state governments are trying to tax commerce on the Internet. If they are successful, some of the advantages of E-commerce will dissolve.

Consumers and Internet users are starting to get quite vocal over privacy issues. Companies rely on the information they gather from site visitors to help plan their marketing efforts. If they can't use this information or sell it to other companies, then perhaps they will no longer find E-commerce an advantage. Many companies are starting to put Information Privacy statements on their Web sites to tell users how the information will be used. Some sites also give the visitor a chance to say no to the distribution of the information.

No one knows how many corporate sites have been hacked into and information compromised because companies don't want to publicize their vulnerability. To be sure, security is a big issue. How do you lock out hackers and still let in customers? What about competitors that access your site just to get the lowdown on your products and/or prices? Of course, they can often do that without the Internet.

Another security issue that turns off many consumers when it comes to E-commerce is a reluctance to enter personal information or credit card numbers. It is actually harder to intercept a credit card number on the Internet than it is to steal it in a traditional retail transaction, but people are still afraid. Businesses can help overcome this fear by
using a technology called Secure Socket Layers, which protects data as they are transmitted through the various media.

<table>
<thead>
<tr>
<th>Table 10.10</th>
<th>Using the Internet in Business: Top Questions for Managers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What value will the Internet and intranets provide the business? Will the benefits outweigh the costs? How can we measure success?</td>
<td></td>
</tr>
<tr>
<td>2. How will business processes have to be changed to use this technology for electronic commerce or electronic business? How much process integration is required?</td>
<td></td>
</tr>
<tr>
<td>3. What technical skills and employee training will be required to use Internet technology?</td>
<td></td>
</tr>
<tr>
<td>4. Do we have the appropriate information technology infrastructure and bandwidth for using the Internet and intranets?</td>
<td></td>
</tr>
<tr>
<td>5. How can we integrate Internet applications with existing applications and data?</td>
<td></td>
</tr>
<tr>
<td>6. How can we make sure our intranet is secure from entry by outsiders? How secure in the electronic payment system we are using for electronic commerce?</td>
<td></td>
</tr>
<tr>
<td>7. Are we doing enough to protect the privacy of customers we reach electronically?</td>
<td></td>
</tr>
</tbody>
</table>
Table 10.10 gives you an idea of some of the questions you should ask before you begin the complex task of creating an Internet presence for E-commerce.

**Bottom Line:** You are a part of the most revolutionary time in business. Many companies are struggling with all the changes and trying desperately to comprehend their role in the new world. You can help yourself and your organization tremendously by understanding the issues involved and developing innovative strategies to resolve the problems.

**Discussion Questions:**

Click on the Discussion icon in the top toolbar to answer the following Discussion Questions.

1. Use your imagination and come up with an idea of how your organization or company can use an Intranet or Extranet.

2. What current processes will you have to change to incorporate your idea?

3. Describe the different considerations when deciding whether you should establish a consumer E-commerce Web site or a Business-to-Business E-commerce Web site.

4. Why would your organization want to develop an Intranet?

5. What are some of the management issues involved with E-commerce and how would you resolve them?
Chapter 10 The Internet: Electronic Commerce and Electronic Business

A few years ago, the computer industry was bragging about 10 million people being connected to the Internet. Now that figure exceeds an astonishing 100 million plus people in the United States alone! The Internet is changing the way we work, play, entertain ourselves, and communicate with people all over the world.

10.1 The Internet

The Internet was developed in 1969 for the U.S. military and eventually spread to universities and civilian researchers. Because of its open structure, interest in its use began to grow beyond these exclusive groups. In 1990 a scientist named Tim Berners-Lee created a software program that he called the World Wide Web which allowed people to find documents on the Internet much more easily. This program allowed for the use of hyperlinks, which connect one document to another. In 1991 commercial use of the Internet was permitted for the first time and that is when its use started to explode. In 1994 the Netscape Communications Company (first named Mosaic) was formed by Marc Andreeson and Jim Clark to market a new software application for the Web called a browser. This graphical user interface allowed users to maneuver around the Web using a point-and-click method instead of text commands.

The Internet is best described by what it isn't. There is:

- No single computer
- No single control source
- No single entry point
- No single type of application

The Internet consists of computers spread all over the world, connected through wired and wireless transmission media, which contain software codes that allow them to talk to each other. That's it.
If you tried to find a single "front door" to the Internet, you'd be looking for a long, long time.

Small businesses and individuals connect to the Internet through Internet Service Providers (ISP) such as AT&T World Net or a commercial online service provider such as America OnLine. With recent mergers in the entertainment and Internet industries, some users can now access the Internet through their cable TV companies.

**Internet Technology and Capabilities**

As you can see from Table 10.1, many services are available to you through an Internet connection.

---

**Table 10.1** Major Internet Capabilities

<table>
<thead>
<tr>
<th>Capability</th>
<th>Functions Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-Mail</td>
<td>Person-to-person messaging; document sharing</td>
</tr>
<tr>
<td>Usenet newsgroups</td>
<td>Discussion groups on electronic bulletin boards</td>
</tr>
<tr>
<td>LISTSERVs</td>
<td>Discussion groups using e-mail mailing list servers</td>
</tr>
<tr>
<td>Chatting</td>
<td>Interactive conversations</td>
</tr>
<tr>
<td>Telnet</td>
<td>Log on to one computer system and do work on another</td>
</tr>
<tr>
<td>FTP</td>
<td>Transfer files from computer to computer</td>
</tr>
<tr>
<td>Gophers</td>
<td>Locate information using a hierarchy of menus</td>
</tr>
<tr>
<td>World Wide Web</td>
<td></td>
</tr>
</tbody>
</table>
Retrieve, format, and display information (including text, audio, graphics, and video) using hypertext links.

**TABLE 10.1**

Email is the most widely used application on the Internet. America Online alone processes an average of 51 million email messages per day, according to the CNet Web site, April 3, 1999. The text explains the construction of an email address. What you need to remember is that the text input is extremely sensitive, so you must be careful when you enter an address. The best way to cut down on errors is to store addresses in an address book and use them instead of typing in an address every time. If you make it a habit to use the Reply function when responding to an email, you also reduce the chance for error.

In March 1999 a malicious virus called "Melissa" was sent throughout the world via email messages. The Computer Emergency Response Team at Carnegie Mellon University called it one of the worst viruses ever released. It created havoc with network servers and shut many of them down because of the tremendous number of emails it generated. This incident demonstrated how pervasive email is and yet how vulnerable it can be to hackers.

The most useful feature of email is the ability to attach files to an email message and send them to colleagues anywhere in the world. This feature alone makes it a valuable tool for telecommuters and for collaboration with co-workers wherever they may be located.

Information Retrieval on the Internet

We keep complaining about information overload, yet we crave more. The Internet provides access to data about any topic you can imagine. Keep in mind that false information is as readily available as true and correct information. Be careful about the source of the information you access.
Another useful technology for collaborative work is the **File Transfer Protocol (FTP)** application. Many companies and individuals use FTP to share documents among geographic locations. It's a little faster and easier than email, but you do need a special software program to use it. Some Web sites offer FTP as a way to move files from a server computer to client computers.

You can get many free software programs for Internet use from various World Wide Web sites. They are very good programs and are easily installed. In fact, many software production companies no longer stock their programs in retail stores and offer them only through their Web sites. This drastically reduces the cost of distribution, packaging and shipping, and allows the company to offer the very latest editions of their programs. It's much more convenient for consumers too because they can just download and install the programs right to their hard drive.

You can also use Web sites offered by software companies to download "patches" or additional features. A **patch** is actually software code that fix bugs in programs. An excellent example of how convenient this process is is demonstrated by the Melissa virus mentioned earlier. Within 48 hours after the virus was discovered, many companies had patches to detect the virus or protect their system from it available through their Web sites. If we were doing business the old-fashioned way, these patches wouldn't have been available for weeks. But then some of you will say that if we had continued to do business the old-fashioned way, we wouldn't have needed the patch in the first place!

When you purchase software now, either through a regular retail outlet or on a Web site, make sure you register with the company, because this will allow it to send you email messages regarding new products, improved products, or patches to existing products. You'll also be able to access its Web site for free technical support. Yes, you do give up information when you send the registration in electronically, but the advantages associated with the notifications and other services may be worth it.
Many computer companies have established Web sites that offer free and quick support for problems you may be having with their products - either hardware or software. You don't have to spend hours on the phone waiting for a person to answer. Most of the problems you have are probably common to other users, and the Web sites are a better way for you to get help.

**The World Wide Web**

The World Wide Web is a vast repository of data and information connected through hyperlinks. When you think about the fact that it didn't even exist ten years ago, it's amazing to realize how much it has permeated everything we do in our personal and business lives.

We discussed protocols before: these are the rules by which data are transmitted over networks. The Hypertext Transfer Protocol (http) is what allows the Web to operate. When you see a Universal Resource Locator (URL) address on a Web site it will always start with http://www. Most software browser programs now automatically insert the http for you so you can simply enter the URL address of the Web site you want to access, beginning with the www.

Hypertext Markup Language (HTML) is the common language with which you create Web documents. It is very easy to use and is now included in most common software applications such as Word, WordPerfect, Excel, etc. As the technology improves to include audio, video, animated graphics, and movies on Web sites, derivative languages such as Dynamic HTML, Java, and ActiveX are becoming more common.

There is a difference between a Web site and a Web page. A Web site has the short domain address such as www.prenhall.com. It is the central repository for many, many Web pages that will be included at the end of the address after the domain name and a slash. For example, www.prenhall.com/index.html is a Web page within the Web site for Prentice Hall. A Web page is a single document stored within the Web site and probably linked to other pages on the site.
Webmasters, people who create and maintain Web sites, are in hot demand because of the limited knowledge and experience most companies have with Web sites. Software application programs such as FrontPage 98 or Macromedia Dreamweaver can help you set up and manage a Web site. You can also use these programs to create single pages and store them on a Web host computer. Many Internet service providers such as America Online and Web sites such as Geocities also give you the ability to create and store your own Web page on their servers.

Which brings us to the matter of managing a Web site once you've created it. You should never create a page or a site and then forget about it. You must constantly manage the information resource and make sure that not only is the content current, but so are any hyperlinks you have with other pages on your site or other outside sites. Many Web site managers make it a habit to change the site or at least some pages on it monthly, weekly, or even daily, in order to keep it fresh. It's one way you can keep people coming back to your site; they will know that something new has been added.

Searching for Information on the Web

The text gives you the basic information for using search engines and directories. You need to understand and remember that the various search engines use different methods of helping you find information on the Web. You shouldn't restrict yourself to just one or two search engines but should try many different ones. You may be surprised at the different results you'll get using the same topic.

Search engines use special software programs to monitor the Web for new or updated sites or pages. When they reach a new site or page they analyze the contents and determine the category in which it will be listed. They then add it to their database so that it will appear on the search result list when someone enters the appropriate subject. You can also search for FTP sites, Usenet, newswires, business news, stock quotes, and weather using these search engine capabilities.
If you develop a site or page you can add your URL to the search engine so it will know your site is available. Many search engines don't require you to do this since their software programs will eventually find your site, but you can speed up the process by registering with the search engines.

Some innovative entrepreneurs have established businesses that will register your site with all the search engines - over 400 of them - for a price. You can do it yourself with your time as your cost.

When you are searching for information, try using a search site which submits your inquiry to 25 different search engines and returns a complete list of the results. Dogpile.com is the most popular of these services. If you type in a topic such as "horse breeding" on the Dogpile.com Web site, it will submit the topic to popular search directories and engines such as Yahoo, Excite, Lycos, Infoseek, and HotBot. You tell the search service how you want the contents listed and in what priority. It's much easier and faster than visiting each search engine site yourself.

You also should be aware of the individual and business directories on the Web. You could call them the "Yellow Pages of the World." They act just like the Yellow Pages of your telephone book. In fact, most of the information listed in them is gathered from telephone directories. They are easy to use and are cheaper than calling your phone company information service; they are free!

Web Portals

Portals are Web sites which serve as a starting point for you whenever you first enter the Web. Portals can be set as the "home page" on your browser, the first page that appears when you open your browser program. The most popular portal at the present time is Netscape Netcenter. This site receives millions of hits per day. You can personalize a portal according to your preferences and get individualized information about the weather, news, stock quotes, and even your daily horoscope. Many also offer you free email accounts.
The Yahoo! portal site reports that it has 35 million registered users. Excite has 20 million. Lycos reports 28 million. At its official launch on Jan. 12, Go Network claimed 9 million registered users. (www.msnbc.com, Web site Apr. 2, 1999)

So what's in it for the portal Web sites? If it's all free, how do they make any money and stay in business? Well, it's free to you, but they make their money by selling advertising space for other companies and by gathering information about you and selling it to other companies. Some portals get a certain amount of money, maybe 10 cents, for every person who clicks from the portal site to an advertiser's site. If that happens a few tens of thousands of times a day, every day, they can make a tidy sum of money. They also give the services away hoping that you'll buy their other products. Some of them simply operate in the red hoping to eventually make a profit.

**Intranets and Extranets**

Net this, Net that, it's almost enough to drive you crazy! Intranets and Extranets are basically the same thing as the Internet and use the same operating methods. Intranets are restricted to the internal members of an organization and Extranets are limited to certain users outside of an organization who are given special access to the Web site. Access to Intranets and Extranets is controlled through the use of usernames, and passwords, plus firewalls, security software programs that keep unauthorized users out of the network.

The beauty of Intranets and Extranets is that they don't require any special software or hardware other than what you would use for the Internet. The easy-to-use software programs to create Web sites and pages gives more people in an organization the ability to use these Nets for very creative purposes. Using these 'Nets can drastically reduce the costs of disseminating information to employees, customers, and suppliers.

Suppose you are the Human Resources Manager of a mid-size company and you are establishing a new employee 401K plan. Of course you need to get the information out to the employees as soon as possible so they can sign up for the plan. Many of them will have
questions and will want some help computing the benefits of their enrollment. You can quickly and easily set up a Web page that explains how to enroll and gives them an enrollment form right on the Web. You can have a Frequently Asked Questions (FAQ) page employees can use to read what other people are asking and also post their questions.

You can answer their questions on the FAQ page, which gives other employees the opportunity to see the information. An especially useful tool would be to include an online calculator to compute contributions and the rate of return on investments. Think of the time you and the other Human Resource Office members will save if employees can do all that on their own and don't have to visit your office.

Extranets are becoming very popular as a way for companies to get information to customers and suppliers quickly and efficiently. It's much less costly to put the information on the Extranet and it's faster to update the information than to have to print and send out paper updates. Some companies are using Extranets to replace EDI systems. Smaller companies that couldn't afford the cost of EDI are using Extranets as a way to allow online product ordering and shipment tracking.

**Internet Benefits to Organizations**

More and more individuals, organizations, and companies are turning to the Internet as an integral company resource for information because of the widespread use and acceptance of the technology, and because of the ease of use and relatively low cost. Table 10.2 gives you an overview of benefits of using the Internet.

<table>
<thead>
<tr>
<th>Table 10.2</th>
<th>Internet Benefits to Organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connectivity and global reach</td>
<td></td>
</tr>
<tr>
<td>Reduced communication costs</td>
<td></td>
</tr>
</tbody>
</table>

Ebook_mis.doc
Lower transaction costs

Reduced agency costs

Interactivity, flexibility, and customization

Accelerated distribution of knowledge

**TABLE 10.2**

To be sure, there are costs associated with using Net technologies. But can you imagine setting up your own private network, which would have to be installed in all the other organizations you do business with? You simply couldn't do it. But you can establish a network that is connected to the Internet, which in turn is connected to the other networks.

The use of Intranets, Extranets, and the Internet is also proving to be the answer to many "road warrior" prayers. They can quickly and easily connect to the home office to receive up-to-date information about products, services, or internal company information. And they can do it from airports, hotel rooms, their own homes, or the ski lifts at Vail. No other technology has ever given companies and individuals so many options.

What started out to be the kingdom of the nerds is now used by millions of people for such things as ordering prescriptions, garden plants, and even Tupperware. Your company or organization can now reach millions of people in ways that were never before possible with reduced transaction costs.

**Bottom Line:** The many uses of Intranet, Extranets, and the Internet, are limited only by your imagination! The Nets are open 24 hours a day, seven days a week. The benefits of using these new technologies are a blessing to many companies.
Chapter 11: Redesigning the Organization with Information Systems

11.1 Systems as Planned Organizational Change
11.2 Systems Development and Organizational Change
11.3 Overview of Systems Development
11.4 Understanding the Business Value of Information Systems

Discussion Questions

Chapter 11
Redesigning the Organization with Information Systems

"What do you mean we have to change the way we make our candy bars? They are the number one selling product we have. Everyone loves them. Why can't we just keep doing things the way we've always done them? It's worked fine this long."

It's not unusual to hear this type of dialog in many companies, large and small, all across the world. Change is hard on people and organizations. But it's one of those necessary evils that keeps companies in the lead or helps destroy them. In this chapter, we're going to focus on using Information Systems as a way to successfully help redesign organizations so they can improve their current processes or establish new ones.

11.1 Systems as Planned Organizational Change

In the last chapter, we said it would be nice if we could give you a checklist of how to establish an E-commerce plan. It would be nice, but we can't. No one can. What we provide in this chapter is information you can use to help plan and analyze organizational changes not only for E-commerce, but also for other improvements.

The triangle that we've used before is back...
All three elements will pose their own unique challenges to managers, but you may be surprised to learn that the hardware and software will probably be the easiest of the three to manage. Before you go much further in this chapter, you may want to go back and review the information presented in Chapter 4 on Individual Models of Decision Making and the Organizational Models of Decision Making.

**Linking Information Systems to the Business Plan**

Too many companies buy the hardware they determine is necessary for a new or improved Information System. Then they purchase some software to go along with the new hardware. Now they realize their hardware is inadequate for the new software, so they buy more powerful hardware. And the vicious cycle continues. Pretty soon they have a whole bunch of hardware and a lot of expensive software: but do they have an Information System? Only if they have made sure that all the hardware and software purchases fit in with their organizational Information System plan and that their people know how to use it.

"A what?" you say: "Another plan that stifles creativity and creates roadblocks to getting work done?" No, a *good* Information Plan will help companies systematically figure out what they need to get the job done and whether all the hardware and software is necessary and if they really do meet the requirements of the organization. A good Information Plan will also take personnel needs into account and help determine how all three elements of the triangle will work together for success.
The problem is that too many companies don't have a plan for integrating new hardware and software purchases into their overall business plan, let alone meshing them with the persware side of the triangle.

Of course, the Information Plan should support the overall business plan and not conflict with it. Make sure the plan includes all levels of the organization, including the strategic and executive levels. These two levels contain the people who often say they are exempt from having to determine information system needs.

And don't forget the persware - the "people" requirements, the most important part of the whole thing.

**Establishing Organizational Information Requirements**

Ever heard the old saying, "If you don't know where you're going, how will you know when you get there?" Well, in order for a company to be successful, management needs to have a good idea of where it's going and how it's going to get there. Management also needs to know what tools it needs along the way.

**Enterprise Analysis**

**Enterprise analysis**, or business systems planning, uses the "big picture" approach. That is, you look at the overall organization and figure out how each unit, each function, all the processes, and each data element fits in. Think of a jigsaw puzzle: each piece is a vital part of making the picture whole. To understand the informational needs of an organization, you first need to understand the organization.

To do enterprise analysis, you first ask each manager or a large sample of managers:

- How they use information
- Where they get it
- What their environments are like
- What their objectives are
How they make decisions
What their information needs really are

You then compile that input into logical application groups (as opposed to the physical application groups we discussed before). From this method you can get an idea of how the processes work, who uses them, and how they fit together.

Do you realize how long this process can take? Do you know how expensive it can be to get the managers to complete the input? Remember that the information will probably be biased because managers will operate from their own personal agenda - it's human nature. And what about the informational needs of non-managers? Don't they count?

The biggest drawback to enterprise analysis is that it only asks questions about current processes and current uses of information. Nowadays this isn't good enough, especially when it comes to E-commerce and integrating new technologies. Enterprise analysis doesn't focus on the need for new processes or new methods of conducting business.

Strategic Analysis or Critical Success Factors

**Critical Success Factors (CSFs)** are simply the goals managers feel will make the organization a success. This method does broaden the scope of the analysis to include entire industries, the broader environment in addition to the firm itself and its managers. That's why it's called "strategic." Basically, you contact several of the top managers, ask them what they think will make the organization succeed, and then combine the results into a cohesive picture.
<table>
<thead>
<tr>
<th>Example</th>
<th>Goals</th>
<th>CSF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit concern</td>
<td>Earning/share</td>
<td>Return on investment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Market share</td>
</tr>
<tr>
<td></td>
<td></td>
<td>New Product</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Automotive industry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Styling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quality dealer system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cost Control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Energy Standards</td>
</tr>
<tr>
<td>Nonprofit</td>
<td>Excellent healthcare</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regional integration with other hospitals</td>
<td></td>
</tr>
<tr>
<td>Meeting government regulations</td>
<td>Future health needs</td>
<td>Efficient use of resources</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improved monitoring of regulations</td>
</tr>
</tbody>
</table>

**TABLE 11.2**

The table gives some good examples of Critical Success Factors and how they mesh with organizational goals.

What makes this method work is that you have a much smaller sampling of data with which to develop an Information Plan. It's faster than enterprise analysis and therefore a little cheaper. And your plan revolves around just a few CSFs instead of a whole slew of information requirements.
Using the CSF method also takes into account how the environment affects information needs, which is a tough question nowadays. Usually top management, the organizational level most involved in this type of analysis, has a better idea of the environmental effects than perhaps lower levels of management.

But hold on a minute. With all its advantages, there are some distinct disadvantages to this approach. Chief among them is that only a small group is interviewed. Their biases then become the biases of the system. How do you formulate the opinions of these few managers into an organization-wide plan? How aware of common tasks at the lower levels of the organization are the top managers? Are you sure the goals of the managers are representative of the goals of the organization? You hope so, but you don't know. Just because this level of management may be more aware of the external environment doesn't make the plan immune to change. That has never been truer than in today's rapidly changing world.

CSFs can be a good start to analyzing a company's organizational needs, but they shouldn't be the end or the only methodology used.

11.2 Systems Development and Organizational Change

Change is disruptive; change is dangerous, change is good, change is necessary, change is constant.
The Spectrum of Organizational Change

**FIGURE 11.3**

Risks and rewards of organizational change.

Figure 11.3 shows the four degrees of organizational change. **Automation** is the easiest (except for those people losing their jobs), and the most common. But that doesn't mean you don't have to plan for the change first.

**Rationalization of procedures** causes the organization to examine its standard operating procedures, eliminate those no longer needed, and make the organization more efficient. It's a good thing, as Martha Stewart would say!

Both types of change cause some disruption, but it's usually manageable and easily accepted by the people.

**Business reengineering**, on the other hand, can cause radical disruption. The mere mention of the term nowadays strikes fear in the hearts of workers and managers at all levels. Why? Because many companies use it as a guise for downsizing the organization and laying off workers. Business reengineering causes planners to completely **rethink** the flow of work, how the work will be
accomplished, and how costs can be reduced by eliminating unnecessary work and workers.

But if you want to talk radical change, take a look at **paradigm shifts**. Now we're talking about changing the very nature of the business and the structure of the organization itself. We're talking whole new products or services that didn't even exist before. We're talking major disruption and extreme change!

The best example of a paradigm shift is looking right at you. Higher education is undergoing a major paradigm shift in the online delivery of education. Classes are now offered through the Internet so that students don't even go to classrooms. Many tried-and-true teaching methodologies are being radically altered to accommodate this shift in how education should be offered.

The Internet is causing all kinds of industries and businesses to alter their products, their services, and their processes in radical ways. Whole new organizations are being created to handle the paradigm shifts involved in E-commerce. Look at the automobile industry as an example of this type of change: traditional dealerships are being disrupted by the automalls and online buying opportunities. How can a local dealer compete on price with these two environmental challenges? What is the dealersÕ role in the revolutionary changes taking place all around them?

If business process reengineering and paradigm shifting are so disruptive and so dangerous, why even try? Because companies realize they have to take on the challenges in order to stay competitive within their industries and environments. They have had to cut costs and streamline their operations because of global economic pressures, in addition to meeting demands of their shareholders. And the rewards can be tremendous.

**Business Process Reengineering**

Because this is such a hot topic, let's look at it more closely.

In order to make BPR successful, you must first redesign the process, then apply computing power to the new processes. If problems
existed in the process before the new system is installed and those problems aren't resolved, the new system could actually make them worse.

Very few processes in business are as efficient as they can possibly be. It's a fact of life. The idea behind successful BPR is to find improvements or even new opportunities. For instance, Federal Express and UPS both have on-line package tracking systems. That simple process was never economically feasible before the Internet. They had to reengineer their business processes to incorporate this new paradigm shift.

New information system software is giving businesses the methodology to redesign their processes. Work flow management offers the opportunity to streamline procedures for companies whose primary business is oriented towards paperwork. Instead of ten people handling a single bank loan application, you can install software that will speed up the process, allow several people to work on the document at the same time, and decrease the number of people who handle it altogether.

BPR attempts fail 70% of the time. That's an astonishing figure when you think about it. What if your car failed to start 70% of the time? Some of the reasons for the high failure rate are lack of planning, management's inability to fully comprehend the enormity and complexity of the effort, and the fact that BPR usually takes much longer than expected.

What can organizations, their managers and workers, do to help make BPR a success? It may be useful to have a diagram of how your processes work now and then envision how they will work after they are redesigned. Try just a few processes to get your feet wet and then expand to other units or processes within the organization. Document how much your current processes cost. You'll be able to measure costs savings (or costs increases) better if you have a baseline for comparison.
### Table 11.5
**New Process Design Options with Information Technology**

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Technology</th>
<th>Option</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field, personnel need offices to receive, store, and transmit information.</td>
<td>Wireless Communications</td>
<td>Personnel can send and receive information wherever they are.</td>
<td>Manitoba Insurance, Price Waterhouse</td>
</tr>
<tr>
<td>Information can appear only in one place at one time.</td>
<td>Shared databases</td>
<td>People can collaborate on the same project from scattered locations; information can be used simultaneously wherever it is needed.</td>
<td>U.S. West, Banc One</td>
</tr>
<tr>
<td>People are needed to ascertain where things are located.</td>
<td>Automatic identification and tracking technology</td>
<td>Things can tell people where they are.</td>
<td>United Parcel Service, Schneider National</td>
</tr>
<tr>
<td>Businesses need reserve inventory to prevent stockouts.</td>
<td>Communications networks and EDI</td>
<td>Just-in-time delivery and stockless supply</td>
<td>Wal-Mart, Baxter International</td>
</tr>
</tbody>
</table>

**TABLE 11.5**

This table shows how you can use new technologies to redesign work processes.
Process Improvement and Total Quality Management (TQM)

Just when you're all settled into a routine at work and everything seems to be flowing along, upper management decides to change things. Even though things do seem to be going well, management is concerned about the quality of the organization's processes, products, and customer service. Data supplied by feedback from the Information System indicates improvements can and should be made.

Total quality management (TQM) relies on an excellent Information System to give workers and management the data necessary to continuously improve products and drive down costs. The lack of good, useful information may not be apparent until the organization can't figure out what it's doing wrong, or doing right. Data from all types of Information Systems can be fed into quality management and make it easier to develop and improve products that blow away the competition.

There is a difference between changes brought about by Business Process Reengineering (BPR) and Total Quality Management (TQM): BPR changes tend to be Draconian and done on a one-time basis, whereas TQM changes are usually less abrupt and happen gradually over time.

How Information Systems Promote Quality

Here are some ways companies can use Information Systems to achieve Total Quality Management:

- Simplify processes by using information to determine what the processes are in the first place. Managers can step back from the day-to-day operations and analyze each step of the process. They can ask themselves what would happen if they didn't complete a step or completed it differently. Are all the steps absolutely necessary or are they completed out of habit or left over from earlier times?

- Identify benchmark targets they want or need to meet in order to show improvement. First, they can identify current statistics. For
instance, the Information System shows the company is currently experiencing a 10% customer dissatisfaction rate. It decides it wants to reduce that rate to 5%. Now there is a standard, or benchmark, upon which to measure improvement.

☐ Use customer demands to improve products by harnessing information from all the data they gather. Efficient use of datamining will give the company pointers on how it can increase the quality of its services and products, or reduce costs.

☐ Reduce the cycle times of production processes by gathering information about how much time each step takes and whether it is possible to truly reduce the time.

☐ Improve the quality and precision of product design by using up-to-date software programs and improved technology to change the way they create and process the product designs. It may take a lot of work and time to learn the newest CAD program or to adopt upgrades, but in the long run the improvements will be noticeable. If a company is still designing products manually or with software that's 5 years old, well, what can we say?

☐ Increase the precision of production with new software and data from the Information System. The software can help managers analyze each step of the process better and easier and look for ways to decrease the time for production. Use the right tools, and improvements will come.

☐ The normal reaction to quality improvement suggestions is "Oh no, we can't do it any better than we already do." If you make use of the Information System, take a hard look at every process and every product, you'll be surprised to find that you really can change things for the better. You can improve upon current practices to the benefit of both customers and the organization. Try it.

**Bottom Line: Continuous change is a necessary part of corporate life. Managing organizational information**
requirements through planned analyses and structured system development rather than a haphazard approach will help a company succeed. Quality and product can be improved through the reliable, useful information produced by a well-developed, well-managed and integrated Information System. Regardless of good current processes, products, and services seem to be, you can always improve some part of each one.

11.3 Overview of Systems Development

System Development includes everything and every step that goes into producing an Information System that solves a problem or helps the organization take advantage of new opportunities.

Don't start thinking right away "Oh, we're going to develop a new computer system? Well, that problem belongs to the IT (Information Technology) department." Nowadays, system development belongs to you as much as it belongs to the techies. You have to work hand-in-hand from start to finish with the techies. You have to work hand-in-hand from start to finish with the techies. You have to work hand-in-hand from start to finish with the techies. You have to work hand-in-hand from start to finish with the techies.
The systems development process.

The arrow in the figure goes in only one direction. Remember that just because you apparently completed one step doesn't mean you can never go back to it at some point in the development process. In fact, many of the steps should be revisited several times, especially if you are using the prototype method of development.

**Systems Analysis**

So what's the problem? Answering that question is harder than you might think. You have to analyze the current situation to determine the real cause of the problem. Remember the garbage can model we discussed in previous chapters: Make sure you're addressing the real problem and not just the symptoms. Effective *system analysis*, adequately determining the real problem, is the key.

Write down everything you do in this stage, especially when it comes to what the real problem or opportunity is. Constantly review it throughout the rest of the system development process to remind you and others of what you're trying to do and where you're trying to go. It's natural to stray from the path! Most of all, determine how your objective fits in with the current Information Systems and the current business plan.

**Feasibility**

Is your idea even feasible? You might be surprised how often organizations fail to answer this question. "Oh, we have a problem? Well, here's the answer; now press on." A *feasibility study* helps you determine if your proposed solution is achievable *before* you spend thousands of dollars.

1. **Technical feasibility:** You have to look at hardware, software, and personnel when you're deciding whether your proposed answer is the right one. Do you currently have the right
hardware and software to develop the new system? Do you have the right people in the right places? It would be nice to develop an E-commerce site on the Web. But is it technically feasible for your company to do it?

2. **Economic feasibility:** Too often organizations underestimate the cost of a new system, especially in the areas of hardware, software, and persware. When it comes to doing business on the Web, many companies accept the fact that most efforts will lose money for the first year. But what about the second year, and the third year, and so on? How much money can the organization afford to put toward the proposed solution, and for how long before it starts to see a payback?

3. **Operational feasibility:** Something's got to give with the new system. What are the changes, who will manage them, and how will they be incorporated into the existing organizational structure? How much change can the organization handle, monetarily and emotionally?

Managers have a responsibility to select the appropriate solution to the problem or opportunity, but the workers are the ones who will carry it out. Managers should get their input and support.

**Establishing Information Requirements**

Figuring out who needs what information, where, when, and how will challenge the political dynamics of any organization. No system can answer every need, so you're going to have to decide who gets what from the new system. That's why you must write down the problem and then keep referring to it throughout the development process. It is too easy to get sidetracked by politics.

You must *think* and then *rethink* the proposed solution. Make sure you thoroughly investigate the **information requirements** - you're going to live or die by the outcome. Whatever happens at this stage will carry through to all the other stages.
The final dilemma is whether a new Information System is really the answer. Would it be better to address the problem through management changes, more training, or changing the existing organizational processes?

**Systems Design**

Congratulations! If you get to this stage it means you managed to live through the Analysis phase. Now you can get down to figuring out how the system will actually solve the problem or help you take advantage of new opportunities. Remember, your goal is to fit the system into the organization and not make the organization fit the new system. Or at least you want to keep them in tandem; that is, the organization should decide what technology is necessary, while the system capabilities can help reshape the organization.

Logical and Physical Design

When we discussed Database Management Systems, we distinguished between two methods of viewing data: the physical design (how the data would actually be stored in the system) and the logical design (how the data would look to the user). Use the same definitions when you are designing your system, and concentrate on the logical design. In addition to elements that Laudon and Laudon point out in the text, the physical design should determine how the new system will support the current organizational structure, or spell out the changes in that structure that will successfully integrate the new system.

Unfortunately, the physical design sometimes overrides the logical design. Why? Because the non-techies give up too much control to the techies. This is a reminder that both sides have to work together, keeping the goals of the system as the number one priority and remembering that the best system is one that meets the needs of the user.

Don't forget people are the most important component of any system. As soon as users begin to feel they have little input into the
development process, you are courting disaster. Keeping the end user involved will produce a better system.

**Completing the Systems Development Process**

Now that you're through the analysis phase and the design phase, you can move on to the remaining steps in the process. Just remember, you can always go back to those two steps and probably should at some point.

**Programming**

The actual programming phase will in all likelihood be carried out by the IT department. If you're using a fourth-generation language, the programming could very well be done by the end user. Make sure, either way, that the programming supports the analysis and design phases. If not, go back and work through them again. It could very well be that what was designed simply can't be programmed. The usual impulse is to program around the design flaws. Don't! Redesign instead.

**Testing**

"Hey, it works!" But does it really work as it was designed in a real-world situation? Was every aspect thoroughly tested by independent testers in the actual setting? Several things that go wrong in this phase of the development process can severely hamper the success of the project.

For one thing, this step is glossed over by both techies and non-techies. People assume that because something was designed and programmed according to the specifications in the analysis stage, it is right. So they just fly right through the testing process. Or they run one or two tests, usually by the very people who designed and programmed the system. "Hey, I know it works 'cause I programmed it." Uh,oh! Wrong! You should never have the same people who were intimate with the design and programming stages do all of the testing. Get a fresh pair of eyes to look at the system.
Most of all, if you do find a flaw in the testing, do not give into the temptation to ignore it or explain it away. Go back to the analysis, design, and programming stages. Get rid of the flaw the right way.

Of the three types of testing explained in the book, unit, system, and acceptance, the last is the one that is most important and yet the most underrated. Managers and users must be adamant about testing the system, measuring it against the analysis and design requirements, and then accepting the system only when it does in fact measure up.

Conversion

You're getting close to the end. You've been through the agony of analyzing, designing, programming, and testing. The system meets the requirements, works right, the end users love it, and now the bosses are clamoring to see some results.

There is no right way or wrong way to implement the system; you have to look at it in the context of your particular organization.

1. You can use the parallel strategy but it's expensive to run two separate systems at one time. If you don't have a lot of confidence in your new system, you might want to go with this one.
2. If you're really confident in your development process or if the old system simply doesn't work any more, you can use the direct cutover strategy. For instance, Friday you're using the old system; come Monday you're using the new one.
3. If neither of the above describe your organization or your new information system, you might want to consider the pilot study strategy. You can introduce the new system into a single area of the organization. If all goes well there, you can install the new system in other areas. You're still going to have to figure out how to run two systems at once and also figure out how to integrate the new system with the old system.
4. The phased approach is similar to the pilot strategy, but now you install parts of the new system slowly into specific areas of
the organization. Again, two systems, two methods, integration problems, support problems, etc.

However you convert, make sure everyone knows what's going on. Tell them through a formal conversion plan and not the grapevine. Use the information you gathered in the earlier stages of the development process to help guide the implementation plan. Make sure you figure out how to convert the data and train the users. User resistance through fear of the unknown can destroy all your hard work and planning.

Production and Maintenance

You buy a new car and think your problems with the old junker are over. Only for a while: Eventually, you're going to have to change the oil, buy new tires, get a new air filter. Sooner or later, the new car will become an old car. The same is true with an Information System.

After you install the new system, go back one more time and make sure it's meeting your needs. Eventually you're going to have to make changes no matter how well designed it is. And someday you'll have to make major changes or replace it altogether.

Bottom Line: You should not look at the system development process as a straight line but rather a series of steps to be revisited and repeated constantly. The most important piece of the puzzle in systems development is the user.

11.4 Understanding the Business Value of Information Systems

Just as you can analyze the benefit of purchasing a new piece of equipment for your business, you can analyze the impact of an Information System. Think about it - you tell the boss you need a new storage system for all the widgets you are producing. The boss will ask you to complete some
type of analysis to see how the bottom line will be affected. The same is true for a new Information System. Just how will it benefit the business overall? You can't reduce everything to dollars and cents, but you can employ the different methods outlined in the book to evaluate a new information system, just as you would a new storage system.

Capital Budgeting Models

Laudon and Laudon present six different methods for analyzing the new system in terms of dollars and cents (capital budgeting).

Cash flow is all about measuring the amount of cash coming in versus the amount of cash going out of an organization. If you have $1000 coming into your pocket and $500 going out, you have positive cash flow. If you have $1000 coming in and $1500 going out, you're in trouble. You have negative cash flow. If you spend $10,000 on a new Information System, you determine how much cash will be flowing out of the organization to pay for it versus how much new cash will be coming in because of the new system.

Keep in mind that there are limitations to each method: which one to use is best decided by your organization. Sometimes the decision to purchase a new Information System or improve it will not be based solely on financial considerations but on how it will affect customer service or improve the organization in the long run.

How much does it cost the company to buy new chairs and desks for a new employee? Maybe $500 or $1000? How much does it cost the company to have the employee access the Intranet for information about the new 401K plan and have questions answered through the Frequently Asked Questions page instead of calling the Human Resources Department? $5, $50, $100? Who knows? The point is you can't always put a price tag on the cost and benefits of technology. You can determine the exact cost of the
computer, but you can't determine the exact cost of the employee's satisfaction with the Intranet.

Continually changing prices of technology don't help much either. The same computer that cost $1500 a year ago can now be purchased for $700. Keep in mind, though, that a computer need not be state-of-the-art to be adequate for the tasks at hand.

The text gives you guidelines for the six different capital budgeting models:

Payback method: time required to pay back initial investment
Accounting Rate of Return on Investment: takes depreciation into account
Net Present Value: considers the time value of money
Cost-Benefit Ratio: divides total benefits by total costs
Profitability Index: compares other uses of the same pot of money
Internal Rate of Return: calculates how much profit is expected

Figure 11.8, page 359 in the text, gives a graphic depiction for comparing the financial models. Make sure you review it for a clear picture of how to calculate each one.

Nonfinancial and Strategic Considerations

You can do all the fancy calculations you want, but remember: the decision may be made for purely nonfinancial reasons. Many corporations are struggling with nonfinancial and strategic considerations as they try to develop Internet applications. Most companies doing business on the Web aren't making money - they're losing it, at sometimes alarming rates. But they've made the decision that the Web-based applications are necessary and they are willing to
absorb the financial loss in return for the long-term strategic gain.

FIGURE 11.9

A system portfolio.

The portfolio analysis shown in Figure 11.9 allows a company to objectively rate multiple projects for risk and potential benefits. Companies too often get locked into just one idea without understanding that multiple choices exist. There is always more than one way to skin a cat.

The scoring model is very effective for comparing various alternatives in terms of costs. This model can go a long way toward helping organizations determine the best course of action and quantify decision making.

Bottom Line: Potential new systems should be evaluated in terms of costs, tangible and intangible. All costs--hardware, software, and persware--should be included in the bottom line so that the organization can truly determine the gains, or losses, associated with the changes that take place.

Discussion Questions:
Click on the Discussion icon in the top toolbar to answer the following Discussion Questions.
1. In the spectrum of organizational change, which is the most radical type of change: automation, rationalization of procedures, business reengineering, or paradigm shifts?

2. What are some of the reasons business process reengineering efforts fail?

3. Discuss the three types of feasibility analysis organizations should use in the system development process.

4. What are some of the elements of managing the implementation of a new information system? Which ones do you think are the most important?

5. Use one of the capital budgeting models discussed in the text to determine the cost of implementing a new system in your organization.

Chapter 12: Approaches to Systems Building

12.1 The Traditional Systems Lifecycle
12.2 Alternative System-Building Approaches
12.3 System-Building Methodologies and Tools
Discussion Questions

Chapter 12 Approaches to Systems-Building

If you've ever watched a house being built, you know everything starts with the blueprints. One page of the blueprint set has an overall picture of how the house will look when it's done. Another page gives a front view, a side view, and a back view. There are several pages with extremely detailed drawings showing where and how everything fits together. You wouldn't dream of building a house without all of this documentation - at least we hope not.
We spent most of Chapter 11 discussing the overall systems development process. This chapter gives a more detailed look at the various methods for actually building a new system. We'll first look at the traditional system lifecycle method and then examine some alternative methods to building a system.

12.1 The Traditional Systems Lifecycle

The systems lifecycle describes large- and medium-size systems projects. It has existed for years and uses tried-and-true methods that help ensure success of the system from its humble beginnings as an idea to an old relic that eventually needs replacing.

There are six stages to the lifecycle:

- Project definition
- Systems study
- Design
- Programming
- Installation
- Post-implementation

The traditional lifecycle may seem rigid today: There are very definite roles for techies and non-techies. In fact, the user is left out of the loop on a lot of the development and implementation. Even though end users or managers have to sign off and accept the system at the end of each stage, they are not as involved in this method as some of the others we'll look at later. That's why this process may not be the best for small systems development.
FIGURE 12.1

The lifecycle methodology for systems development.

Stages of the Systems Lifecycle

The project definition stage helps you determine if a problem exists, or if there is an opportunity the company can take advantage of with a new information system. You can also determine if you need to modify an existing system in order to keep up with the competition. At this point you decide what the new system can do - something like the main page of the house blueprints.

The systems study stage takes longer than you might expect. You need to gather as much information as you can about the current situation, what you expect from the new system, and how it will all fit together. Oh, and don't forget to check the business plan. The more information you gather at this stage, the more complete your
information requirements statement will be and the better idea you'll have of the finished product.

In the design stage, before you go much further, make sure techies and non-techies are speaking the same language, singing the same tune, using the same sheet of music, É you get the idea. You'd be surprised how many times a failure to communicate at this stage really fouls things up later on. Often each side thinks it knows what the other side is saying: just make sure they do.

Just before the programming stage begins you should get everyone together, review all documentation, rehash system requirements, and verify agreement (preferably in writing) from all sides. It's hard work to create the programming code - it can be harder to re-create it later on. What you decide up to this point will be pretty much set in concrete during the programming stage.

The installation stage includes the steps discussed in Chapter 11: testing, training, and conversion. This is where the rubber meets the road!

Don't think your job is done once the system is installed and fully operational. You still have work to do: you need to review the original specifications against the finished product and make sure they are met. Are users adequately trained, or do you still need work in this area? Does the system need a little bit of tweaking to make it run better? Is it fully integrated and supportive of the rest of the organization and the overall business plan? Double check just to make sure (post-implementation).

Users shouldn't feel they have to accept errors or products that don't meet their specifications. Your job at this point is to uncover those areas that do need changing before they become a way of life. Do it early, when it's still easy to make changes.

Finally, the system will break down or become obsolete and you'll have to start all over. Just like the house that seemed so perfect ten years ago and now seems small and outdated, it's the nature of the beast.
Limitations of the Lifecycle Approach

The lifecycle approach works well for major systems but doesn't fit the bill for smaller ones. It's expensive, time-consuming, and sometimes doesn't allow techies and non-techies to work together as they should.

**Bottom Line:** The System Lifecycle works well for large system development projects. There are definitive roles for techies and non-techies. It's a highly structured method of developing systems.

12.2 Alternative System-Building Approaches

Prototyping, application software packages, end-user development, and outsourcing are alternatives to the Lifecycle approach and in most situations are actually preferred methods of building a new system.

**Prototyping**

**Fast, cheap, user-centered:** Prototyping can be the best way to develop a new system if the end users don't have a clue about what they really want the end product to look like. Even if they have a few clues, this approach works well because users can guide the process based on what they see as the system is being built.

Have you ever watched a television show where the police artist draws a picture of the crook as the victim looks on? The artist draws the eyes and gets approval from the onlooker. Then the mouth is sketched in and approved. Pretty soon a composite drawing is completed, and the cops are off and running. That pretty much describes the prototyping method of building a system.

**You would generally use prototyping for very small systems or small parts of a larger system. You wouldn’t want to use**
this method to build a company-wide Information System. It can be too unstructured, making it harder to manage in large projects. Prototyping works well when you're developing user interfaces and output reports - areas the users will see the most.

The text outlines the four steps you use when developing a prototype. The important thing to keep in mind is that these steps should be repeated many times over. If you work through them just once, you might be in trouble. Some additional tips:

**Step 1:** Ask lots of questions.
**Step 2:** Sketch an informal flowchart with a pencil and paper. Pay attention to the decision trees.
**Step 3:** Have users try every part of the new system.
**Step 4:** Repeat, repeat, repeat.

If you are the developer, make sure the user signs off on every step of the process. Verify that the prototype does in fact meet the user's needs. If you're the user, are you happy with the new system and does it work well for you? If not, why not? If not, go back to Step 3.

Advantages and Disadvantages of Prototyping

Prototyping can be less costly than the traditional systems approach, but if you fail to follow some of the basic principles of systems development, it can be more costly. For instance, if you ignore the basic principle of how the prototype fits into the other Information Systems in the organization, or how it supports the business plan in general, you may be costing the organization more money than you realize. Did you just create an island of information that is incompatible with other systems, or is it fully supportive and easily utilized in other areas?

The greatest advantage of the prototyping method of developing systems is that users see the product, or at least a pretty good replica of it, right away. If they like it, you
press on. If they don't like it, changes can be made immediately. There's less red tape and bureaucracy (perceived or otherwise) to work through in this method.

But be careful if you use the prototype as the actual production version. Is it the best it can be, or are you just tired of fiddling around with it?

**Application Software Packages**

Fast, easy, convenient, user-driven: Many software packages are extremely convenient for non-techies to use to build their own systems. Commonly called "off-the-shelf" software, these packages can be the best method of creating an Information System if that system is fairly standard across different types of businesses.

Table 12.1 lists examples of Application Software Packages that are most commonly used in organizations and businesses of all types.

**Table 12.1** Examples of Application Software Packages

<table>
<thead>
<tr>
<th>Accounts receivable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bond and stock management</td>
</tr>
<tr>
<td>Computer-aided design (CAD)</td>
</tr>
<tr>
<td>Document imaging</td>
</tr>
<tr>
<td>E-mail</td>
</tr>
<tr>
<td>Enterprise resource planning (ERP)</td>
</tr>
<tr>
<td>Groupware</td>
</tr>
<tr>
<td>Healthcare</td>
</tr>
</tbody>
</table>

Ebook_mis.doc
Hotel management
Internet telephone
Inventory control
Job costing
Library systems
Life insurance
Mailing labels
Mathematical/statistical modeling
Order processing
Payroll
Process control
Tax accounting
Web browser
Word Processing

**TABLE 12.1**

*You don't have to worry about system documentation, since that usually comes with the software. You still have to write local procedures for using the program, but you don't have to start from scratch. Training is easier because once you learn how to use the menus and toolbars in one program, the same skills can be carried over to other programs. Training*
manuals often come with the program or are available through online help functions.

Application software packages also provide an easier method of obtaining code corrections, updates, and enhancements: simply go to the Web site of the company that wrote the software and download the latest version. Need technical support for the program? Log on to the Web and you're there. No telephone calls, no waiting on hold for hours, no begging the IT staff to fix your problem. In fact, you'll probably find answers to questions you didn't even know you had!

Most of the common programs still need to have standards for use within the organization. For instance, if you use an accounts receivable application software program, you should still set standards for how you will adapt that program to meet the unique requirements of your company.

**Advantages and Disadvantages of Software Packages**

Most off-the-shelf software can't be changed, so you have to take what comes. The unique requirements of your organization probably won't be met. You'll end up having to change your methods to match the software, instead of the other way around. Some software packages do allow some customization, but not as much as a program developed solely for your organization.

Larger software programs such as Enterprise Resource Planning (ERP) may require extreme organizational changes to adapt to the software. Or you have to create or purchase separate software programs called middleware that will bridge the gap. Make sure you understand up front what will be required for implementing the software before you purchase it. You can easily spend thousands of dollars, only to find out that you can't use the program.

Application software packages still need lots of planning, especially when it comes to integrating them with the other
Information Systems throughout the organization. Compatibility is key.

You should determine the total cost of ownership with these programs beforehand. Is your hardware adequate to handle the new software? Many organizations and individuals learned this painful lesson in August 1995 when Microsoft released Windows 95. Expensive hardware upgrades were required in order to run the software. What are the training costs, implementation costs, and integration costs? They all add up.

**FIGURE 12.4**

Effects of customizing on total implementation costs.
The graph in Figure 12.4 shows that as modifications increase, so do the total costs of implementing a software package. Sometimes the changes, if they are numerous enough, can wipe out any expected savings.

Selecting Software Packages

Selecting software packages can be just as demanding as developing a system on your own. You have to evaluate:

- The program's functions to make sure they fit your needs
- The flexibility to adapt to your business
- User-friendliness (persware)
- Hardware and software resources
- Database requirements
- Installation and maintenance efforts
- Documentation
- Vendor quality (including follow-up)
- Cost
Just as you would for any piece of equipment, you would seek Requests for Proposal (RFP) from several vendors to evaluate the software package according to your needs. Remember, you give up a lot of control when you choose to go with a software package.

End-User Development

This method of system development is a bit like prototyping, but the end user designs and develops the new system using the fourth-generation language tools we reviewed in Chapter 7. It's convenient for small applications, and the user can have complete ownership of the system.

![End-User Development](image)

FIGURE 12.5b

End-user development.

This section of Figure 12.5 shows how much quicker it can be to have end-user system development rather than the traditional lifecycle development: end users can complete the system in minutes or days, whereas the traditional development takes weeks or months.

End-User Computing Tools: Strengths and Limitations

The tools available to the end user are getting easier to use all the time and increase the likelihood that the system will meet the user's specifications, since the user is building it.
There’s no one else to blame if the system doesn’t do what the user wants it to do. But don’t attempt to build larger and more complex systems using this method. The capabilities of the tools are limited.

Management Benefits and Problems

Managers should be aware of some inherent dangers when allowing users to develop their own systems. Standardization can be a tough issue when you use this method. You’re almost begging for conflicts in data processing and storage, since each user will have his or her own method of creating, defining, and developing data.

It may be faster to build a system using this process, but the system may not be as complete or as advanced. There are limitations to what you can do. While it may seem less costly to use the fourth-generation language tools to build systems, you must still figure out the total cost of ownership (TCO), including the time it takes for the non-techie to learn to use the tools. The TCO should also include the cost of each version of the software license that the organization will have to pay for.

The biggest danger is creating those islands of information. The chance of redundant end products just went up, since each user will have his or her own system with slight differences that may prohibit cross-utilization of the information.

We’re not trying to discourage this type of system development. As the text points out, the advantages of having users develop their own products are tremendous. You just need to be aware of the risks.

Managing End-User Development

One way to reduce some of the risks associated with this development process is to establish information centers in the organization. These are like technical support units that
offer help and guidance to users. They can be the focal point for training, reviews, and advice. They could also ensure that systems meet certain organizational standards. Just don't make them too bureaucratic or difficult to access, because then no one will use them.

Outsourcing

What happens if an organization decides it doesn't have the in-house expertise to support the system development process or any of the system maintenance required? No problem: outsource. There are hundreds of outside companies that will do the job. These companies offer expertise and experience. They can also offer smaller organizations economies of scale that make overall information processing cheaper.

When to Use Outsourcing

To summarize the text, it is best to use an outsourcing company:

For mainstream applications such as payroll. You may not be able to do it cheaper because of economies of scale.

When time is not of the essence. Can you process data updates at night? Can you afford to have the system go down without damaging core business processes? If you don't have the in-house support necessary to manage a system. Do you lack the necessary hardware, software, and persware your organization needs to succeed?
The total cost of ownership of a system can be cheaper because of outsourcing. Perhaps the outsourcing company can keep up with changing technologies better than the organization. It may simply be that the organization decides to spend in-house information resource dollars in other ways.

Should you decide to use an outsourcing company to develop an Information System, you must be more careful than ever to ensure that everything, right down to the smallest detail, is in writing and agreed upon by both sides. You are signing a contract with the outsourcer that carries the full force of law. You must agree on how changes will be made to the current system. How responsive will the outsourcer be to changing requirements? You still have some responsibilities for the system; what will they be? Get it in writing!

You must continually analyze the outsourcing company's performance and cost and make sure it remains the cheaper, better way to handle the organization's needs. At some point in time, you may find a different method is in fact cheaper. Bottom Line: There are different ways to develop information systems: prototyping, application software packages, end-user development tools, outsourcing. Analyze each and then pick the right tool for the right job.

12.3 System-Building Methodologies and Tools

Remember our analogy about building a house? Let's go back to it for a minute. What if you only had a hammer and a screwdriver when you built the house? What if you didn't have any idea of how the finished product would look, but made it up as you went along? Worse, what if you ran out of money halfway through? These things happen all the time. From methods developed in the early 1970s that still apply in the 1990s, to snazzy new development processes,
there are many useful tools organizations can use to help them build a new system that will work when it's done.

**Structured Methodologies**

Just as you use blueprints to build a house, you can use a step-by-step or structured approach to building an Information System. You lay a good, solid foundation first and then build upon that. You construct the walls, then you put the roof on. Once you have the outer structure completed, you can work on the details of the house. So too with an Information System.

A structured methodology is oriented toward the actual processes used rather than the data generated. Each step must be completed before the next one is started—just like building a house.

These methods all have their shortcomings. In fact, many of them simply aren't flexible enough to be used in designing systems in today's fast-paced world.

Structured Analysis

**Structured analysis** covers the inputs, the processes, and the outputs, much like the diagram we showed you in Chapter 1. **Use data flow diagrams** such as Figure 12.6 so you can track how the information enters, how it's processed, and how it comes out.
It's very helpful to use a data flow diagram because people understand pictures much better than a whole lot of text. It also forces you to think the whole process through from beginning to end. You can test the process on paper to see if it's feasible. It doesn't matter whether you are using a structured approach to system development or one of the other types we've discussed in this chapter.

If you use process specifications, which define the logic of the lowest-level transformations in the data flow diagram, you can review the details of each process to make sure they flow through the input, process, and output design correctly and efficiently.

Structured Design

Using a structured design makes sure your system is clear and simple. It may not seem so, but you can actually save time, money, and frustration by following the rules and techniques of a structured...
design. A **structure chart** like the one shown here will give you a visual picture of the system and help you understand the relationship between each element.

**FIGURE 12.7**

High-level structure chart for payroll system.

**Structured Programming**

Creating modular code is one of the best methods of creating easy-to-use and -maintain systems. If you can create a **module** of code that can be used several different ways, you'll be able to change the code more easily (for maintenance purposes) because it will be the same everywhere. Creating a block of code once, to be used many times, is certainly cheaper and faster than creating it over and over.

The idea behind structured programming is that you create one way in and one way out. Doing so reduces the chance for programming error or conflicts in how the data will be processed.

**Flowcharts**
By using a **system flowchart**, you can track a piece of data from the beginning to the end just to see if the processes are going to work the way they are supposed to. You use the physical design view rather than the logical design view.

Flowcharting is an old design tool that is still in use. It is used for physical design but not for program design because it does not provide top-down modular structure as effectively as other techniques. What it does provide is a method for tracking processes to make sure they all work and to show outside factors that may be necessary in support of the system.

**Object-Oriented Software Development**

Other methods keep data and processes separate. **Object-oriented software development** combines the two and treats them as one object. More important, the objects are created once and, if they are done right, can be used many times over. That reduces the cost of creating new objects. It also makes it easier to create new software, because you aren't continually starting from scratch.

**Computer Aided Software Engineering (CASE)**

Face it: many of the steps we've discussed in the traditional system development approach aren't completed because they are boring and mundane. Who likes writing user documents or coordinating the activities of the development team? These necessary functions often go undone because no one likes doing them. **Computer-aided software engineering (CASE)** tools automate much of the mundane, repetitious work and can sometimes do a better job of it than a human.

CASE tools keep you organized by automatically updating data dictionaries and validating design diagrams and specifications. If you make a change in one diagram, any reference throughout the program will be automatically updated. Nice, huh?
FIGURE 12.11


The figure shows an example of how CASE tools let you visualize business processes while you're developing a process to automate them.

These tools won't do everything for you, though. You still have to ask the hard questions: Is the system feasible? cost effective? right for our business? integrated with other areas of the organization? And they require organizational discipline. CASE tools enforce common methods and standards.

**Rapid Application Development (RAD)**

Supply and demand. The supply of technical specialists is not enough to support the demand for new systems, or maintenance of the old
ones. Something has to fill the demand - that's why you see so many new methods already on the market and more advanced, easier-to-use tools coming down the road. The shortage of skilled technicians is also why you see more and more companies moving away from the structured methods we've reviewed in this chapter and Chapter 11. There just isn't enough time.

**Rapid Application Development (RAD)** reduces the time it takes to build systems by using many of the tools we've discussed. You can choose from prototyping or fourth-generation tools to develop systems much more quickly.

**Software Reengineering**

If you can squeeze just one more year out of that old car, you sigh. That's what a lot of companies think about their old information systems. We've talked about how costly new systems are - hardware, software, and persware. People don't like change. Changing information systems is very disruptive to organizations. Sometimes they choose to fix their old systems rather than build new ones. You're seeing examples of this with the Y2K bug. Many companies are **reengineering** their software rather than installing new for various reasons. Some find it cheaper, some find it easier, and some just don't have a choice but to fix the old.

Software reengineering can be much easier to accomplish if the organization was smart enough to create good documentation when it was built and to change the documentation when the system was changed. Many companies are finding out that wasn't always the case, and now they're paying for it. Lots of good lessons are learned the hard way!

If acceptable documentation doesn't exist, **reverse engineering** can help you determine how the underlying process works and how it's structured. Essentially, you start with a functioning system and tear it apart to find out how it works. It's much like tearing down a perfectly good radio to see how the parts fit together.
**Forward engineering** takes the information from the reverse engineering process and creates a new, structured program code for the system. Figure 12.12 can help you understand the reverse and forward engineering process.

![Diagram: The reengineering process.](image)

**FIGURE 12.12**
The reengineering process.

**Bottom Line:** To get the best possible product, you have to have a sound structure and good methods for building your system. This will save time, money, and aspirin.

**Discussion Questions:**
Click on the Discussion icon in the top toolbar to answer the following Discussion Questions.

1. How does the traditional systems lifecycle approach differ from the prototype method of developing systems?

2. What is the advantage of using an application software package? What types of application software packages could you use in your organization?

3. How can you determine if outsourcing is advantageous to your organization?
What makes object-oriented software development different from other tools for system development?

Chapter 13: Systems Success and Failure: Implementation

13.1 Information System Failure
13.2 Causes of Information System Success and Failure
13.3 Managing Implementation
Discussion Questions

Chapter 13 System Success and Failure: Implementation

We've all heard information system horror stories of wasted money and excessive delays. Some of us may have been directly affected as consumers of both private and public projects that just didn't work. In this chapter we'll try to discover why information systems have such bad reputations and how you can help prevent similar problems in your organization.

13.1 Information System Failure

You purchase a new, very expensive stereo system with all the bells and whistles available on the market. You're really excited about your purchase and can't wait to get home and set it up. You're imagining how great all your CDs will sound. You set it up, plug it in, and, to your horror, it doesn't work. You fiddle with the controls, check the wiring, and try again. It still doesn't work. You take it completely apart, recheck it, plug it in, and this time it does work but sound comes from only one speaker. You take it back to the store but the people there refuse to refund your money. They say the problem is yours and they have no responsibility.

Unfortunately, this sad story happens with Information Systems more times than anyone cares to remember. The text states that up to 75 percent of large systems may be considered failures because they don't give the users the functionality they expected or they were too costly.

Many organizations end up using a Band-Aid approach in these situations, which costs more time and money. They have to develop
manual ways to get around the deficiencies in the system or spend extra time and money to correct the problems.

Unfortunately no organization is immune to these problems. Figure 13.1 shows you the four problem areas in which Information Systems are likely to experience difficulties.

![Diagram of Information System problem areas]

**FIGURE 13.1**

Information system problem areas.

The common thread running through all the horror stories and the problem areas we'll discuss are people, specifically users. No we're not placing the blame on them; just the opposite. Lack of user involvement and the failure to keep the user in the forefront of the development process is usually the cause of the **system failure**.

**Information System Problem Areas**

Let's look at each of the problem areas in Figure 13.1 individually.

**Design**

We've said repeatedly throughout this course that the Information System must mesh with the business plan and support it, not conflict with or ignore it. Unfortunately, in the design phase of the
Information System the user may have been left out of the planning and testing functions. We described the **physical design** and **logical design** of a system in Chapter 11 and mentioned that the user is more concerned with the logical view of data. Too many times, user interfaces are designed by the techies from a physical view. When that happens, the interface can be useless to the user. Simply put: a successful system must be designed from the user's viewpoint.

Don't let all the fancy bells and whistles available to developers get in the way of simplicity of use. Just because you can, doesn't mean you should. And don't forget to design according to the overall organizational goals.

Data

In the rush to produce, data are simply dumped into the system. We mentioned in previous chapters that data developed by separate organizational entities might be structured differently. The structure of an address in Marketing may be totally different from an address developed by Manufacturing. When the data from both areas are brought into a new system, the users find them incompatible with their needs.

[run on below]

If the data take on new and different meanings, users may use them wrongly or ignore them altogether.

Failure to develop a complete, cohesive **data dictionary** can lead to disaster. Still, many Information System developers choose to ignore this tool.

Costs

You decide to purchase a car. The salesperson tells you initially that it will cost $20,000. The day you arrive at the dealership to pick up the car, the sales manager hands you a bill for $38,000. He is quite surprised when you faint.

Most Information Systems experience cost overruns. Why? Usually because of a failure to account for all costs associated with the
implementation such as training, type of conversion (parallel, phased, etc.), and probably testing. Sometimes, in the political desire to have the system approved, planners will be too optimistic in their estimates of the total time for development. Too many times, planners and developers will count only the cost of the hardware and software and forget to include the cost of persware.

Operations

For many reasons, the system simply may not operate the way it was planned and be considered a failure. Perhaps the hardware capacity is not adequate for the software. Or the hardware and software may be incompatible with the user's needs.

**Measuring System Success**

Figure 13.2 shows you the five most important measurements of a successful Information System. How an organizations measures its success will vary according to its own criteria and according to who does the measuring. If the techies measure system success, the organization is liable to get a totally different result than if users measure the success. It's important that the measurement come from a wide variety of people involved in the development, deployment, and use of the system.

1. High levels of system use: Get feedback from a wide variety of users.
2. User satisfaction with the system: What has it done for me lately?
3. Favorable attitudes: How well do users interact with and get support from the techies
4. Achieved objectives: How well does the system support the goals of the organization?
5. Financial payoff: Is it worth the cost? Some things you can't put a price tag on such as improved relations with customers
FIGURE 13.2

Measures of information system success.

Bottom Line: The four problem areas impeding Information System success, design, data, costs, and operations, have a common thread--the lack of user involvement. Including users in all steps of implementation can turn failure into success. Measuring Information System success is different for every organization.

13.2 Causes of Information System Success and Failure

Managers, planners, developers, and employees fail to realize all the side issues involved in implementing an Information System. They view it as changing computer equipment or software programs, and ignore the impact of change in general on the organization as a whole. They don't understand the need to manage organizational changes (persware) as aggressively as they manage the hardware and software.

Often it's the failure to manage change and not the failure to manage the system which contributes to the downfall of many organizations. You can do everything in the system development process just right, but if you don't manage the
changes the people in the organization will experience, you very well could have done all that work for nothing.

The Concept of Implementation

In Chapter 11 we talked about the mechanics of implementation---the hardware and software. Now let's look at the role people play in implementation.

Organizations can approach implementation from a top-down perspective or from a bottom-up perspective. Both methods have advantages and disadvantages. Regardless of the approach, it takes total support and commitment from all levels of the organization to help make the new system a success.

Table 13.1 shows the ingredients necessary for successful implementation of an Information System from a total organizational standpoint.

<table>
<thead>
<tr>
<th>Table 13.1</th>
<th>Actions and Indicators for Successful System Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support by local funds</td>
<td></td>
</tr>
<tr>
<td>New organizational arrangements</td>
<td></td>
</tr>
<tr>
<td>Stable supply and maintenance</td>
<td></td>
</tr>
<tr>
<td>New personnel classifications</td>
<td></td>
</tr>
<tr>
<td>Changes in organizational authority</td>
<td></td>
</tr>
<tr>
<td>Internilization of the training program</td>
<td></td>
</tr>
<tr>
<td>Continual updating of the system</td>
<td></td>
</tr>
<tr>
<td>Promotion of key personnel</td>
<td></td>
</tr>
<tr>
<td>Survival of the system after turnover of its originators</td>
<td></td>
</tr>
<tr>
<td>Attainment of widespread use</td>
<td></td>
</tr>
</tbody>
</table>

TABLE 13.1

Implementing a new system is not just about how to put the hardware and software into place. You have to address and
manage the persware element of the triangle and make sure that it is in sync with the hardware and software. You in essence become a change agent.

You have to convince users that the system is going to improve their work and that the new will be better than the old. If people are going to lose their jobs because of the new system or if they are going to experience a significant difference in responsibilities, you must be clear in communicating with them.

Causes of Implementation Success and Failure

Keep in mind there is no "one size fits all" when it comes to successful implementation. What works well for one organization may lead to failure in another. Why? Because each organization has its own culture, its own political structure, and its own methods. "Cookie cutter" implementation plans simply don’t exist.

User Involvement and Influence

Make users feel they own the new system instead of it being an enemy or something they should fear. That’s why we've stressed user involvement through the entire development process. The new system shouldn't be a surprise on Monday morning! Familiarity should breed acceptance when it comes to new Information Systems.

It’s so very important to get techies and non-techies working in partnership. The strengths of one group can compensate for the weaknesses in the other. That is, techies may not fully understand the business processes. Users may not know how to design an application interface. . It's actually a simply concept, but one that many organizations fail to grasp.

We've talked before about how the techies view systems versus how the users view systems. Table 13.2 gives you good insight into the user-designer communications gap. As a manager, your job is to bridge that gap to help ensure
success of the new system. Understand where both sides are coming from, and you'll do a better job of getting them to work together.

User Concerns
Designer Concerns

Will the system deliver the information I need for my work?
How much disk storage space will the master file consume?

How quickly can I access the data?
How many lines of program code will it take to perform this function?

How easily can I retrieve the data?
How can we cut down on the CPU time when we run the system?

How much clerical support will I need to enter data into the system?
What is the most efficient way of storing a piece of data?

How will the operation of the system fit into my daily busy schedule?
What database management system should we use?

**TABLE 13.2**
Management Support and Commitment

If managers don't like the new system or fear it, then how in the world can you expect the workers to accept it? The best way to get managers to like, support, and fund the new system is to communicate with them every step of the way. Make sure they know what's going on. After all, managers are people too, and they have the same fears and resistance as anyone else.

Level of Complexity and Risk

The more complex, the more risk. That's pretty easy to understand but harder to manage. As Laudon and Laudon point out, the bigger the project in size, the bigger the headaches. It's pretty evident that managing two or three people working on a small system development project is easier than managing 20 people working on a huge project that will envelop the entire organization.

Some organizations choose to develop and implement a new system for a single business unit at a time and then deploy it to other units using a phased approach. It may seem to take longer and cost more, and probably does, but it's easier to manage and problems are easier to resolve on a smaller scale.

Management of the Implementation Process

For some strange reason, when it comes to implementing Information Systems, basic elements of success seem to escape peoples' attention. Let's assume you are a manager for a large highway construction company. You decide you need to purchase a new bulldozer. You call several different suppliers and obtain various price estimates. You evaluate how much the bulldozer will cost, including the cost of the truck with which you'll transport it from job to job. None of your current employees knows how to drive the bulldozer, so
you'll have to pay for one of them to go to school. You certainly aren't going to spend all this money and then not have anyone trained in the proper operation of the equipment. In short, you methodically evaluate the bulldozer purchase from a total cost of ownership and operation point of view.

You also decide you need a new Information System to keep track of information for the company. You talk to a buddy who heard from a friend that his cousin just bought a new computer at a cheap price from a Web site that was throwing in free software. You hop on the Net, order the system, receive it overnight, set it up on the desk, and stare into oblivion because neither you nor anyone else in your company knows how to operate the computer. You then discover that the free software is totally wrong for the tasks you need completed. But hey, you got a good price on it.

You didn't even think to use the same methodical procedures to evaluate the Information System as you did the bulldozer. Now you have to spend extra money and time to purchase new software, have your people trained on it, and then devise new procedures to accommodate a system that simply doesn't fit into your current business practices.

The point of all this? Use the same methods to evaluate a new Information System as you would any other piece of equipment. Use the same planning process for implementing the Information System as you would all other equipment. Determine the total cost of the new system as you would any other tool. Draw on your experiences of previous projects when implementing a new Information System, even though they may not have been related to computers. The principles are the same: it's just another piece of equipment.

If you're building a road and you fall behind in the schedule, it's feasible to add extra workers to get caught up. But only to a point. You can't paint the road stripes until you get the asphalt laid down. You can add five workers to paint the
stripes but it won’t help if you still only have one person laying the asphalt. After a while, adding more workers actually becomes detrimental. It’s the same with Information Systems. Many steps in the process must be done in a certain order. Until you finish one step, you can’t go on to the next.

By using PERT charts and Gantt charts, you can stay on top of schedule delays. Managers should create an atmosphere of understanding so employees aren’t afraid to tell them of schedule delays. Don’t shoot the messenger-- just work with the message.

The Challenge of BPR and ERP

People fear change even though it may be good for them. They fear it even more the less they know about it. The text says that 70% of all Business Process Reengineering and Enterprise Resource Planning projects fail. That’s a startling number when you realize the amount of resources organizations spend on these projects. Most people want to blame the Information System. But sometimes the failure has nothing to do with the computer equipment or the software programs. The failure can be a result of lack of change management in the organization.

What’s so different about BPR and ERP that make these projects stand out from other types of organizational change? Mostly the sheer size of the undertaking, the complexity of the changes, and the fact that these projects encompass the entire organization. Previous projects may have involved just the Production Department or perhaps the Sales and Marketing functions.

BPR and ERP seek to join every department, every function, and every process of the business. Change of this magnitude is extremely difficult to sell to the managers and employees and extremely difficult to complete because of the massive resources and length of time it takes.
The Implementation Process: What Can Go Wrong

What can go wrong? It may seem like anything and everything if you don't manage it well.

Analysis: If you don't know what you're fixing, how will you know when it's fixed?
Design: Just who is going to use the system?
Programming: When the only tool you have is a hammer, everything tends to look like a nail.
Testing: Sorry, there is no crib sheet available.
Conversion: Would you drive a new car before you added the tires?

Bottom Line: Not managing the organizational changes inherent in new Information Systems is often a cause of failure. The larger the project, the more risk involved in success or failure. Implementation of a new Information System should be planned for and managed like non-computer related systems. Business Process Reengineering (BPR) and Enterprise Resource Planning (ERP) projects involve the entire organization and not just smaller, separate parts.

13.3 Managing Implementation

Anticipate, apply, adjust.

Murphy's Law is made for computers; whatever can go wrong, will go wrong. You have to anticipate problems and be ready to solve them. No system yet devised has been problem free. If you understand and accept that implementing a new information system shouldn't be that much different from implementing any other type of new system or piece of equipment in the organization, you can
use many of the same principles to guide you through the process.

Controlling Risk Factors

There is risk in everything you do. The smallest project has risk. Understanding and managing risk, especially when it comes to people, will help you succeed. Adjusting the risk levels to the size of the project helps you cope with the myriad of changes, inside and outside the system.

Use the tools available to you:

*External integration tools*: We simply can't say it enough: Get the users involved and keep them involved.

*Internal integration tools*: Good communication and working relationships will help lead you to success.

*Formal planning tools*: PERT charts and Gantt charts can help keep you on track and help improve communications between techies and non-techies.

*Formal control tools*: You'll know when you're off track and when your goals are met or not met.

If you involve users throughout the design, implementation, and follow-up to the installation of new systems, they tend to take on ownership of the system. They start to feel a part of the success or failure of the project. Most people don't want to fail, so they will do what they can to help you succeed. On the flip side, if they don't feel any connection to the project, it has no apparent relevance to their job, they feel disengaged from the success, and they won't care whether it succeeds or fails. That's why it's so important to involve them in every step.

If they feel threatened by the new system, they will do what they deem necessary to protect themselves. You'll have to
guard against destructive, although innocent, sabotage of the system (counterimplementation). People will weigh their own needs against those of the organization. You have to make sure the two agree as much as possible. Remember the concept of personal agendas we discussed in Chapter 4? It's back.

What are some causes of user resistance?

Sometimes people simply don't want to spend the energy to learn new ways of accomplishing tasks. Or, they may have had bad experiences with organizational changes in the past. Perhaps they lost their previous job because of corporate downsizing as a result of reorganization. Maybe they've heard of other people who were laid off and had a hard time finding another job. (People oriented theory) Managers should communicate completely and thoroughly with employees to alleviate their fears. Make sure they are properly trained on the new system. Have them play an important role in the implementation of the new system.

People hate feeling stupid and ignorant. If the new system is complicated or confusing, and the interfaces are difficult to use, and the system goals conflict with the organizational goals, users will do whatever they can to bypass the system. If they only know how to use the interfaces but don't understand the purpose of the design or the importance of the system, they tend to resist what they don't understand. (System oriented theory) The users must be educated not just on the "how" but on the "why" of the new processes.

If people value their power and stature in an organization, they like to keep the environment that feeds their self-esteem needs. If a new system threatens their position, they naturally won't be happy about it. (Interaction theory) Feelings of loss can be overcome by giving people new responsibilities within the changing structure of the organization. They can be made part of the design or implementation team. They could be given restructured roles.
and make an important contribution to the success of the system.

It's all a balancing act on the proverbial high-wire of success.

Designing for the Organization

"Just what will this new system do for us?" That's a very appropriate question, but unfortunately, it's often ignored. Everyone seems to get so caught up in the hustle and bustle of the implementation process that they forget the organizational impact analysis. We urged you earlier to write down what you wanted the end result of the project to be in terms of the organization. If you did so, you can use this as the basis for your impact analysis. The analysis can also be a great communication tool to explain to people how their jobs will be affected, to explain the changes required, and to help them plan the individual effort required for a successful new system.

Allowing for the Human Factor

Even though we're discussing this element at the end of the chapter, please don't get the impression that you should wait until the end to give it your full attention. In fact, it should be at the top of your list of priorities throughout the entire implementation process so that it is incorporated into every facet of the new system.

How will the new system fit into the human element? That's the idea behind ergonomics; getting human and machine to agree and complement one another.

Sociotechnical Design

Unless you design a system that will be totally controlled and operated by robots, you must pay attention to the sociotechnical design of your system. Simply stated, this means how the technical aspects of your system will fit in with the human aspects.
Will the users enjoy using the system because it fits their needs, or will they hate it because it doesn't come close to meeting their job needs? A good system blends all the technical bells and whistles with the human factors necessary for successful implementation.

Bottom Line: Managers can control risk factors of large Information System projects by using available tools. Focusing on the impact on the organization as a whole is important. Managing the change in the organizational structure that results from implementing a new system is as important as managing the system itself. It's also an important step toward overcoming user resistance.

Discussion Questions:
Click on the Discussion icon in the top toolbar to answer the following Discussion Questions.

1. Focus on an Information System failure you might be familiar with. Which of the four problem areas was dominant?

2. In Question 1, What could the organization have done differently to change the outcome?

3. Why does the incorporation of users' knowledge and experience help make an Information System project a success?

4. Why is it so important to manage employees' fear of change when implementing BPR and ERP projects?

5. Explain various ways managers can overcome user resistance to change brought about by implementing Information Systems.

Chapter 14: Managing Knowledge
14.1 Knowledge Management in the Organization
14.2 Information and Knowledge Work Systems

14.3 Artificial Intelligence
14.4 Other Intelligent Techniques
Discussion Questions

Chapter 14 Managing Knowledge

As we've mentioned in other chapters, information is becoming an important corporate resource that must be captured, protected, preserved, and grown. How you do that is the focus of this chapter.

14.1 Knowledge Management in the Organization

Creating and using knowledge is not limited to information-based companies: it is necessary for all organizations, regardless of industry sector. It's not enough to make good products; companies must make products that are better, less expensive to produce, and more desirable than those of competitors. Using corporate and individual knowledge wisely will help companies do that.

In the last few years, companies have downsized and flattened their organizations. Many of the employees who were laid off had been with the company for years. When they walked out the door, they took experience, education, contacts, and information with them. The companies are finding out how important that human resource is to their success.

And as companies continue to expand on a global basis and increase their use of technology to connect workers, they have to devise methods of disseminating information quickly to as many people as possible. If an employee in Chicago has experience with a certain production method, it would be silly not to share that information with employees in Singapore so that they don't "reinvent the wheel."

So as knowledge becomes a central productive and strategic asset, the success of the organization increasingly depends on its ability to gather, produce, maintain, and disseminate knowledge. To understand the concept of knowledge management, think of
knowledge as a resource just like buildings, production equipment, product designs, and money. All these resources need to be systematically and actively managed.

**Information Systems and Knowledge Management**

As we explained in Chapter 2, there are two main components to a Knowledge Management system: Office Automation Systems (OAS) and Knowledge Work Systems (KWS).

We're all pretty familiar with OAS systems that secretaries, clerical workers, and some professionals use. In fact, you've probably used some of the same applications contained in an OAS. The most popular is the Microsoft Office suite, which includes word processing (Word), personal information management systems (Outlook), spreadsheets (Excel), and database software (Access). OAS systems help disseminate and coordinate the flow of information created by someone other than themselves, BOTH internally and externally to the organization.

KWS, on the other hand, support the creation and integration of new knowledge that is beneficial to the organization. One could argue that the most important element of a KWS is the **tacit knowledge** that resides in the minds of the employees. Most other types of knowledge you can learn from books. Tacit knowledge usually comes from experience.

Figure 14.1 shows the types of systems an organization would use to create knowledge, capture and codify it, share the knowledge among people, and distribute it with various Office Automation Systems.
FIGURE 14.1

How contemporary information systems support workers.

Knowledge Work and Productivity

The text has a good discussion of productivity gains as a result of the increased use of Information Systems of all kinds. The latest figures say that "productivity growth - which languished at 1% during the 1970s and '80s - has taken a long-term leap to 2% or more as companies use information technology to become more efficient." Business Week, May 3, 1999, p. 47.

To add another dimension, it has long been known that our government does not adequately measure the dollar value associated with the export of information to foreign countries and the products created in the Information Services sector. It's not as easy to count the products from Information Services, such as software or financial advice, as it is to count the number of cars loaded onto a ship bound for Europe.

One of the more interesting aspects of the discussion in the text is the statement "Value created by computers may primarily flow to customers rather than to the company making the investments."
customer is happier; but is the company more productive? And although the company may not necessarily be able to count the productivity gains, it can realize gains from satisfied customers who return for more products or more information or more services.

The point made in the last paragraph of this section on p. 428 is one we've stressed throughout this course: Simply throwing a computer on an employee's desk does not make him or her instantly more productive or instantly smarter. You have to train people on the best use of the system. The company as a whole also has to rethink processes, workflows, and goals. If you had a problem or an inefficient process before, new hardware and software won't automatically fix it: think business process redesign and paradigm shifts.

**Bottom Line:** Information and knowledge are key business assets that must be nurtured, protected, grown, and managed for the benefit of the entire organization.

14.2 Information and Knowledge Work Systems

Information work is the art of creating and processing information. We use the term "art" because some companies do a very good job of creating, processing, and managing their information; others do such a poor job that these tasks become a detriment to the success of the organization. Which kind of company do you want to work for or own?

The two groups of employees primarily concerned with KWS are the data workers who process and distribute information and the knowledge workers who create knowledge and information.

Laudon and Laudon describe several ways to distinguish these two groups. You can also distinguish the two by the type of work they perform and how they create and use information. Here are some questions to help you:

*Do they create original ideas, or do they process, record, and store someone else's?*
Do they make their own original decisions regarding the information?
Do they establish procedures to create and process the information, or do they follow someone else's procedures?

**Distributing Knowledge: Office and Document Management Systems**

![Diagram](image)

**FIGURE 14.2**
The three major roles of offices.

*The office, as we know it in the traditional sense, is the setting for the generation and processing of information. As Figure 14.2 shows, it's where different roles mesh into a smooth "machine" of producing information, knowledge, and ideas instead of a product that you can touch, feel, or smell.*

**Table 14.1**

<table>
<thead>
<tr>
<th>Office Activity</th>
<th>Typical Office Automation Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>Managing documents</td>
</tr>
<tr>
<td></td>
<td>Word processing; desktop publishing, document imaging; Web publishing; work flow managers.</td>
</tr>
<tr>
<td></td>
<td>Scheduling</td>
</tr>
<tr>
<td></td>
<td>Electronic calendars; groupware, intranets</td>
</tr>
</tbody>
</table>
Communicating
E-mail; voice mail; digital answering systems; groupware; intranets

Managing data
Desktop databases; spreadsheets; user-friendly interfaces to mainframe databases

**TABLE 14.1**

*Table 14.1 describes typical Office Automation Systems and the activities they support, all of which are vital to the success of the organization. While some OAS still rely on stacks and stacks of paper, modern technology emphasizes digital sourcing, storage, and distribution. As computers and associated technology become more embedded into the normal workflow of offices, more is being done without paper. For instance, a clerical worker can create a document, send it to co-workers or supervisors for their input via email, have it returned electronically, correct it, and distribute it online.*

*But no matter how much we talk about a paperless society, we are actually generating more paper than ever. One of the emerging technologies that is enhancing the productivity and ease-of-use of Office Automation Systems and reducing paper problems is the document imaging system, which converts documents and images into digital form so they can be stored and accessed by computer.*

*Documents not in use are stored on-line on an optical disk system called a jukebox. The index server maintains the information the system will use to locate, access, and retrieve a document.*

*A wonderful example of document imaging systems is bank checks. Most banks don't return canceled checks any more. They make a digital image of the check, store it electronically, then destroy the piece of paper. If you ever need a copy of*
one of your old checks, you have to request it. While the initial use of paper isn’t reduced, the cost of processing and mailing the checks to the customer is gone altogether.

The advantages of using document imaging systems lie in the chance to redesign workflows. If companies aren’t willing to do this, then they are laying out a lot of money to buy and install a system that they’ll never fully use.

Creating Knowledge: Knowledge Work Systems

In this section we’ll review many different Knowledge Work Systems (KWS) so that you have a clear understanding of how they differ from OAS and other Information Systems. These systems help create new products or improve old ones, and they’re also used to integrate new data into the flow of information that is so vital to an organization.

It's important that you understand the functions KWS perform. They:

- Keep the organization up-to-date in knowledge
- Serve as internal consultants
- Act as change agents

Requirements of Knowledge Work Systems

The first requirement of a KWS is that it provide knowledge workers with the necessary tools:

- Graphics tools
- Analytical tools
- Communication tools
- Document management tools
FIGURE 14.4

Requirements of Knowledge Work Systems

*Figure 14.4 shows how the elements of a KWS work together. Note that this kind of system requires links to external knowledge bases.*

*Most KWS require powerful workstations that can process the huge graphics files some professionals need or perform the massive calculations other types of professionals require. We're not talking clip art or simple adding or subtracting. We're talking huge amounts of data that must be processed quickly and the necessary storage for large files. The workstations must also have the necessary equipment and telecommunication connections that enable the knowledge workers to connect to external sources of information via Extranets, Intranets, or the Internet. These systems must have system and application software that is easy to use and manipulate, and intuitive to learn.*

*Examples of Knowledge Work Systems*

*Pick up any business or technology magazine, or watch the news channels and you'll find numerous examples of how companies are using Knowledge Work Systems to re-create*
their core processes, create new products or services, or improve old ones. The text gives some excellent examples:

Computer-aided design (CAD) applications are used by design engineers to build new products or improve old ones. It used to take 3-4 years and millions of dollars to design a new car. With improved CAD systems, automobile manufacturers have reduced the time to 18-24 months and cut the cost by millions of dollars. Boeing Company has seen the same startling results in their design process for airplanes.

Virtual reality systems have sophisticated imagery that makes you feel like you're "right there!" You may have seen this system on TV shows or in the movies. You're usually required to wear special equipment that feeds your reactions back to the computer so that it can plan its responses to your input. The U.S. Air Force uses virtual reality systems to help train pilots.

VRML (Virtual Reality Modeling Language) is a set of specifications for interactive 3-D modeling on the Web. Many companies are putting their training systems right on the Internet so that people can have access to the latest information and can use it when they need it. Some Web sites use Java applets to help process the programs on the local workstation.

How would you like to make investment decisions based on information that is 90 days old or older? Would you have very much faith in a system that told you only how the company did financially last year, or would you also like to know how the company performed last quarter? That's the idea behind investment workstations. They combine information about companies that is internal and external, new and old, in order to advise clients on the best use of their investment dollars. Massive amounts of data must be processed quickly in order to keep up with changing market
conditions and the changing nature of the industries themselves.

**Sharing Knowledge: Group Collaboration Systems and Intranet Knowledge Environments**

It's no surprise that the workplace is changing rapidly. In fact, you'd have a hard time defining "workplace" in today's world. Group Collaboration Systems' role, along with Intranets, is to support all the new and different ways we work.

**Groupware**

Lotus Notes is the best-known groupware application, with Microsoft Exchange following closely in second place. The three Cs of groupware (communication, collaboration, and coordination), allow people to work together from virtually anyplace on earth. Telecommuters, and people assigned to geographically separated functions, can zip documents from one place to another, or even better, work on the same document at the same time. According to an article in Business Week magazine, Mar. 29, 1999, the most popular feature of groupware is email.

The newest version of Lotus Notes also allows users to hold online chat sessions. Users know when their colleagues are online and can then discuss current projects with them in real time. The use of groupware can reduce the costs of travel significantly and allow more communication between people than ever before. This kind of software support gives global companies tremendous advantages in merging their organizations and enhancing collaboration between offices around the world.

The Lotus Web site, [http://super.lotus.com](http://super.lotus.com), has an excellent online demonstration of how you can use groupware and other features to enhance the three Cs of groupware, including a new feature that allows mobile access to Intranets, Extranets, and Web sites.
### Table 14.3

**Capability**

**Description**

**Publishing**
Posting documents as well as simultaneous work on the same documents by multiple users along with a mechanism to track changes to these documents

**Replication**
Maintaining and updating identical data on multiple PCs and servers

**Discussion tracking**
Organizing discussions by many users on different topics

**Document management**
Storing information from various types of software in a database

**Work-flow management**
Moving and tracking documents created by groups

**Security**
Preventing unauthorized access to data

**Portability**
Availability of the software for mobile use to access the corporate network from the road

**Application development**
Developing custom software applications with the software

---

**TABLE 14.3**

This table gives you more ideas about how groupware can help companies organize and manage knowledge.

**Intranet Knowledge Environments**

**Joe, a mechanic in Albuquerque, needs to fix a radiator in a car he hasn’t seen in five years (it’s an old car). He can’t remember exactly how the gasket fits on the top of the radiator or what bolts he needs. He walks over to his**
computer, accesses the Intranet the automobile manufacturer has established, clicks on the type of car, the type of repair, and downloads the latest information about fixing the part. He can view a video file showing him how the gasket fits, listen to an audio file that explains which bolts he needs along with acceptable substitutes, and read a warning about the dangers he might face when he removes the radiator.

Instead of the hours it might have taken Joe before to look through a manual, fiddle with the part, and try various methods of fixing the radiator, he can have the job done in less than half a day. Joe saves time and money, the customer is happy to get his car back so quickly, and the auto company saved hundreds of dollars training Joe.

Think about the other advantages of using Intranets to manage and disseminate this knowledge. The auto company didn't have to process very much paper to get the latest training manuals to Joe. Joe didn't have to sort through the new manuals, toss out the old, or ignore both the old and the new while he tried to fix the part on his own. No one wasted time organizing the most current information, and yet it was available whenever it was needed by whoever needed it.

Joe didn't need any special hardware or software or even any unique telecommunications transmission media. All he needed was a regular cheap computer hooked to a regular cheap telephone line. The company didn't have to install any special hardware or software other than what it normally would have to access an ordinary Internet or Intranet site. If he had any special questions, Joe could have sent an email to the technical support staff at the Repair Headquarters, who would have answered his question via a return email.

The technical support staff at the Repair Headquarters would track Joe's question and if it was unique, they would update their database with his question and answer so that it would be available to other mechanics or other support staff. The
question and answer, ultimately filed in the database, would be available to the company’s engineers for input in the next design review.

Amazing what we can do with today’s technology! But what happens if Joe chooses not to use the technology? What happens if the technical support staff decides not to share information with the design engineers for fear they’ll lose their jobs? What if the design staff ignores the data available to them? We're right back to the triangle of hardware, software, and persware. You've got to get the people to support the system and make it their friend so they will use it to the benefit of the company.

Bottom Line: You can distinguish between OAS and KWS systems by the way they manage knowledge and information, and by the type of worker using them. OAS systems are comprised of information processors, while KWS systems create and manage knowledge using Computer Aided Design systems, virtual reality systems, and VRML. Knowledge is shared through the groupware and Intranet components of a KWS.

14.3 Artificial Intelligence

Many people have the impression that Artificial Intelligence (AI) is all about computers taking over the world and turning on their human inventors. That's not true; they can't replace humans. We'll find out why in this section.

What Is Artificial Intelligence?
The artificial intelligence family.

As you can see from Figure 14.5, the field of AI includes many initiatives. Artificial intelligence is the art and science of adapting computers to emulate how humans think and act and make decisions. AI is also used to accomplish physical tasks that may be too dangerous for humans and to use logic to help humans solve problems. While computers seem smart, they are only as good as the humans who program them. Most important, they aren't capable of true human behavior. That is, they can be programmed to perform human-like actions, but they can't truly act like a human.
For instance, much of human behavior is based on intuition; some call it gut reaction. If we sense that the fire is hot, we jerk our hand away. If we sense we are falling, we grab for something to break our fall. You could argue that these reactions are learned by having our hand burnt or suffering painful bruises from previous falls. Computers could eventually "learn" the same behaviors, but the parameters for reacting would have to be programmed into them by humans.

What also sets humans apart from computers is that we think and act based on concepts. When you look out the window and see the wind blowing, what goes through your mind and what do you do? It depends. It depends on whether it's winter or summer. It depends on whether it's raining, snowing, or neither. If it's winter and snowing, you'll grab an extra heavy coat, your gloves, your boots, and maybe a scarf. If it's summer with no rain, you may be happy with a nice breeze. Your actions are based on concepts and impressions. A computer can't act on concepts and impressions. It acts on facts fed to it by a program.

Why Business Is Interested in Artificial Intelligence

Businesses are interested in AI because of the characteristics it offers that no other system type offers. That is, AI's ability to:

Preserve intelligence and knowledge: Computers don't quit the job on a moment's notice (they just crash at unexpected times).
Store information for access by a wider group than may be possible with a human: You can pass computer information around much easier than you can a person.
Create a mechanism to supplement humans in dangerous, repetitive, physical situations: You can use AI systems for building security.
Eliminate monotonous jobs: Many factories are replacing humans with computers (robots) to complete boring, repetitious tasks.
Suggest solutions that were used in similar situations: Yes, the local human expert can advise you on how the job was accomplished last year, but the computer is accessible to a wider range of people.
Capturing Knowledge: Expert Systems

Expert systems are a common form of artificial intelligence. They are used to assist humans in the decision-making process, but they don't replace humans. Many of the decisions we make are based on past experience, but we have the added benefit of reasoning and intuition. Expert systems ask questions, then give you advice and reasons why you should take a certain course of action based on hard data, not on hunches. Again, they don't make the final decision.

Most of the problems an expert system helps resolve can in fact be solved by a human. But since the computer is faster or safer, businesses choose to use them instead.

How Expert Systems Work

Expert systems rely on a knowledge base built by humans based on their experiences and knowledge. The base requires rules and knowledge frames in which it can process data. When you think about it, humans work the same way. You look out the window to see if it's raining. If it is, then you grab your umbrella. If it's not raining, then you don't. There you have it: a rule base.

Knowledge frames "represent knowledge by organizing information into chunks of interrelated characteristics." Your knowledge frame would be comprised of the fact that when it rains, you get wet; therefore you need to prevent that from happening.

Yes, we used a very simplified example. Most expert systems require thousands of rules and frames in which to operate. The knowledge must be specific. In the example above, you wouldn't take any action if the only information you had was "It rains 350 days a year in the Amazon rain forest." Neither would an expert system.

The AI shell (the programming environment of an expert system) uses rules, frames, and an inference engine to
accomplish its tasks. The inference engine uses forward chaining or backward chaining to move through the rules and the frames.

In our example, using a forward chaining inference engine, you would start with the idea that it's raining. You'd move through a series of decisions until you reached a conclusion and acted on it. You would determine that it's raining, then you'd decide how much, then you'd decide how wet you don't want to be, then you'd decide to take an umbrella. As long as the answer continues to be yes, you keep moving forward.

In a backward chaining inference engine, you'd start with a hypothesis and work backward until your hypothesis is proved or disproved. You got wet because it was raining; using an umbrella would have prevented that from happening.

Building an Expert System

You build an expert system the same way as you build other Information Systems. However, it's even more important to maintain and update an expert system: You never want to make decisions based on outdated or incorrect information. A knowledge engineer is especially adept at pulling information from various sources, including humans, and making sure it fits into the expert system.

Examples of Successful Expert Systems

You measure the success of an expert system by:

Reduced errors
Reduced cost, reduced training time
Improved decisions
Improved quality and services
Happy users and happy customers
Most problems solved by expert systems are mundane situations. "If it's raining then take an umbrella." But what happens if it's cloudy and only looks like it will rain? That's the exception to the rule about which the human being should make the final decision. The expert system might advise taking the umbrella along or leaving it home based on the input. The human makes the final decision to take or leave the umbrella.

Problems with Expert Systems

If you understand that expert systems can only do so much, you'll be just fine. If you understand that they aren't people with the powers of reasoning and intuition and therefore they can't make every decision, you'll know when to override the system and when to go with its output. Remember that everything in an Expert System is based on IF this, THEN that. But we know not everything is black and white, and there are many gray areas.

Expert systems should not replace managers. They can aid managers in the decision-making process, but managers have to make the final call. For instance, you suggest to your boss that you should receive a pay raise. You have many subjective reasons why you should receive the raise; you arrive early and stay late, your work is always (well almost always) turned in on time, you filled in for Sam while he was on vacation. What happens if your boss feeds that into an expert system that uses only facts? You may or may not get the raise. Your boss still needs to use intuition, reasoning, and gut reaction to make the final decision.

Organizational Intelligence: Case-Based Reasoning

So far, we've concentrated on capturing the individual knowledge in an expert system. Through practical experience, you've realized that "two heads are better than one." Very seldom will only one individual work on a project.
Or perhaps one individual works on the candy bar ad campaign while another works on the breakfast cereal campaign. They have different and yet similar experiences. What if you could tap into each person's experience and knowledge on a collective basis? Take the best of the best from each one and apply it to your needs. Then you give your knowledge to someone else who will combine it with knowledge from others and continuing building on "the best of the best." That's what a case-based reasoning (CBR) system does best.

The Help files you find in most desktop software applications are built on a case-based reasoning model. The technical support staff combines thousands of customer queries into a single database of problems and solutions and refines that information into a series of IF this is the problem, THEN try this. Access the Help files in your desktop software and try it.
How case-based reasoning works.

Figure 14.9 gives you an excellent overview of how a case-based reasoning system works.

Bottom Line: Businesses are interested in Artificial Intelligence to preserve the experience and knowledge of their employees and use it to their competitive advantage. Expert Systems emulate humans in the decision-making process but cannot replicate the intuition and reasoning that still require the human touch.

14.4 Other Intelligent Techniques

We've said all along that computers can't replace humans. Some systems are coming pretty close, though.

Neural Networks

This type of Knowledge System is as close to emulating the human ability to learn as we've been able to come. The text discusses how neurons, along with synapses, work in a brain. That's basically how neural networks operate.

Let's return to our umbrella example. How do you know to take an umbrella when it's raining? You probably got wet a few times without one. Then you tried using one when it rained and discovered that you didn't get wet. You learned that when it rains, an umbrella will keep you dry.

You give a neural network data for which you already know the output so that it has a base of correct information upon which it can build. When you give it new, different data, the computer will compare it with the previous data to determine what the correct outcome of the situation should be. If the data don't fit, it figures out why. It adds that information to its current database of knowledge and then
keeps taking in more data. It eventually learns the right outcome. The more data it takes in, and the more situations it gets right, the better it becomes at knowing the right answer to the next set of decisions.

If you want an excellent online demonstration of neural networks, try this Web site:

The Difference Between Neural Networks and Expert Systems

- Expert systems emulate human decision making
- Neural networks learn human thought processes and reasoning patterns

- Expert systems use rules and frames in which to make their decisions
- Neural networks adjust to inputs and outputs

- Expert systems require humans to update their database of information
- Neural networks continue to expand their own base of information

Fuzzy Logic

Okay, one more time, back to our umbrella. If it's only cloudy outside, how do you know whether to take the umbrella? "It depends on how cloudy it is," you say. If it looks like rain, you know to take the umbrella; there is a strong possibility that it will pour buckets. If it's only a little cloudy and doesn't look like rain, you'll take the chance that you won't get wet and leave the umbrella at home. That's fuzzy logic!

Fuzzy logic, a relatively new rule-based advance in AI, is based on approximate values and ambiguous data. A fuzzy
logic system will combine various data into a range of possibilities and then help solve problems that we couldn't solve before with computers.

Genetic Algorithms

We've evolved as a human race through genetics. We are made up of many combinations of generations of humans. That's how genetic algorithm systems work. Solutions to problems are examined by the system. The best solution is retained for future use, while the worst solutions are discarded. The solutions that are retained are used to help provide better solutions to future problems. They are combined and mutated the next time they are used.

Businesses often need to solve problems that are dynamic, complex, and have many variables. Very few problems are clear-cut, black and white. Genetic algorithms are good systems for businesses to use because it's almost like having millions of people coming at a problem from all directions.

Hybrid AI Systems

We've mentioned before about taking the best of the best and that's just what hybrid AI systems are. They take the best parts of expert systems and the best parts of fuzzy logic, and the best parts of neural networks, and combine them into one system that solves the problem. You can look forward to more of this hybridization as we continue to expand our knowledge of technology and human beings.

Intelligent Agents

Jump on the Web and find the best price for computer printer supplies. Simply typing the words "computer printer supplies" into your favorite search engine will result in thousands of pages with more than just price information. You can find specific information on prices much faster using an intelligent agent. These software programs learn your
personal preferences for accomplishing simple tasks and can take the drudgery out of repetitive, specific work.

Businesses can use intelligent agents to help train users on new systems, schedule appointments, or monitor work in progress. By far though, the most popular use of this nifty little software program is that of a "shopping agent" which surfs the Web for you looking for specific items to purchase or the lowest prices on a particular item.

Bottom Line: Many new technologies can help humans solve difficult problems or take advantage of new opportunities. Neural networks learn how to make decisions. Fuzzy logic uses "ranges of possibilities" instead of giving black-and-white, yes-no answers. Intelligent agents take much of the drudgery out of searching dozens of Web sites.

Discussion Questions:
Click on the Discussion icon in the top toolbar to answer the following Discussion Questions.

1. Discuss the difference between Office Automation Systems and Knowledge Work Systems in the way they create and use knowledge and information.

2. Describe how an organization can use groupware and Intranets to enhance the three Cs: communication, collaboration, and coordination.

3. How is an expert system different from a neural network?

4. What are some applications for intelligent agent uses on the Internet?

5. How does fuzzy logic work?

Chapter 15: Enhancing Management Decision Making
15.1 DSS - Decision-Support Systems

Ebook_mis.doc
Chapter 15 Enhancing Management Decision Making

The more 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 to help them.

15.1 Decision-Support Systems

When we discussed Transaction Processing Systems and Management Information Systems, the decisions were clear-cut: "Should we order more sugar to support the increased production of candy bars?" Most decisions facing executives are unstructured or semistructured: "What will happen to our sales if we increase our candy bar prices by 5%?"

Decision Support Systems (DSS) help executives make better decisions by using historical and current data from internal Information Systems and external sources. By combining massive amounts of data with sophisticated analytical models and tools, and by making the system easy to use, they provide a much better source of information to use in the decision-making process.

DSS and MIS

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

<table>
<thead>
<tr>
<th>MIS</th>
<th>DSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structured decisions</td>
<td>Semistructured, unstuctured decisions</td>
</tr>
<tr>
<td>Reports based on routine flows of data</td>
<td>Focused on specific decisions or classes of decisions</td>
</tr>
</tbody>
</table>
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

Greater emphasis on models, assumptions, ad hoc queries
Traditional systems development
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? You might find it helpful to review the information about decision-making processes from Chapter 4.

Types of Decision-Support Systems

Because of the limitations of hardware and software, early DSS systems provided executives only limited help. With the increased power of computer hardware, and the sophisticated software available today, DSS can crunch lots more data, in less time, in greater detail, with easy to use interfaces. The more detailed data and information executives have to work with, the better their decisions can be.

Model-Driven DSS were isolated from the main Information Systems of the organization and were primarily used for the typical "what-if" analysis. That is, "What if we increase production of our candy bars and decrease the shipment time?" These systems rely heavily on models to help executives understand the impact of their decisions on the organization, its suppliers, and its customers.

Data-Driven DSS take the massive amounts of data available through the company's TPS and MIS systems and cull from it useful information which executives can use to make more informed decisions. They don't have to have a theory or model but can "free-flow" the data.

Ebook_mis.doc
By using **datamining**, executives can get more information than ever before from their data. One danger in datamining is the problem of getting information that, on the surface, may seem meaningful but when put into context of the organization’s needs, simply doesn't provide any useful information.

For instance, datamining can tell you that on a hot summer day in the middle of Texas, more bottled water is sold in convenience stores than in grocery stores. That's useful information executives can use to make sure more stock is targeted to convenience stores. Datamining could also reveal that when customers purchase white socks, they also purchase bottled water 62% of the time. We seriously doubt there is any correlation between the two purchases. The point is that you need to beware of using datamining as a sole source of decision making and make sure your requests are as focused as possible.

Laudon and Laudon describe five types of information you can get from datamining customer information:

- **Associations**: Immediate links between one purchase and another purchase
- **Sequences**: Phased links; because of one purchase, another purchase will be made at a later time
- **Classification**: Predicting purchases based on group characteristics and then targeting marketing campaigns
- **Clustering**: Predicting consumer behavior based on demographic information about groups to which individuals belong
- **Forecasting**: Use existing values to determine what other values will be
**Components of DSS**

A DSS has three main components, as shown in Figure 15.1: the **database**, software and models. The database is, of course, data collected from the organization's other 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 datamining.

The What-If decisions most commonly made by executives use **sensitivity analysis** to help them predict what effect their 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.

**Examples of DSS Applications**

<table>
<thead>
<tr>
<th>Organization</th>
<th>DSS Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Airlines</td>
<td>Price and route selection</td>
</tr>
<tr>
<td>Equico Capital Corporation</td>
<td></td>
</tr>
<tr>
<td>General Accident Insurance</td>
<td>Investment evaluation</td>
</tr>
<tr>
<td>Bank of America</td>
<td>Customer buying patterns and fraud detection</td>
</tr>
<tr>
<td>Frito-Lay, Inc.</td>
<td>Customer profiles</td>
</tr>
<tr>
<td>Burlington Coat Factory</td>
<td>Price, advertising, and promotion selection</td>
</tr>
<tr>
<td>National Gypsum</td>
<td>Corporate planning and forecasting</td>
</tr>
<tr>
<td>Southern Railway</td>
<td>Train dispatching and routing</td>
</tr>
<tr>
<td>Texas Oil and Gas Corporation</td>
<td>Evaluation of potential drilling sites</td>
</tr>
<tr>
<td>United Airlines</td>
<td>Flight scheduling</td>
</tr>
<tr>
<td>U.S. Department of Defense</td>
<td>Defense contract analysis</td>
</tr>
</tbody>
</table>

**TABLE 15.1**

The table shows some DSS examples. When you're reviewing the extended examples in the text, try to correlate them to the points we've just covered.
Pioneer Natural Resources - Uses PC software tools discussed in Chapter 7 to make cost-effective decisions regarding complex relationships in varying scenarios.

The Advanced Planning System - A Manufacturing DSS: Uses the sensitivity analysis model of "What-If" analysis

Southern California Gas Company: Uses classification and clustering datamining techniques to focus new marketing efforts.

Shop-Ko Stores: Uses the datamining technique of associations to recognize customers' purchasing patterns.

Geographic Information Systems (GIS): Very popular with, of all people, farmers and ranchers. Using GIS tools, they can determine exactly how much fertilizer to spread on their fields without over- or under-spraying. They save money, time, and the land! Because of pinpoint accuracy, GIS systems are used by emergency response teams to help rescue stranded skiers, hikers, and bicyclists.

**Web-Based DSS**

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. Figure 15.3 shows an Internet **CDSS (Customer Decision-Support System).**
Customer decision support on the Internet.

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) 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.

An excellent example of many different consumer financial calculators can be found at http://www.interest.com/hugh/calc
Bottom Line: Executives make semistructured 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. Datamining 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 interface that is easy to use.

15.2 Group Decision-Support Systems

More and more, companies are turning to groups and teams to get work done. Hours upon hours are spent in meetings, in group collaboration, in communicating with many people. To help groups make decisions, a new category of systems was developed--the group decision-support system (GDSS).

What Is a GDSS?

You've been there: a meeting where nothing seemed to get done, where some people dominated the agenda and others never said a word, which dragged on for hours with no clear agenda. When it was all over no one was sure what was accomplished, if anything. But the donuts and coffee were good!

Organizations have been struggling with this problem for years. They are now using GDSS as a way to increase the efficiency and effectiveness of meetings. The text includes a list of elements that GDSS use to help organizations. We'll highlight a few of them:

- Preplanning: A clear-cut agenda of the topics for the meeting.
- Open, collaborative meeting atmosphere: Free flow of ideas and communications without any of the attendees feeling shy about contributing
Evaluation objectivity: Reduces "office politics" and the chance that ideas will be dismissed because of who presented them instead of what was presented.

Documentation: Clear communication about what took place and what decisions were made by the group.

Preservation of "organizational memory": Even those unable to attend the meeting will know what took place; great for geographically separated team members.

GDSS Characteristics and Software Tools

We're back to our triangle of:

- **hardware**
- **software**
- **persware**

In GDSS the hardware includes more than just computers and peripheral equipment. It also includes the conference facilities, audiovisual equipment, and networking equipment that connects everyone. The persware extends to the meeting facilitators and the staff that keeps the hardware operating correctly. As the hardware becomes more sophisticated and widely available, many companies are bypassing specially equipped rooms in favor of having the group participants "attend" the meeting through their individual desktop computers.

Many of the software tools and programs discussed in Chapter 14, Groupware, can also be used to support GDSS. Some of these software tools are being reworked to allow
people to attend meetings through Intranets or Extranets.
Some highlights:

Electronic questionnaires: Set an agenda and plan ahead for the meeting
Electronic brainstorming: Allows all users to participate without fear of reprisal or criticism
Questionnaire tools: Gather information even before the meeting begins, so facts and information are readily available
Stakeholder identification: Determines the impact of the group’s decision
Group dictionaries: Reduce the problem of different interpretations
Now instead of wasting time in meetings, people will know ahead of time what is on the agenda. All of the information generated during the meeting is maintained for future use and reference. Because input is anonymous, ideas are evaluated on their own merit. And for geographically separated attendees, travel time and dollars are saved. Electronic meeting systems make these efficiencies possible. Figure 15.6 shows the sequence of activities at a typical EMS meeting.

FIGURE 15.6

Group system tools.

All is not perfect with EMS, however. Face-to-face communications is critical for managers and others to gain insight into how people feel about ideas and topics. Body language can often speak louder than words. Some people still may not contribute freely because they know that all input is stored on the file server, even though it is
anonymous. And the system itself imposes disciplines on the group that members may not like.

How GDSS Can Enhance Group Decision Making

Go back to the previous list of problems associated with meetings and you can determine how GDSS solve some of these problems.

1. Improved preplanning: Forces an agenda to keep the meeting on track.
2. Increased participation: Increases the number of people who can effectively contribute to the meeting.
3. Open, collaborative meeting atmosphere: Nonjudgmental input by all attendees.
4. Criticism-free idea generation: Anonymity can generate more input and better ideas.
5. Evaluation objectivity: The idea itself is evaluated and not the person contributing the idea.
6. Idea organization and evaluation: Organized input makes it easier to comprehend the results of the meeting.
7. Setting priorities and making decisions: All management levels are on equal footing.
8. Documentation of meetings: Results of meeting are available soon after for further use and discussion.
9. Access to external information: Reduces amount of disagreements by having the facts.
10. Preservation of "organizational memory:" Information is available to other groups within the organization.

You can see from this list that the potential for efficient and effective meetings is increased by using GDSS to promote open and organized decision making in groups.

Bottom Line: More and more, decisions are being made by groups in today's business environment. Most meetings are inefficient. Using Group Decision
Support Systems, comprised of hardware, software, and people, helps streamline group meetings and communications by removing obstacles and using technology to increase the effectiveness of the decisions.

15.3 Executive Support Systems

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 so, 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, always changing, so the system must be flexible and easy to manipulate.

The Role of ESS in the Organization

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. Many executives are also turning to the Web to provide the flexibility they need.

Developing ESS

As with DSS, executive support systems are 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, 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 ways.**

**Benefits of ESS**

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 summarized information.

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.

**Examples of ESS**
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.

The Sutter Home Winery uses mostly external data, including information from the Internet, in its ESS. It organizes the information in order to help executives make decisions based on trends in the marketplace. The information includes data on competitors and information from market research. Sutter uses its system output to determine sales forecasts, marketing campaigns, and investment plans.

Managers at the Royal Bank of Canada are able to choose their own criteria (from among 15 choices) to drill down and navigate data through easy-to-use interfaces. They don't have to accept data in formats chosen by someone else who may not understand individual manager's needs. Data analysis is more timely because the information is quicker to obtain and more convenient than before.

Virtually all of the information in the U.S. General Services Administration's ESS is internal data used to help executives manage the government's assets and inventory of buildings. The information is used for analysis of the efficient, or inefficient, use of buildings. The systems includes the ability to drill down to more specific detail if necessary. Output includes graphs and pictures of the inventory. Huge amounts of data are available quicker and are more specific to the user's needs.

Bottom Line: Executive Support Systems meet the needs of corporate executives by providing them with vast amounts of information quickly and in graphical form to help them make effective decisions. ESS must be flexible, easy to use, and contain both internal and external sources of information.
Discussion Questions:
Click on the Discussion icon in the top toolbar to answer the following Discussion Questions.

1. Compare the characteristics of an MIS and a DSS. Why are decision support systems more suited for executive decision making?

2. What advantages does a data-driven decision support system have over a model-driven DSS?

3. How can datamining enhance a company's marketing campaign for a new product being introduced to college students?

4. What benefits do group decision-support systems provide organizations?

5. Why must an executive support system be flexible and easy to use?

Chapter 16: Information Systems Security and Control
16.1 System Vulnerability and Abuse
16.2 Creating a Control Environment
16.3 Ensuring System Quality
Discussion Questions

Chapter 16 Information Systems Security and Control

You may remember a movie called "The Net" which premiered several years ago. It was a suspense film about a woman whose computer identity was stolen and manipulated. At one point during the movie, she didn't exist, at least according to the computers. Many people wonder if all that is really possible, and the sad answer is yes.
16.1 System Vulnerability and Abuse

As our society and the world itself come to depend on computers and information systems more and more, systems must become more reliable. The systems must also be more secure when processing transactions and maintaining data. These two issues, which we address in this chapter, are the biggest issues facing those wanting to do business on or expand their operations to the Internet. The threats are real, but so are the solutions.

Why Systems Are Vulnerable

- Hardware failure
- Fire
- Software failure
- Electrical problem
- Personnel actions
- User errors
- Terminal access penetration
- Program changes
- Theft of data, services, equipment
- Telecommunications problems

**TABLE 16.1**

This table points out some of the technical, organizational, and environmental threats to Information Systems. The weakest link in the chain is poor management of the system. If managers at all levels don't make security and reliability their number one priority, then the threats to an Information Systems can easily become real.

With distributed computing used extensively in network systems, you have more points of entry, which can make attacking the system easy. The more people you have using the system, the more potential for fraud and abuse of the information maintained in that system. Yes, it's hard to control everyone's actions. That's why you have to make it everybody's business to protect the system. It's easy for people to say that they are only one person and therefore they
won't make much difference. But it only takes one person to disable a system or destroy data. Let's see why.

**FIGURE 16.1**

Network vulnerabilities.

**Hackers**, those who intentionally create havoc or do damage to a computer system, have been around for a long time. Many companies don't report hackers' attempts to enter their systems because they don't want people to realize their systems are vulnerable. That makes gathering real statistics about hacking attempts and successes hard. It is a huge problem, though.

Some hackers penetrate systems just to see if they can. They use special computer systems that continually check for password files that can be copied. Or they look for areas of the system that have been "left open," so to speak, which they can use to enter the system. Sometimes they don't do any damage, but far too often they destroy files, erase data, or steal data for their own use. Other hackers attack systems because they don't like the company.

Password theft is the easiest way for hackers to gain access to a system. No, they don't come into your office at night and look at the
piece of paper in your desk drawer that has your password written on it. They generally use specially written software programs that can build various passwords to see if any of them will work. That's why you should use odd combinations of letters and numbers not easily associated with your name to create your password. The longer the password, the harder it is to replicate.

Have you ever picked up a cold or the flu from another human? Probably. You then spread it to two or three other people through touch or association. Those people spread it to two or three more people each. Pretty soon it seems that everyone on campus or at work is sick. That is how computer viruses are spread. You copy a file from an infected source, use the file, and maybe send it to friends or associates. The virus is now on your computer and spreads to files other than the original. You then send the same or even a different file to a few friends and their computers are infected.

In March 1999 a virus called Melissa was written by a hacker and sent out via an email attachment. While the virus didn't damage any computer files or data, it severely hampered normal operations of many companies and Internet Service Providers through the increased number of emails it generated. Here's what CERT (Computer Emergency Response Team) said about it on its Web site (www.cert.org): "Melissa was different from other macro viruses because of the speed at which it spread. The first confirmed reports of Melissa were received on Friday, March 26, 1999. By Monday, March 29, it had reached more than 100,000 computers. Some sites had to take their mail systems off-line. One site reported receiving 32,000 copies of mail messages containing Melissa on their systems within 45 minutes."

Whether you use a stand-alone PC or your computer is attached to a network, you're just asking for trouble if you don't have antivirus software. This type of software checks every incoming file for viruses. Not if, but when, you receive an infected file, the software alerts you to its presence. You can choose to delete the file or "clean" it. Make sure you update your antivirus software every 30 to 60 days because new viruses are constantly being written and passed around.
Concerns for System Builders and Users

Every user must be concerned about potential destruction of the Information Systems on which they rely. We can't stress this point enough. Let's look at three concerns: disasters, security, and errors.

Natural disasters such as fires and earthquakes can strike at any time. A spilled cup of coffee can also do some damage!

As the text points out, many companies create fault-tolerant systems that are used as back-ups to help keep operations running if the main system should go out. These back-up systems add to the overall cost of the system, but think about the losses if the company's system goes down. Add the cost of lost productivity by the employees to the lost transactions and unhappy customers; you do the math.

Just imagine what would happen if an airline reservation system (a typical online transaction processing system) went down. Have you ever called a company to place an order for a new dress and it couldn't take your order because the computer was down? Maybe you called back later and maybe you didn't.

Companies spend a lot of money on physical security such as locks on doors or fences around supply depots. They need to do the same thing on their Information Systems. Here the security is in the policies, procedures, and technical measures the company uses to keep out unauthorized users or prevent physical damage to the hardware.

Surely you've heard the saying, "Garbage In, Garbage Out." What may seem like a simple error to you may not be to the customer. Let's flip that around; what if you wanted to fly to Dallas on March 15 and the reservation clerk booked you on a flight for April 15? The potential for error exists all through the processing cycle, as Figure 16.2, p. 504, shows. You must be cognizant of these error points when designing and building a system, especially an end-user developed system.
It would be nice to have a perfect world, but we don’t. Defects in software and data are real. You as an end user can't do much about the software, but you can do something about the data you input.

Bugs and Defects

The term *bug*, used to describe a defect in a software program, has been around since the 1940s and 1950s. Back then, computers were powered by vacuum tubes - hundreds and thousands of them. Grace Hopper, an early pioneer, was troubleshooting a computer that had quit running. When her team opened the back of the computer to see what was wrong, they found a moth had landed on one of the tubes and burned it out. So the term "bug" came to describe problems with computers and software.

With millions of lines of code, it's impossible to have a completely error-free program. Most software manufacturers know their products contain bugs when they release them to the marketplace. They provide free updates and fixes on their Web sites. That's why it's a good idea not to buy the original version of a new software program but to wait until some of the major bugs have been found by others and fixed by the company.

Because bugs are so easy to create, most unintentionally, you can reduce the number of them in your programs by using the tools discussed in other chapters to design good programs from the beginning. Many bugs originate in poorly defined and designed programs and just keep infiltrating all parts of the program.

The Maintenance Nightmare

You simply can't build a system and then ignore it. It needs constant and continual attention. Laudon and Laudon state that half of a company's technology staff time is devoted to maintenance.

When you're considering organizational changes, no matter how minor they may seem, you must consider what changes need to be
made to the systems that support the business unit. Keep in mind that software is very complex nowadays. You just might have to search through thousands or millions of lines of code to find one small error that can cause major disruptions to the smooth functioning of the system.

In the other chapters we stress good system analysis and design. How well you did back then will play out in the maintenance of the system. If you did a good job, maintenance will be reduced. If you did a poor job analyzing and designing the system, maintenance will be a far more difficult task.

Data Quality Problems

The text gives some startling numbers concerning the FBI files (let's hope your name isn't one of their errors). But let's bring the problem of poor data quality closer to home. What if the person updating your college records fails to record your grade correctly for this course and gives you a D instead of a B or an A? What if your completion of this course isn't even recorded? Think of the time and difficulty you'll experience getting the data corrected.

**Bottom Line: Information Systems security is everyone's business. Use antivirus software on your computer and update it every 30-60 days. The "it won't happen to me" attitude is trouble. Many system quality problems can be solved by instituting measures to decrease the bugs and defects in software and data entry.**
16.2 Creating a Control Environment

How do you help prevent some of the problems we've discussed? One of the best ways is to introduce controls into your Information System the same as you might in any other system: through methods, policies, and procedures.

Think about what a typical company does when it builds a new office building. From the beginning of the design phase until the building is occupied, the company decides how the physical security of the building and its occupants will be handled. It builds locks into the doors, maybe even designs a single entry control point. It builds a special wing for the executive offices that has extra-thick bulletproof glass. Fences around the perimeter of the building control the loading docks.

These are just a few examples to get you to think about the fact that the company designs the security into the building from the beginning. You should do the same thing with an Information System. It's no different from any system that requires preplanning and well-thought-out policies and procedures before the building begins.

Let's look at the two distinct types of controls: general controls, which focus on the design, security and use of computer programs and data files, and application controls, which are concerned with the actual application programs.

General Controls

General Controls in Information Systems consist of the systems software and manual procedures used to control the design, security, and use of the programs and the data files in the overall system. General controls would be the overall security system, which may consist of outside door locks, fencing around the building, and employee passes. General controls wouldn't be concerned with what happens in one particular area of the building.
Implementation Controls

Remember in previous chapters when we discussed good system development procedures? They're back! When you use implementation control methods, you audit the development procedures and processes to make sure they conform to the business's standards and policies. Were all the steps completed, or did you skip some of them? What input did users and management have in the design and implementation of the system? Were managers allowed to sign off on milestones during the development process, or were they left out of the loop altogether? There is a reason why you have to use good, sound development procedures.

The people who are in charge of developing the system shouldn't be the same ones who audit the development process. You should use someone who wasn't involved in the development process in any way.

Software and Hardware Controls

How is your system software installed, maintained, and used? What security measures are in place to ensure only authorized users are allowed access to your system? Are you using the latest version of virus protection software? These concerns are part of the software controls you should develop.

Companies control all of their manufacturing equipment, office supplies, and production tools--or at least try to. They should apply the same hardware controls to computer equipment as they would any other piece of equipment. Sometimes they don't. Laptop computers are especially vulnerable to theft and abuse: Companies seem to be very lax about employees borrowing laptops and then never returning them.

Computer Operations and Data Security Controls
Computer operations controls are the responsibility of the Information Technology Department staff and are concerned with the storage and processing of data. Often overlooked in this area is the need for protecting the system documentation that details how jobs are processed, how data are stored, and how the systems operate. Someone who steals this information could do serious damage.

Whether you're working with current data or archived data, you still need to protect them from unauthorized access or use. The movie "The Net" depicted a fictionalized version of data theft and manipulation. While it may have been an exaggeration, this could happen if a company doesn't do enough to protect its data.

Data security controls should consist of passwords that allow only certain people access to the system or to certain areas of the system. While you may want to grant employees access to their payroll data or 401K data through an Intranet, you must make sure they can access only their information and not that of any other employee. You wouldn't want a co-worker to be able to access your paycheck information, would you?

If you allow employees to keep certain data on their machines that are not backed up to the mainframe computer, you need to ensure that safeguards are installed on the individual PCs. Make sure you have controls in place for access to individual data, backing them up, and properly protecting them against corruption. Do you even have a policy about whether employees can store data on their individual terminals?
The kinds of security profiles shown in Figure 16.4 can be established to restrict access to certain areas of information.

An effective way of limiting access to data is to establish computer-generated logs that show every employee who logged on, what he or she did, what part of the system was accessed, and whether any data were used or updated. Logs are easily created by system software programs and should be periodically reviewed by the Information Technology staff and department managers. If nothing else, it gives them an idea of what their employees are doing.

Administrative Controls

To properly execute and enforce all these controls, you have to have administrative controls--rules, procedures, standards, and discipline. You don't want to wait until disaster strikes, until a hacker destroys data, or an employee steals...
information and gives it to the competition, to realize you weren't paying attention to what's going on.

Segregate the functions of your users. Whoever puts data in the system shouldn’t be the one who audits them for correctness or completeness. That's like having a bank teller be the only one who ever counts the money in the till. Whoever develops and writes the software programs shouldn't be the one to check the programs for errors.

Application Controls

We've talked about controls for the general use of an Information System. Application controls are specific controls within each computer application used in the system.

In Chapter 1 we used a diagram of a basic Information System with input, processing, and output. Remember this figure?

FIGURE 1.2

Functions of an information system.
Each activity in the system needs controls to ensure the integrity of the data input, how it's processed, and how it's stored and used.

**Input Controls**

Are the data accurate and complete? We used an example earlier of a course grade being entered incorrectly. If your system had a method to check the data on the input documents against the actual data entered into the system, this kind of error could be caught and corrected at the time it was entered. Many companies are using source data automation to help eliminate input errors.

We also discussed in earlier chapters the use of interorganizational systems between companies. These systems also need some type of input control to ensure the integrity of data as they move from one company's system to the other company's.

Managers can use control totals to determine that the documents used to enter data equal the number of transactions processed by the system. For instance, if the Sales Department says it entered data from 1,500 documents on April 21, were 1,500 transactions actually processed by the system that same day? If the number is different, managers can investigate the discrepancy and determine the cause of the mismatch.

Edit checks validate the data that were entered into the system. This control method is very important for user-developed systems such as spreadsheets that record travel expenses for employees. You could design an edit check into the spreadsheet that would verify how much money employees spend per day on meal costs. If the amount exceeds that allowed by the IRS, an edit check would warn the employee that he or she must have receipts to prove the
actual amount spent. The edit check validates the data before they are processed.

Processing Controls

As the name describes, processing controls are used during the actual processing of the data.

If Suzy says she entered 100 items into the system on Tuesday, your application program would have a method of checking and reporting the actual number of data entries for that day. Not that you think Suzy is lying; you just need to have a method of verifying and reconciling data entered against data processed.

If Sam mistakenly submitted two invoices for the same customer on the same day with the same parts ordered, a computer matching control would catch the discrepancy and create a report that can be used to investigate the error. Perhaps the customer really did order the same part twice on the same day. More than likely it is an error that's better caught before it causes an embarrassing incident for the company.

Table 16.4 gives you ideas about other edit techniques companies can use for checking data as they are input, processed, and output.

<table>
<thead>
<tr>
<th>Edit Technique</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reasonableness checks</td>
<td>To be accepted, data must fall within certain limits set in advance, or they will be rejected.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>If an order transaction if for 20,000 units and the largest order on record was 50 units, the transaction will be rejected.</td>
<td></td>
</tr>
<tr>
<td>Format checks</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Characteristics of the contents (letter/digit), length, and sign of individual dta fields are checked by the system.
A nine-position Social Security number should not contain any alphabetic characters.

Existence checks
The computer compares input reference data to tables or master files to make sure that valid codes are being used.
An employee can have a Fair Labor Standards Act code of only 1,2,3,4, or 5. All other values for this field will be rejected.

Dependency checks
The computer checks whether a logical relationship is maintained between data for the same transaction. When it is not, the transaction is rejected.
A car loan initiation transaction should show a logical relationship between the size of the loan, the number of loan repayments, and the size of each installment.

TABLE 16.4
Output Controls

Is the information created from the data accurate, complete, and properly distributed? Output controls can verify who gets the output, and if they're authorized to use it. You can also use output controls to match the number of transactions input, the number of transactions processed, and the number of transactions output.

Maybe there's a glitch in the system somewhere that is causing transactions to be recorded twice on the data storage device. Obviously that's a situation the company should know about before customers report it. Output controls can help you uncover this kind of discrepancy.

Security and the Internet

We can't stress enough the importance of security for Intranets, Extranets, and the Internet. Organizations must control access through firewalls, transaction logs, access security, and output controls. Software programs that track "footprints" of people accessing the system can be a good way to detect intruders in the system, what they did, what files they accessed, and how they entered your system initially.

The most important point is that you get the software, use it, and protect one of your most important organizational resources.

Most people are reluctant to buy and sell on the Internet because they're afraid of theft, fraud, and interception of transactions. To help make transactions secure, many companies are using very sophisticated methods of protecting data as they travel across the various transmission mediums.
Watch any World War II movie and you’ll see episodes of the good guys intercepting coded messages from the enemy. The messages were scrambled and almost impossible to interpret. But the good guys always won out in the end and unscrambled the message in time to save the world. Now we use sophisticated software programs to encrypt or scramble transmissions before they are sent. Sender and recipient have special software programs they can use to encode and decode the transaction on each end.

**FIGURE 16.5**

Public key encryption.
Figure 16.5 shows how encryption works using public and private keys. The keys are created through complicated mathematical formulas. The longer the key, the harder it is to decipher. That's the whole point of encryption. As the text points out, authentication, message integrity, and digital signatures are the key elements of this system.

Developing a Control Structure: Costs and Benefits

You should be realistic about security and system controls. If you set up five layers of entry into your Web site, people probably won't access it that much. They'll either ignore it or find a way around your controls. You have to analyze the system and determine those areas that should receive more security and controls and those that probably can use less.

Returning to our building analogy, the Executive Wing, which houses the CEO and other key executives, will probably have more locks on the doors, more entry barriers, than the area the data workers occupy. You can't check absolutely every person who traverses the hallways each day, but you can have regular employees wear badges that readily identify them.

So too with the Information System. You probably don't want to incur the expense of checking absolutely every transaction that is entered into the system, so you check a sampling of the data. Just make sure the sampling is large enough to detect any exceptions.

Companies and governments systems constantly use risk assessments to determine weak links in their physical building security. You can use the same methodology to assess the risk in your Information System. Use risk assessment to develop cost comparisons for developing and maintaining security against the loss potential.

The Role of Auditing in the Control Process
Companies audit their financial data using outside firms to make sure there aren't any discrepancies in their accounting processes. Perhaps they audit their supply systems on a periodic basis to make sure everything is on the up-and-up. They should also audit their Information Systems. After all, information is as important a resource as any other in the organization. MIS audits verify that the system was developed according to specifications, that the input, processing, and output systems are operating according to requirements, and that the data are protected against theft, abuse, and misuse. In essence, an MIS audit checks all the controls we've discussed in this chapter.

We mentioned earlier that a bank teller wouldn't be the one to count the money in the till at the end of the workday. To ensure validity in an MIS audit, you would use someone totally disconnected from the system itself. Usually companies hire outside auditors to verify the integrity of the system, since they won't have any vested interest in hiding any flaws.

A good way to audit the Information System is to trace a typical transaction through the entire system. The auditor might enter erroneous data in the system and test the safeguards used to alert the staff about the error. An auditor might attempt an unauthorized access to the system or certain areas of the system to examine the validity of the company's firewalls and other access barriers.

Auditing the Information System is too important to ignore or neglect. Schedule periodic audits and then correct any and all flaws that are found.

Bottom Line: Controls, general and application, must be designed into the system at the beginning, not as an afterthought. General controls are concerned with the system software and manual procedures. Application controls protect the data input, the data processing, and the information output.
16.3 Ensuring System Quality

There's a reason why we explained all those methods and procedures and processes in previous chapters for building good, solid Information Systems. They ensure system quality so that the product produced by the system is as good as it can be.

Software Quality Assurance

Just as you must assure quality of other products and other work, you must assure the quality of your software.

Methodologies

It's easier to find the flaws in a system if you create all new systems and programs the same way every time. If you want to check the system, fix the system, add to the system, or audit the system, you won't have to spend time figuring out how it was built in the first place. In this case, predictability leads to efficiency. The documentation that most people fail to develop makes it easier to determine how the system is built and how it operates. Yep, it's a headache, but it's useful and necessary.

Resource Allocation

Most companies and most people spend the majority of their time in the programming phase of system development. Not a good idea. Just accept the fact that the more time you spend analyzing and designing a system, the easier the programming and the better the system. You will save a lot of time and headaches and money. Honest, it really does work that way!

Software Metrics

Be objective when you're assessing the system by using software metrics to measure your system. Emotions tend to
cost money and use unnecessary resources. The text gives several good examples of metrics you can use to measure your system inputs, processes, and outputs. For metrics to be successful, they must be:

- Carefully designed
- Formal
- Objective
- Measure significant aspects of the system
- Used consistently
- Agreed to by users advance

Testing

You can't ignore testing as a vital part of any system. Even though your system may appear to be working normally, you should still verify that it is working according to the specifications. Walkthroughs are an excellent way to review system specifications and make sure they are correct. Walkthroughs are usually conducted before programming begins, although they can be done periodically throughout all phases of system development.

Once a system has been coded, it is much harder and more expensive to change it. We're beginning to sound like a broken record, but it's important that you understand and remember that the more work you do before the programming phase begins, the less trouble you'll have later. You can't just start pounding the keyboard and hope everything works out okay.

Quality Tools

Just as you would manage any big project—a house, a highway, a skyscraper—you must manage the entire systems development project. You can do it much easier using project management software that allows you to keep track of the thousands of details, deadlines, tasks, and people involved in
the project. This type of software also helps you keep everything in sync.

Data Quality Audits

We spoke earlier of MIS audits, which check the system and its general controls and application controls. Data quality audits verify the data themselves. Many of the principles we discussed in the MIS audit apply to this type of audit. A company should formally record the number and types of errors customers report. Using this record can help managers do data quality audits by giving them ideas of where they can start looking for problems or areas that need to be improved.

A few comments regarding the three items in the text:

Survey end users for their perceptions of data quality: How do they see it? Looking at your data through a different set of eyes can reveal problems you weren't aware of.

Survey entire data files: This can be expensive and time-consuming, but very fruitful.

Survey samples from data files: Make sure the sample is big enough and random enough to uncover problems.

It's better for the company or organization to uncover poor quality data than to have customers, suppliers, or governmental agencies uncover the problems.

Bottom Line: Managers can ensure Information Systems quality through methodologies, adequate resource allocation, software metrics, testing, and the use of quality tools. If data quality suffers, it's a sure bet the information obtained from that data will be of poor quality also.
Discussion Questions:
Click on the Discussion icon in the top toolbar to answer the following Discussion Questions.

1. What are some measures an organization can take to enhance the quality of its software and data in any Information System?

2. Discuss the differences between general controls and application controls that organizations should use in Information System design.

3. What is the role of auditing in the operation of an Information System?

4. Discuss how data quality audits can help verify the accuracy of information obtained from the Information System.

Chapter 17: Managing International Information Systems
17.1 The Growth of International Information Systems
17.2 Organizing International Information Systems
17.3 Managing Global Systems
17.4 Technology Issues and Opportunities
Discussion Questions

Chapter 17 Managing International Information Systems

The world just keeps getting smaller and smaller. No company can afford to ignore foreign markets or the impact of foreign competition on the domestic business environment. You have to adapt to the changing faces, literally, of your competition and devise a plan to bring your organization into its focus.
17.1 The Growth of International Information Systems

Globalization is possible even with very small businesses because of the technological advances in computer networks and telecommunications. Is your organization developing a Web site for E-commerce? You'd better have it available in 4 or 5 foreign languages. That's what it takes today to compete.

Developing the International Information Systems Infrastructure

You must have an Information System in place that will support the communications, coordination of people and products, and order processing for both domestic and foreign markets (international information systems infrastructure). You have to understand the characteristics and individual needs of foreign markets, just as you need to understand the domestic markets.

Wal-Mart learned the hard way that it couldn't just walk into a foreign country and build a store mirroring those in the United States. Sales were very low and the products just weren't moving in many of its foreign stores. It wasn't until Wal-Mart analyzed store designs and layouts, quizzed potential customers, and focused on foreign operations without the bias from domestic stores that the company realized it was a much different world outside the U.S. It rearranged stores, stocked more items from within the countries, met local customers' needs, and dramatically increased sales.

Don't start creating all those juiced-up Information Systems as soon as you decide to pursue the foreign marketplace. We said before that every Information System implementation plan must be in harmony with the basic business plan. In fact, you must first develop the overall business strategy for entering the global arena. Then and only then can you begin to think about how the Information System will be synchronized with the basic strategy.
The Global Environment: Business Drivers and Challenges

Table 17.1 gives you an idea of some of the global business drivers, factors influencing the direction of businesses, that organizations must consider in today's environment.

Table 17.1 The Global Business Drivers

**General Cultural Factors**

Global communication and transportation technologies

Development of global culture

Emergence of global social norms

Political stability

Global knowledge base

**Specific Business Factors**

Global markets

Global production and operations

Global coordination

Global workforce

Global economics of scale

**TABLE 17.1**
Perhaps the most important challenge facing corporations and companies wanting to open foreign markets is that of the global culture. We're beginning to share more culture because of increased telecommunications and the Internet. However, when you are merging two entities, one domestic and one foreign, into one business, the culture of that merged organization can be an important influence on how well the company does.

Bill Vlasic from *The Detroit News* writes: "DaimlerChrysler AG executives who want to get ahead must accept foreign assignments, learn a different language and adapt to the evolving culture of the newly merged global automaker. That's the message from Andreas Renschler, 40, former head of the Mercedes-Benz factory in Alabama who recently assumed responsibility for global executive management development at DaimlerChrysler."
(web.idirect.com/~wemac/articles/a3_g.html, Jan. 6, 1999)

The DaimlerChrysler case points out the need for everyone in an organization to think global. We'd like to destroy the myth of domestic being defined as a U.S.-based company and the foreign company being from, well, from a foreign country. In 1998 the German automobile manufacturer Daimler bought the U.S.-based Chrysler Corporation. In this case Chrysler was actually the foreign-based manufacturer while Daimler was the domestic organization. It's rumored that German-language teachers are quite sought after in Detroit, Michigan!

Countries that we traditionally have thought of as Third World, or underdeveloped, are emerging as forces to be reckoned with. Chile, Brazil, Mexico, and others play as big a part in the global economy and its effect on worldwide trade as our own country.

Advanced telecommunications systems now allow companies to work around the clock and around the world. Companies may choose to locate parts of their corporate offices in other countries because they fit better with the corporation's overall global strategy in that location. Ask yourself this question: Who says all corporate offices must be located in the continental U.S.?
You know that doing business in foreign countries is not all that easy. There is tremendous risk associated with global businesses. Russia is a prime example of how difficult it can be for businesses to establish themselves in foreign markets amid political turbulence and disorder. Just when your company thinks all is well with its foreign establishment, a terrorist attack can put a crimp in the best-laid plans.

It's not always that desperate, but companies should make a point of adapting to foreign cultures, just as Wal-Mart had to. For instance, in many countries afternoon siestas are the norm. Other countries have religious and historical laws that prevent women from working or accepting jobs that place them in the position of supervising men. The point is that not everyone thinks, works, acts, and plays like Americans (see particularism).

A startling example of how domestic and foreign cultures and laws collide is the case of individual information and privacy. In many European countries, companies and governmental organizations are not allowed to collect certain pieces of information about individuals. If they are allowed to collect the information, there are very strict laws about how they must store it and who can access it. The individual must be notified first before the information can be given to another entity.

Contrast that with the American business practice of collecting individual information without the person's knowledge and then selling that data to whoever pays for it. Corporations and companies must reconcile these differences in order to allow transborder data flow between their merged Information Systems.

If you thought building an Information System for an organization doing business only in the U.S. was tough, think about some of the factors we've just discussed and then imagine how you would build a system that takes disparate practices into account. So why do companies even attempt to build themselves into global merchants? Because the potential payoff is enormous!

**Bottom Line: Global businesses must devote time and attention to understanding the cultures of countries in which**
they want to do business. Not only must they merge their business units, they must also merge their people into a cohesive team. They must understand and deal with external factors in both the domestic and foreign environments.

17.2 Organizing International Information Systems

*First you have to decide what you're going to do--you have to choose a strategy. Then you have to organize your business around this strategy. The last step is to build the system that will incorporate the first two.*

*Global Strategies and Business Organization*

---

**Table 17.3** Global Business Strategy and Structure

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Business Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Domestic Exporter</td>
</tr>
<tr>
<td></td>
<td>Multinational</td>
</tr>
<tr>
<td></td>
<td>Franchiser</td>
</tr>
<tr>
<td></td>
<td>Transnational</td>
</tr>
<tr>
<td>Production</td>
<td>Centralized</td>
</tr>
<tr>
<td></td>
<td>Dispersed</td>
</tr>
<tr>
<td></td>
<td>Coordinated</td>
</tr>
<tr>
<td></td>
<td>Coordinated</td>
</tr>
</tbody>
</table>

Ebook_mis.doc
Table 17.3 shows the four main strategies that can form the basis for a global organizational structure. Let's dissect each one.

Domestic exporter: Most operations are located in the domestic country, and the company exports products to foreign companies. A company located in India which imports rugs to the United States would fit this category. All
corporate offices are in India, and products are sent to distributors in the U.S.

Multinational: Part of the company is located in the domestic country, and other parts are located in foreign countries. Japanese automobile manufacturers might be in this category. Years ago we complained loudly in the U.S. about cheaper Japanese-made cars flooding our markets and demanded that they produce vehicles in our country if they wanted to sell them in our country. So they left their corporate operations in Japan, built some factories in America, and satisfied our concerns.

Franchiser: Some operations are located in the domestic homeland, while extended activities associated with the product are conducted in foreign countries. Starbucks Coffee Company is a primary example of this type of global business. Its corporate headquarters is located in Seattle, Washington. Recipes for products are developed in Seattle. Some coffee beans are roasted in Seattle and then shipped to coffee shops in England. These operations are franchised to keep quality controls in place, and the final product is made in the local area.

Transnational: One globe, one company. DaimlerChrysler is the perfect example of a transnational corporation. Its Web site (http://www.daimlerchrysler.de/index_e.htm) describes it as "the first automotive, transportation and services company with a truly global structure." Corporate headquarters are "located in Stuttgart, Germany and Auburn Hills, Michigan, USA." DaimlerChrysler did business in 200 countries with 441,500 employees at the end of 1998. Manufacturing facilities are located in 34 countries around the world. Bill Vlasic's article in The Detroit News, Jan. 6, 1999, quoting Andreas Renschler at DaimlerChrysler, says: "The biggest difference between people is not the national culture. It's how you think things have to be done. We have to integrate their experiences, and use the best of the best."
Global Systems to Fit the Strategy

Once you've decided which global business strategy to follow, it's time to decide how your Information System will support it.

**FIGURE 17.2**

Global strategy and systems configurations.

*Figure 17.2 gives you an idea of the type of Information System which will best support the different business strategies. To summarize the text definition of each type of system:*

- **Centralized:** Everything is located at the domestic home base.
- **Duplicated:** Development occurs at the home base; operations are located at foreign locations.
- **Decentralized:** Each business unit, regardless of location, has its own system.
- **Networked:** All business units participate in development and operations.
Reorganizing the Business

You have to decide what your overall business goals are, what makes sense for your organization, fit the Information System structure to your needs, and never lose sight of new opportunities.

1. Organize value-adding activities along lines of comparative advantage. Starbucks has to decide where to locate the marketing function to maximize its potential. Perhaps it can centralize this function in Seattle so the theme of the current marketing campaign is the same in every coffee shop. It is very picky about maintaining quality control over the bean roasting processes. Is this process better left in Seattle, or should it be moved to England to maintain freshness and high quality?

2. Develop and operate systems units at each level of corporate activity--national, regional, and international. Wal-Mart would probably maintain small Information Systems in each foreign country to support its local operations. A regional Information System would support entire geographic areas such as Southern Europe. Each of these regions would be connected to the main system in the United States that supports activities on a global scale.

3. Establish a world headquarters and a global chief information officer (CIO) position. DaimlerChrysler has one person who is responsible for the entire Information System spanning the globe. While smaller units spread throughout the world would actually carry out the operations, the CIO would ensure total integration of all local, regional, and global systems.
Bottom Line: There are four main global strategies businesses can use to organize their global efforts: domestic exporter, multinational, franchiser, and transnational. Determining the global strategy will help a business determine its Information System structure.

17.3 Managing Global Systems

*Take all the problems and challenges you can think of when developing a single Information System for a domestic operation (see Table 17.4) and then multiply it by tens or hundreds. Now you understand the problem of developing a system to support a global operation.*

<table>
<thead>
<tr>
<th>Management Challenges in Developing Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agreeing on common user requirements</td>
</tr>
<tr>
<td>Introducing changes in business procedures</td>
</tr>
<tr>
<td>Coordinating applications development</td>
</tr>
<tr>
<td>Coordinating software releases</td>
</tr>
<tr>
<td>Encouraging local users to support global systems</td>
</tr>
</tbody>
</table>

**TABLE 17.4**

A Typical Scenario: Disorganization on a Global Scale

*The text gives a wonderful scenario of challenges facing corporations wanting to develop Information Systems to support global operations. Bring it a bit closer to home:*

Ebook_mis.doc
You're part of a team of 12 students with an assignment due by the end of the month. You have to develop a Web page to support three different presentations given in three different sections of the same class. Each of you will receive an individual grade in addition to a team rating. You've been given minimal resources with which to complete the assignment.

All 12 team members approach the project from different perspectives, different values, different needs, and different goals. Some like to start early and do a thorough job; others never start any assignment until the day it's due. Some team members have Apple computers, some have PCs; some have the most current software, others rely on programs created 5 years ago which are incompatible with today's software. All are busy with jobs, other classes, and other interests; you find it nearly impossible to meet in order to coordinate project tasks.

Now you can begin to understand the difficulty managers face when they are organizing or reorganizing global commerce.

Strategy: Divide, Conquer, Appease

Figure 17.3 shows the connection between the core business processes and the core systems. Only a few business processes use global core systems. Others are divided among regional and local systems. Let's look at the tasks that need to be accomplished.
Define the Core Business Processes

Decide how your business processes are divided among global, regional, and local units. Which location does each process better than the others? Make sure you keep cultural and political biases out of the way when deciding which location is better. Carefully analyze each task and all available resources to support the process in each location. You may be surprised to learn that it's cheaper and more efficient to store manufactured goods separately from where they are produced.

Identify the Core Systems to Coordinate Centrally

Once you've identified and analyzed each workflow process, you can figure out which to centralize and which to keep decentralized. Some decisions will be based on political influences, and some decisions will be made to appease
various groups within the organization. Some decisions will seem totally rational, while others may seem irrational.

Once you analyze and determine which core business processes to keep locally, establish regionally, or maintain in transnational centers, you can build your system. It's obvious you wouldn't decide that a process should be done locally and then build a transnational Information System to support it.

While determining how and where to establish your core processes is the first step, part of the analysis must include the implications of building an Information System to support them. For instance, if you decide to create a transnational unit to handle customer technical support, how will your Information System support the data storage associated with customer information? How will you handle the political and cultural influences that determine access and distribution of the personal information associated with your customers? While it may make sense to create this unit on a transnational basis, you might decide that an Information System to support it is not feasible.

Choose an Approach: Incremental, Grand Design, Evolutionary

Don't bite off more than you can chew. If you try to fulfill your development and implementation plan all at once, combining every task into one huge project, you're setting yourself up for failure. It may indeed be cheaper to do it that way, but you have lots of considerations other than cost. There are political, cultural, and historical biases to overcome. Remember, change is extremely difficult for people to accept. You have to convince everyone, especially the executive branch, that your plan is possible and best for the company.

Many companies choose to take an evolutionary approach to merging disparate Information Systems. That is, they pick
the most critical areas, such as finance, to merge first. Then they move on to perhaps Sales and Marketing. Corporate Strategic planning may be next, and last might be Human Resources systems. The point is, you can't do it all at once.

Make the Benefits Clear

You have to convince the organization's managers that the impending changes will benefit them in the long run. Get them behind your effort and use them to help you develop and establish system changes. They need to understand how they can enhance their own operations through the new system.

Global systems can help an organization improve its vertical and horizontal operations. If a political conflict interrupts sugar supplies, a global system can shift the flow of that vital supply to another region. As global operations continue to expand, corporations are realizing the benefits of having multiple geographic locations from which they can operate virtually uninterrupted.

Should a region or operating unit experience a disruption in sales, such as we've seen in Asian markets in the last few years, the economic burden of the declining profits can be spread to other units of the global company. The economies of scale that corporations are realizing through global operations is tremendous. No longer does a company have to build individual production units in every country in which it wants to sell its products.

Implementation Tactics: Cooptation

Get the opposition on your side as quickly as possible. Cooptation is the process of getting the naysayers to help you determine the solution to the problem without giving up total control of the change process. Persuading them to help you is far better than beating them into submission.
Let's say that the German unit of your transnational company is the best at writing graphical user interfaces for your order processing system. Have those people create and implement the new GUI in their unit and then transport the interface to the French unit. The Asian unit may be the best at writing middleware software that connects a Unix operating system to a Windows operating system. So the Asian unit would do that part of the integration and then expand it to the European and U.S. units.

The central management office in Finland would still determine the overall structure of the project, but individual units could be assigned the design, development, and implementation. That way, they all begin to gain ownership for the success of the new system.

We mentioned earlier the need to determine which core business processes were done best in particular units. We trust you did that because you can now use the results to help decide where various processes can best be developed. The centers of excellence for each core business process can determine the initial requirements for the applications, do all the analysis, design the application, and then test the new procedure in a central region. Remember the phased conversion process discussed in Chapter 11? Use it to install the new system throughout your global community.

The Management Solution

Management's biggest task is to manage the changes that must take place in a global company. As we mentioned earlier, the changes are more difficult and complex because of the added characteristics of politics, culture, and language. Here are some guidelines:

Agree on common user requirements: Keep the list of core business processes short and simple. It's easier to implement. Don't lose sight of the common goal of
integration.

Introduce changes in business procedures: Your legitimacy is enhanced by how well people accept your authority as a change agent. If you establish yourself as knowledgeable, competent, willing to accept input from others, and if your vision of the end result is sound, you’re more likely to succeed. Give other people some ownership of the change process, and they’ll be more than happy to help you and the company succeed.

Coordinate applications development: Communicate, communicate, communicate. Tell people what’s going on; don’t surprise them about anything. Change is difficult enough without people feeling they’re getting blindsided.

Coordinate software releases: Try to get everyone working from the same sheet of music at the same time.

Encourage local users to support global systems: All participants will want to do it their way because that’s what they are most comfortable with. Your task is to convince them that they may need to adapt to a new way of doing business for the overall good of the company. Again, give them ownership without giving up total control.

You’ll still have a difficult time because you’ll have so many things to work on at one time. That’s why we suggest using the strategy of one step at a time, little by little.

Bottom Line: Analyze each workflow process and decide which business unit can best carry it out. Go with the best of the best. Match the structure of your Information System to that of your core business processes. Make the benefits clear
to all levels of the organization. Use cooptation to encourage ownership of the system. Manage the changes in the Information Systems as intensely as you manage anything else.

17.4 Technology Issues and Opportunities

The advances in technology, and the desire to seize new business opportunities presented by the advances, is what induces organizations to undertake the changes we've been discussing. However, the same things that drive the desire can create the headaches, as Table 17.5 points out.

**Problem of International Networks**

| Costs and tariffs |
| Network management |
| Installation delays |
| Poor quality of international service |
| Regulatory user requirements |
| Changing user requirements |
| Disparate standards |
| Network capacity |

**TABLE 17.5**
Main Technical Issues

Hardware, software, and telecommunications are special problems in a global setting: you need to synchronize, harmonize, integrate.

Hardware and Systems Integration

Most global companies are a result of merging several units into one cohesive success story. When the merger takes place, you can't just buy all new hardware and software. It's too expensive for one thing, and it probably won't make sense. You have to figure out how you're going to get all the different types of hardware to work together in one seamless system. You have to get one type of software "talking" to another type of software.

You've already figured out your core business processes. Now you should figure out which type of software, some of which may already be present in the various units of the merged organization, is the best to use for each process. If you're currently using proprietary software and choose to keep it, you will probably need a bridge, or middleware software, in order for it to work across all your business units and regions.

Each region of the business is used to working according to its standards. For instance, the German unit has been storing data according to its standards and definitions. The Asian units have been using different standards and definitions to accomplish the same task. The idea is to get the data conformed to one standard across all units so that it can be shared efficiently and effectively.

Each unit is going to have to adapt in order for that to work. That's where the central office comes into the picture. It will have to determine the end goal of the business and the final
information requirements needed, take the best of the best, adapt the rest, and solidify all the units into a cohesive whole.

Connectivity

Most Americans don't think twice about the reliability of our telecommunications systems. When you pick up the phone in Peoria, you expect it to work and work well. When you log onto your Internet Service Provider, you expect instantaneous connections at relatively high speeds. When you travel from state to state, you know that the telephone system will work the same in Texas as it does in Pennsylvania. And you expect reasonably low rates for telephone service, television, and Internet service. Not so in foreign countries.

When you're trying to establish global communication networks, you must work through the maze of various laws, high to low levels of service reliability, different rate charges and currency exchanges, and different companies and governments controlling the telecommunication systems.

You can attack this problem three different ways:

- **Build your own network**: very expensive, time consuming, and not an option in some countries.

- **Patch together a public network**: very expensive, time consuming, and a hodgepodge of services.

- **Outsource telecommunication requirements**: economies of scale, rely on previous experiences of outsourcers, limited to data transmissions.

As the Internet grows outside the U.S., more corporations are turning to it as a solution to the connectivity problem. To be sure, there are still problems associated with using the
Internet. But its open standards, ease of use, and expanding connections offer viable solutions.

Software

We mentioned before that different foreign units probably have divergent standards for their Information Systems. Trying to merge databases from several domestic units is tough enough. Trying to merge databases from different countries can be quite troublesome because of the added layer of politics, traditions, and languages.

Even though the English language is widely accepted in foreign business circles, and it seems reasonable to build software programs based on that language, the decision will create its own problems. Foreign business units may resent having to use applications written in a different language—what’s wrong with Spanish, they may say? While most of the upper management of the foreign business units may understand English and can use it, will the data workers know the language, or will they have to learn it at the same time they are learning a new Information System?

Traditionally, companies have merged their transaction processing systems into one or a few worldwide applications. Now they are looking to do the same with collaborative workgroup software, and well they should. We mentioned at the beginning of this course that many companies are "time-shifting" their projects around the world.

A person in New York City may work on the new advertising campaign all day Tuesday. When she's done for the day, she may send the project electronically to a collaborator in New Delhi, India. He will work on it for several hours and forward it on to the third team member located in Munich, Germany. All of them need to be able to communicate using collaborative software in a common language.

New Technical Opportunities and the Internet
As with everything in our world today, the Internet is offering businesses vast new opportunities and challenges. The virtual private networks (VPNs) that Laudon and Laudon discuss in the text are eliminating many of the bottlenecks that companies have found in their telecommunication systems and filling the void of critical communication systems in foreign nations. With the advancements in cellular and satellite telephone systems, emerging nations can forego the cost of stringing wires through rural areas by using new technology and still offer their people conveniences they haven’t had before.

**FIGURE 17.4**

How a VPN works.
You can understand from Figure 17.4 how countries and companies can save huge sums of money through current technology.

Reliance on the Internet to overcome disadvantages in telecommunications systems will answer some of the problems companies have had. But, as we noted before, the Internet will create other problems that global corporations will have to solve.

Bottom Line: Differences in hardware, software, and telecommunications throughout the organization and the countries in which you're doing business pose tremendous challenges in integrating disparate business units into a cohesive global whole. The Internet can help resolve some of these issues, though it will create other problems.

Discussion Questions:

Click on the Discussion icon in the top toolbar to answer the following Discussion Questions.

1. Discuss the cultural factors organizations must understand in order to do business on a global scale.

2. Discuss the differences in the four strategies organizations can use to organize their global business.

3. What are the benefits of cooptation when managers are building new Information Systems to support global businesses?

4. How can the Internet help companies resolve hardware, software, and telecommunications problems in transnational businesses?
Chapter 18: Managing Firm Infrastructure and Enterprise Systems
18.1 Managing IT Infrastructure and Architecture: Enterprise Computing
18.2 Managing the New IT Infrastructure
18.3 Enterprise Systems
18.4 Industrial Networks and Extended Enterprise Systems
Discussion Questions

18.1 Managing IT Infrastructure and Architecture: Enterprise Computing

Unfortunately, businesses haven't always worked as a unit. Production created business processes separately from Accounting. Sales and Marketing had their own systems, and so on. Usually none of the systems linked into the others within the same company (application specific view). Most systems were intentionally created separately, since technology did not allow an entire organization to feed from one big, integrated system.

Now technological advances have given corporations the computing capacity and the tools to create a single system that can link all parts of the organization. With the explosion of the Internet, the ability to bring vendors and suppliers into the organization's system is now available through enterprise computing.

Compare the difference between Figure 18.1, the old view of systems, and Figure 18.2, the new way of thinking about Information Systems.
Basic Concepts of Enterprise Computing

The four basic concepts of enterprise computing are compared in Table 18.1.
The information technology investment portfolio is concerned with the amount of money firms spend on Information Systems and whether the organization is receiving a fair return on its investment. With "Internet-centric" companies, this concept can be skewed or simply thrown out altogether. Many of these companies are more concerned with the strategic value of their Information Systems and don't expect a return for several years. Amazon.com loses millions of dollars every quarter but it continues to focus on brand building rather than a real dollar return on investment.

Just as every town and city in the world relies on basic facilities to function, such as roads and utilities, corporations rely on the proper amount of hardware, software, and people to create and operate their IT infrastructures. Firms should continually review and question whether they have the right mix of each to carry out their business plan.

How do companies intend to make money? After all, isn't that why businesses exist? When businesses answer that question, they have found their business logic.
Combine the IT infrastructure with the business logic, in the right mix, and you have the information architecture necessary to make the firm a success.

When developing enterprise computing systems, there are no cookie cutter answers to the tough questions management must explore and answer. The company needs to develop a plan, complete with graphics and descriptions that spell out how the business processes will be supported by the Information System and how the company expects to excel using enterprise computing.

It's not enough to tell your suppliers they will be able to use your Information System. The real question is how the key business processes will be enhanced by allowing suppliers to tap into the information system.

How will you know if the organization is really better off with the enterprise computing system? You should measure the company's performance after implementing the new system with the its performance before installation. That's the only sure way you'll know if the effort has paid off.

**Industrial Networks and Trans-enterprise Systems**

Selling paper towels may seem like a very simple task. Have you ever thought about the supplies that go into that roll of paper towels? Where do the raw products come from? Once the towels are made, how do they get on the shelves of your local grocery store? Many suppliers and vendors are involved in the product from start to finish: it's not produced solely by the manufacturer.

What if the maker of the paper towels was able to control the product lifecycle better and thereby reduce costs by including the suppliers and vendors in the total process? That's what industrial networks are all about.

The dilemma occurs when various manufacturers develop separate systems for their products and then expect the suppliers to join in. If
a supplier deals with several different manufacturers, it could end up with several different systems that don't mesh.

**Business Drivers: The Changing Business Environment**

It's not your father's business environment anymore. We've seen tremendous changes in the world over the last ten years, many of them driven by technological changes and advances. Table 18.2 describes the business factors that drive change and highlights the impact of each on companies trying to keep up.

**Table 18.2 Business Drivers of Enterprise Systems: Changing Environments**

<table>
<thead>
<tr>
<th>Business Driver</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market change</td>
<td>Globalization and increasing information intensity reduce margins in traditional industries.</td>
</tr>
<tr>
<td>Industry change</td>
<td>Mergers, acquisitions, and consolidations in traditional industries increase scale economies and intensify industry competition.</td>
</tr>
<tr>
<td>Firm-level change</td>
<td>Business process redesign efforts of the 1990s in traditional industries force jettisoning legacy systems and highlight the need for enterprise-wide systems to support the newly defined business processes.</td>
</tr>
<tr>
<td>Product change</td>
<td>The growth of information, knowledge, and high-tech-based products shortens product cycle times; increasing information intensity of traditional products and services shortens cycle times.</td>
</tr>
<tr>
<td>Management process</td>
<td>From discrete business process focus toward a view of the firm as an integrated set of processes; from neoclassical competition firm-based views toward industry-based views of cooperation and alliance.</td>
</tr>
<tr>
<td>thinking</td>
<td>Management strategy</td>
</tr>
<tr>
<td></td>
<td>Growing belief that information architecture investments could lead to unique knowledge that could not be purchased on input factor markets.</td>
</tr>
</tbody>
</table>

**TABLE 18.2**

The factor associated with all the drivers of change is that businesses aren't as free to raise prices. They must cut costs in order to stay competitive and to expand their markets. The emerging global economy has put the brakes on simple price changes to enhance the bottom line. Many companies have been able to hold the line on costs by updating their IT infrastructures and reshaping their IT architectures.
Businesses also realize they cannot allow islands of information to exist in their organizations but must have a cohesive Information System that feeds information from one unit to another. Older systems didn't allow for cross-utilization of information. Companies with these older systems are now realizing the severe disadvantage they suffer if they don't use information as a key resource.

In 1999 Bill Gates, Chairman of Microsoft, Inc., published a book called *Business @ the Speed of Thought*. The title alone speaks volumes about how companies are beginning to view information and how fast information-based products and services change. Today's innovation is tomorrow's dinosaur. Products and services that used to take months and years to develop can now be brought to market in weeks or days.

In the past businesses were judged by how well they functioned within their own business. Now they are branded by the entire industry to which they belong. Vehicle manufacturers are judged on the value chain they help create within the entire industry, from the procurement of raw products to the impact on the environment from the vehicle emissions.

Many Internet-based companies are racing to build brand awareness and improve processes and products. Charles Schwab online brokerage, for example, is far ahead of its competitors in the delivery of online stock trading. It seems reasonable to think that Schwab could take a rest, because it will be quite a while before the competition catches up to the superior infrastructure and product delivery it's built. Don't be so sure. Other brokerage firms are forging ahead and building their own systems to take advantage of new enterprises on the Internet. No company can afford to rest for even a little while lest the competition beat it at its own game.

**Technology Drivers: The New Networked Environment**

Just five short years ago, the term *virtual organization* didn't exist. Now, more and more companies are adopting this concept because of the technological drivers in enterprise systems and industrial
networks. Virtual partnerships are possible and make sense because of advances in technology.

If a company wants to embark on a new service, it doesn't necessarily have to work alone. It doesn't have to hire the people, purchase the hardware and software, and struggle with all the development costs by itself. It can partner with another company, use networks to enhance product delivery and keep costs down. A company using enterprise computing and industrial networks can go places not possible a few short years ago.

**An Ideal Model of Enterprise Computing**

In an ideal world, the business drives the technology and not the technology the business. To have this happen, four conditions must exist:

- The right amount of infrastructure
- Close coupling of the architecture and the business processes
- Adequate strategy to cope with environmental and competitive pressures
- An adequate governance model to align the IT infrastructure with the business strategy

**Bottom Line:** Enterprise computing views an organization as a whole and not just as its separate parts. Four concepts--IT investment portfolio, IT infrastructure, business logic, and information architecture--are necessary elements for success in enterprise computing.
18.2 Managing the New IT Infrastructure

How do you get information, the right kind and the right amount, from the environment into the organization and then move it throughout the organization? Let's look at some ways to do this successfully.

Elements of the New IT Infrastructure

The old days were simple: Your organization probably had a huge mainframe sitting in the basement with dummy terminals spread throughout the company. All data were maintained on the one system and specialists were the only ones allowed to touch it.

Now you must try to mesh remnants of the old legacy systems with the newer servers which have countless clients connected to them. On top of that, employees are more mobile nowadays and need cell phones. Not just plain old cell phones: These cell phones must be connected to the company's Intranet so product data can be downloaded while the salesperson is sitting thousands of miles away in a meeting with a potential customer. The icing on the cake are all the users who want to use fourth-generation software to build their own applications using downloaded corporate data.

Each element of the new IT Infrastructure poses its own unique set of challenges not just to the IT staff, but to the organization as a whole. Sally in Marketing just can't understand why she can't develop her own set of data and store it on her desktop. Tom in Sales wants to buy the latest PalmPilot device to use in customer meetings and can't figure out how to connect it to the enterprise computing system. The newest product supplier needs help accessing the corporate Extranet in order to get information added to its own database. The local phone company is short of help and can't get the extra T1 transmission line installed for Internet access for three more months. The outsourcing
consultant company needs to know how soon the company will be ready to test the newest order-processing application. The CEO needs someone in her office right away to help her set up the latest version of the Internet browser.

Ahhh, for the good old days...

**Key Infrastructure Decisions**

Many companies have five-year plans for their products and services. That's good; companies should have an idea of where they want to go. As the text points out, "The overarching question is 'What business capabilities are we seeking?" To say that arriving at the answer is difficult is a drastic understatement.

Superfast advances in the four key infrastructure components listed in Table 18.4 make the situation critical for most organizations.

### Table 18.4 Key Infrastructure Decisions

<table>
<thead>
<tr>
<th>Technology</th>
<th>Typical Choices</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processors</td>
<td>S/390, UNIX, AS/400, Wintel</td>
<td>Scale, leverage, technology trajectory</td>
</tr>
<tr>
<td>Software environment</td>
<td>Custom/SAP/PeopleSoft/Baan/Oracle/DB2</td>
<td>Scale, leverage, technology trajectory</td>
</tr>
<tr>
<td>Shared applications</td>
<td>Enterprise (Global) / Regional/SBU/Local</td>
<td>Business logic, governance</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>Global and local, public/private/firm</td>
<td>Business model and strategy</td>
</tr>
</tbody>
</table>

**TABLE 18.4**
Most of these technologies seem to be obsolete or outdated a few months after they are purchased. The key is to select the technologies that fit somewhere in the middle of what you are currently using and where you want to be in a few years.

If your organization is currently using WINTEL (Windows operating systems and Intel processors) technology as the basis for your system, you shouldn't purchase Apple machines. Should the organization decide to move towards technology that's not compatible with the current infrastructure, plans need to be made and funds allotted for some type of middleware that will allow compatibility for the time being.

Software development projects must be judged on whether the company adopts a policy to build its own, use a pre-written specialized program, or go with general off-the-shelf software. We've discussed the pros and cons of each of these in previous chapters. The important thing to remember is that the software must support the business processes, both current and future.

As a company decides on the type of software to use, it must decide how the software will be deployed. Management needs to take a hard look at where it intends to be five years from now when deciding this question. Will the software be an enterprise-wide program, managed regionally, in separate business units, or installed on a local basis with each geographic unit operating independently? The decision made at this point will set the stage for how easy or difficult future expansion will be.

In the old days organizations had one choice for telecommunications: AT&T. That's was it. Now the choices are as broad and varied as the globe itself. Does the company go with a local, private provider or a global, public provider, or a combination of the two? If you need the most advanced security for data transmissions you may need to
build your own telecommunications network; but this is very expensive and very limiting.

**Connecting Infrastructure to Strategy: Governance**

How do you know that the decisions you make regarding the IT infrastructure are the right ones for the organization? By letting business goals and strategies guide you. Focusing on the goals will prevent the business from purchasing unnecessary technology just because it's there. Having the organizational strategy decide the direction of the infrastructure will curb the impulse to grab the newest toys with the neatest bells and whistles.

Four levels of the organization should govern decisions about the IT infrastructure:

- **CEO, CIO, and the strategic council**
- **Operational groups**
- **Business units and regional units**
- **Specific business functions**

**Dealing with Mergers and Acquisitions**

If you can't build it, buy it. If you can't beat the competition, join it. Spread your risks by expanding into other product lines. Often companies decide it's better to merge or acquire other companies than to go it alone.

When a company does decide to merge with or acquire another company, it usually makes the decision from a strategic point of view. The senior executives are more concerned with how the new company can help them win new customers, enhance current products or services, or beat the competition. Very little time is spent exploring how the IT infrastructures will mesh with each other. Yet the inability to bring divergent systems together can derail the new enterprise.
Executives should learn to consider the impact information technology will have on making the new organization a success. Which system will they keep as the predominant system? How will the data be merged? Will new applications be required? What kind of IT staff will be needed for the new system?

Of course many of these same types of questions must be asked of every business unit in the combined organization. However, since the Information System plays such a critical role in the success or failure of the new company, these are very important questions to ask specifically of the IT department.

The business environment may drive the merger and/or acquisition, but information technology makes it happen--or not happen.

Bottom Line: The new IT infrastructure is more complex and complicated than ever. Choosing the right technology demands an understanding of where the company is now and where it wants to go. The core structure of the business should decide the type of software and its location in the enterprise computing system.
18.3 Enterprise Systems

Now that the company has agreed to use enterprise computing and the grand design approach to solving problems, what are the effects on the IT infrastructure?

- Experimentation with other designs is limited.
- Significant resource commitments are necessary.
- This approach is nonadaptive.
- Success depends on faithful execution of all its elements.

Enterprise Systems: The Vision

What is the scope of enterprise systems, and what are they supposed to accomplish? Here's the dream:

"No more islands" is one of the great promises of enterprise computing. A single system will serve all areas of the organization and all data and information will be managed from a single point of view--that of the total organization.

Managers will manage from a firm-wide vantage point. They won't make decisions in isolation from other business units. Whatever they do in their own department will be available to all other business units.

All for one and one for all. Data will be managed for the total organization and cross-fed to and from individual units. This holds the promise of easy expansion to accommodate new business ventures and new technologies.

The organization will truly be driven by the customer and not by traditional production and supply factors. The customer will dictate that individual units act in a more cohesive manner and provide "one face" representing the entire organization. The business is then able to respond faster and
more efficiently to competitive markets and add new products and services for the customer.

**Enterprise Systems: The Reality**

Lofty goals indeed--and necessary ones in today's business environment. Here's the real story.

Many of the systems in place today have been around for a long time--much longer than expected in many cases. The systems have created dependencies that may be difficult to break. Enterprise systems promise to replace these aging systems with new hardware and software from top to bottom. And they promise to do it quickly. Take everything you've learned in this course and ask yourself if it's truly possible to do this so quickly.

There are some things you can't put a price tag on, such as improved customer relations or better employee morale. Yet these are the very benefits enterprise systems touts as their cornerstone for success. Some benefits won't be realized for years, especially if the firm installs the enterprise system in a piecemeal fashion. But the bean counters, bless them, want concrete evidence of the financial payback on the investment.

Even though enterprise systems promise improvements over older legacy systems patched together over time, do they really deliver on that promise? Do you have the technical knowledge available within the firm to conquer the new hardware, software, business process changes, and persware development necessary to make the new system a success? Or are you just gaining a whole new set of problems similar to the old problems but with new names?

Building bridges between the old system and the new can be worse and cost more than continually expanding and improving the old system. The new enterprise systems offer opportunities, but you'll still be relying on the old system for some time.
Some business assets can be sold and bought: new equipment that makes the production line more efficient, streamlined customer order processes, new trucks that reduce shipping costs. But how do you buy or sell strategic advantages that come from enterprise systems? Moreover, how do you take advantage of the new opportunities offered by the newer systems? And last, if all your competitors are using the same enterprise system, how do you create differentiation for your suppliers and customers?

18.4 Industrial Networks and Extended Enterprise Systems

When you're trying to imagine industrial networks, think about the automobile manufacturers. Ford, GM, and DaimlerChrysler make cars and trucks. Do they make every part of every car and do they actually sell every car? Do they make the tires? Do they make the starter assemblies? Do they own the trucks and trains that transport the cars to the dealers? Do they own the dealers?

No; when you think about it, the Big Three are assemblers of vehicles. Goodyear, Michelin, and others make the tires. Delphi Industries makes the starters. Independent truckers and the railroad lines own the transportation. Individual people own the dealerships. But they all work in concert to get your favorite car or truck to your doorstep. An industrial network links them all together in a vertical chain.

Industrial Networks: The Vision

How we'd like it to be:

When you order a new vehicle, the information is passed from the dealer or Web site to the manufacturer. At the same time, information regarding the specifications of your new car are passed to the parts suppliers, the tire makers, and the truckers. Everyone along the way knows what you ordered and when you expect delivery.
If one piece of the vertical network needs help or information or improvements, all other parts of the network can help. Managers won’t think of their individual companies, but will act on behalf of the entire industry.

Managers, specifically IT managers, will be required to view their information infrastructures from the vantage point of an entire industry and not their individual companies. Suppliers won’t benefit from having three or four different platforms thrust on them by various manufacturers.

It may seem strange that a company can enhance its business capabilities by joining forces with competitors. Industrial networks and the promise of greater efficiencies and lower costs demand that firms do so. The example in the text of Dell and IBM working together to increase their sales is an excellent snapshot of the future of other industries.

Industrial Networks: The Reality

Landmines abound in this new paradigm. Here’s the real story.

Companies have always safeguarded information to increase their competitive advantage. And now they’re just going to throw open the doors and give critical information to the world? Not quite. Businesses will still control the release and flow of information in one of three ways:

- **Hierarchy**: One company decides for the rest how information will be disseminated, who gets it, and how they are allowed to use it.

- **Market interface**: Each company is on equal footing with its partners and lets the marketplace drive their participation.

- **Network interface**: A third party or a steering committee of sorts manages the network.
Who will pay for what and at what percentage? Will all partners in the industrial network share the costs equally? How will suppliers and vendors be charged for the benefits they receive? How will a company determine its return on investment, especially when the return may be in less tangible benefits?

Systems break down and require upgrades. Who will be responsible for maintenance of the system? When a firm relies solely on itself for information, that question is easily answered. It isn't so clear when a company relies on an industrial network shared by other companies and competitors. Divided loyalties between a company's own internal network and the industrial network is a very real concern.

Steps to Building and Managing ES and IN

Questions managers need to ask themselves before embarking on the long voyage:

1. Where are you now in relation to the technology and the other firms? On a piece of paper, draw a circle and write inside "You are here." Describe your company in terms of its technology knowledge and describe other firms in the same way.
2. Know who you are and where you want to be: Draw another circle and write inside "Where you belong." Now fill in everything in between. Get input from various sources. Be honest with yourself and your company.
3. Devise a five-year plan: Sketch out ideas of what your company could look like in the next five years.
4. Understand the necessary and fundamental changes required: Are you ready and willing to change the way you manage? Are the other managers ready and willing?
5. Recognize the need to re-educate employees: How will you retrain managers and employees to carry out the changes you described in item 4?

6. Provide incentive systems for the new environment: The carrot-and-stick approach does work.

Bottom Line: Industrial networks link suppliers with manufacturers from the beginning of the process to the conclusion of the transaction. Information is passed on all along the way to gain efficiencies and cut costs. Industrial networks may require a sea-change in the way a company functions. Managers must be ready and willing to accommodate the changes.

Discussion Questions:

Click on the Discussion icon in the top toolbar to answer the following Discussion Questions.

1. Why is it important to consider all four concepts of enterprise computing: IT investment portfolio, IT infrastructure, business logic, and information architecture?
2. Explain the difference between enterprise computing and industrial networks.
3. Discuss the four key infrastructure decisions a business must make for enterprise computing.
4. Describe the governance role the four levels of an organization play in determining the direction of the IT infrastructure.
5. Pick any industry and describe how an industrial network would improve it.

These lecture notes are based on the book Management Information Systems: Organization and Technology, 6th edition, by Kenneth C.
Laudon and Jane Price Laudon. They have been produced by Prentice-Hall, a division of Pearson Education.

**List of Chapters**

1. Information Systems Revolution: Transforming Business and Management
2. The Strategic Role of Information Systems
3. Information Systems, Organizations, and Business Processes
4. Information, Management, and Decision Making
5. Ethical and Social Impact of Information Systems
6. Computers and Information Processing
7. Information Systems Software
8. Managing Data Resources
9. Telecommunications and Networks
10. The Internet: Electronic Commerce and Electronic Business
11. Redesigning The Organization With Information Systems
12. Approaches to Systems-Building
13. System Success and Failure: Implementation
14. Managing Knowledge
15. Enhancing Management Decision Making
16. Information Systems Security and Control
17. Managing International Information Systems
18. Managing Infrastructure and Enterprise Systems

--------------------------FINISHED EBOOK--------------------- 382 Pages
:: Introducing the Master of Information Systems

What is the MIS?

Information Systems (IS) is about the effective use of IT by people and organisations. As such it is focussed on more than just business or technology needs – it spans the two.

The Master of Information Systems (MIS) program provides an advanced course of study for students who want to understand how information technology can be used to create change and value in an organisation.

The MIS is the Department of Information Systems showcase postgraduate coursework suite of programs, designed for IS/IT graduates and practitioners who want to take a step up in the IS profession. It is ideal for those planning to work in roles spanning the IT and business organisations.

The program will interest students wanting to cover state-of-the-art subject matter and who require study flexibility.

View the latest MIS flyer in pdf format

Mark Brodsky is an IS practitioner with 15 years experience across a range of roles, industries, and worldwide locations. Mark is responsible for the Masters by Coursework programs. He teaches at Masters level on viewpoints of Information Systems Practice, Business to Business e-Commerce, and the IS Industry Consulting Project.

Ebook_mis.doc
The MIS is available as a two year (200 point), an eighteen month (150 point) and a one year (100 point) full time equivalent course. (Please note the 100 and 200 point programs are pending CRICOS code approval.)

The course aims to:

- Broaden and deepen knowledge in a range of current topics in information systems; and
- Encourage the development of transferable skills including the ability to think strategically, critically and independently.

This is not a technical course – it assumes technology knowledge and builds on it.

The program will interest professionals wanting to cover state-of-the-art subject matter and who require study flexibility.

The Postgraduate Certificate and Postgraduate Diploma in Information Systems provide a shorter 50 point and 100 point (respectively) opportunity to undertake advanced learning in IS.

Because these degrees are oriented towards the provision of professional development, we require that applicants have a relevant prior academic background and for some versions of the program, work experience. Go to Entry Requirements for further information.

Example career moves as a result of study

Software Developer or Team Leader to >> Systems/Business Analyst, IS Project Manager

IT Support team or Network Architect to >> Support, Vendor, Network, or IT Manager

See Careers and Industry for more information

:: Why do the MIS?
Key Features of the MIS

The MIS provides a strong strategic focus, ideal for future IS/IT leaders. It does this by showcasing the research strengths of the department, combined with its strong links to industry and the rich experiences of the student body. The degree is deliberately kept to a small course where you are treated as an individual to enhance your learning.

Benefits include:

- Small classes - around 15-30 students, with the academics/facilitators able to provide individual attention and flexibility.
- Individual course planning with the Program Director to develop a program suited to your learning and career needs and
- A very flexible course with few compulsory subjects and a wide range of relevant electives available from other faculties

For more information on what learning in the MIS is like see the Learning Environment.

Dr Lucy Firth is an expert in innovation and ICT adoption in industry. Lucy has consulted to governments, industry and the UN in Australia, Asia and Europe. She is currently Vice President of the International Telecommunications Society. Lucy lectures in organisational change, innovation, international issues and the CIO function.

Who is the MIS for?

Applicants for the MIS generally come from three key career
backgrounds although each group has the intention to develop their knowledge and leadership qualities as information systems professionals. Some students have undertaken an undergraduate degree in IT, IS or a related field and want to develop broader strategic thinking before embarking on a career. Others have had a career in one or more IT professional career paths including programming, systems analysis and design, operations management, systems support, project management, information management, IT architecture and strategic planning, IT training or IT consulting. Alternatively, students may have an undergraduate degree in a field unrelated to IT; however over time they have transitioned into an IT role from their original profession and developed IT skills.

What will I Learn?

While many students focus on the professional IS knowledge and skills derived from studying the MIS (see MIS Program and Subjects), the development of transferable skills is of equal importance in developing IS leaders. This is an intrinsic part of the MIS learning experience. Such skills include:

- confidence to solve business and IT problems
- critical analysis and research
- independent learning
- collaboration and effective team participation
- time and project management
- application of models, frameworks and management theory with consideration to impacts and outcomes
- development of presentation and oral communication
- report writing and the ability to argue clearly

It is these transferable skills which allow students to apply their newly learnt professional skills with confidence in the business world and which often lead to career progression. In addition the support gained from studying with a set of peers undergoing the same personal and professional experiences is an important benefit as is the support provided by academic staff committed to student development.
Graduate IT@Melbourne

The MIS is a part of the Graduate IT@Melbourne suite of programs. Graduate IT is a new generation of graduate coursework programs for those seeking managerial, technical or commercial roles in the information and communications technology industry or for those who are seeking to embrace the latest cutting-edge knowledge in IT.

:: Master of Information Systems Program and Subjects

The MIS Program

The postgraduate IS courses at the University of Melbourne provide professional development to those who are currently working in the information technology and information systems fields. The degrees:

- first recognise that "people and organisations" are involved not just technology so the culture and change are very important
- recognise that you need to make it “effective” – get the management and planning of IS right
- provide understanding of issues with the “usability” and adoption of technology, and
- provide an understanding of how appropriate applications and technologies (“IT”) can be used to implement Information Systems

These areas are broadly reflected in the MIS course map shown below.

Information Systems Course Planning

The program director will meet with you to discuss your career goals and interests and help you to formulate a course that is tailored to your individual needs.
The course map below is a tool that some of our students use to help them understand the available options and to begin considering their course needs.

Associate Professor Peter Seddon specializes in understanding how organizations can make more effective use of information technology (IT). His three chief interests at present are (1) implementation and use of enterprise application software, (2) IT outsourcing, and (3) the management of the IT function. Dr Seddon teaches these topics in both the undergraduate and Masters courses.

So for example:

- If your intention was to build your career as a business analyst and change consultant you might consider taking subjects in the “Modelling, Analysis and Design” and the “Project/Change/Organisation Management” areas, coupled with subjects from the “Applications and Technology Management” area that are appropriate to the applications or technologies you most want to work with.

- If your intention was to build a career as an IT Manager/CIO but leave your options open to later undertaking research, you might focus on subjects from the whole “Management, Planning, and Entrepreneurship” area, coupled with a mix of subjects from the “Applications and Technology Management” area and one or both subjects from the “Research” area.

*Click in the subject names in the course map to view a description. (Information Systems subjects only)*
Each year, selected students are given the opportunity to participate in an industry consulting project. This involves working with individual businesses/organisations to identify and deliver a significant consulting engagement. Students work in areas related to what they have learnt in their degree, interacting with industry and managing client relationships. Through these consulting projects, many students are making a name for themselves and enhancing their career prospects.

A list of all Postgraduate subjects taught by the department is available at:
www.dis.unimelb.edu.au/postgraduate/pgsubjects.html

MIS Subjects and Electives
Full-time students may select up to four subjects per semester while part-time students select up to two subjects. Students will complete a total of 12 subjects to meet the requirements of the Master of Information Systems, selected from the Department's postgraduate subjects.

Up to two electives may be undertaken during the course. Students have access to a comprehensive range of elective subjects from other courses and Faculties. Typical areas of interest to students include knowledge management, law, computer science, economics, business and general management and organizational psychology. Examples of appropriate electives are shown in the course map diagram at the bottom of each subject grouping.

The shorter Postgraduate Diploma in IS and Postgraduate Certificate in IS require the completion of 8 and 4 subjects respectively.

**MIS Timetable**

University subject timetables are available from the Student Information System.

**Topic 2 Management Information Systems**

In the exam you are expected to:

- Understand the difference between an information system and a data processing system.
- Understand the role and relevance of an information system in aiding decision making.
- Recall Definition of a management information system (MIS)
- Recall that an MIS is a system to convert data from internal and external sources into information. This is communicated in an appropriate form to managers at different levels, enabling them to make effective decisions for planning, directing and controlling activities for which they are responsible.
- Describe the development and life cycle of an information system
Recognise the existence of formal methods, the need for clear time scales, agreed deliverables and approval to proceed.

Describe the success or failure of a management information system

Understand the factors influencing the success or failure of an information system, e.g. inadequate analysis; lack of management involvement in design; emphasis on computer system; concentration on low-level data processing; lack of management knowledge of ICT systems and capabilities; inappropriate/excessive management demands; lack of teamwork; lack of professional standards.

The five classical functions of a manager are:

1. **Planning** – the direction a company takes e.g. diversifying, where to operate.
2. **Organising** - resources such as people, space, equipment and services.
3. **Coordinating** - the activities of various departments.
4. **Decision-making** - about the organisation, products or services made or sold, the employees, use of I.T.
5. **Controlling** - monitoring and supervising the activities of others.

The role of a **management information system** (MIS) is to provide a manager with sufficient information to make informed decisions to help him to carry out the above functions. The best definition of an MIS is:

The role of a management information system is to convert data from **internal** and **external** sources into information that can be used to aid in making **effective decisions** for planning, directing and controlling.

We need to make the distinction between a data-processing system and an information system:
Data processing systems record day to day transactions, e.g. sale of a CD to a customer.

Operational Information systems read the collected data and do things like producing lists of items that need to be re-ordered.

The MIS will analyse the sales data to highlight sales trends of different product lines, to enable decisions to be made as to whether the product needs special promotion, or whether it should be discontinued.

The MIS deals with internal and external information. The internal information can be got quite easily from the various systems on the company network, e.g. sales figures for each product line. The external information is gathered from:

- Intelligence about competitors’ activities. This can come through reading articles in the press, leaks, or even industrial espionage.
- Information about population shifts. As the population gets older, the less likely they are to be interested in pop-music or customising cars, but are more likely to be interested in weight-loss products or holidays for the over 50s.
- Economic and social factors. Sales of cars would go down in an area where a major employer had just closed down a plant.
- Government Legislation. Financial forecasts would change if the minimum wage rose.

The MIS can be used to gather information from both formal and informal flows of information.

A formal flow of information is one in which a procedure is adopted, e.g. the downloading of sales figures from several branches first thing on a Monday morning. External data can be collected using specialised data collection agencies such as Dun and Bradstreet who produce economic data for academic and commercial organisations. Formal flows can also come from people working on the same document at several locations, or by use of e-mail, or by use of company intranets.
Informal information flows come from chance meetings, reading magazines or newspapers, or watching the news on TV.
The MIS must produce information for managers on three levels:

- **Operational** – day-to-day decisions such as ordering in more stock.
- **Tactical** – decisions that have a short to medium term effect, e.g. introducing a new product to a particular retail outlet;
- **Strategic** – long term decisions that will affect the future of the organisation, e.g. whether to open a new store, or take over a rival concern.

In 1973 a study showed the following about the time taken by a manager on various different tasks:

- Desk work – 22 %
- Travel – 3 %
- Unscheduled meetings – 10 %
- Scheduled meetings (the practical alternative to work) – 59 %
- Telephone calls – 6 %.

Some chief executives have to change their attention rapidly form one task to another. In some cases, half their activities last less than nine minutes.

**Types of Decision**
A manager can make two kinds of decision:
Structured – which are repetitive and need a definite routine and procedure to deal with them, e.g. stock is below 15 %, so an order need to be place with a supplier.

Unstructured – require knowledge, insight, and evaluation. They may well crop up without warning, and the right decision can be critical.

The manager may well go through the following stages when considering what decision to take:

1. Recognise the problem. The MIS may give information about the performance of the department, and where there is a problem.
2. Consider the solution. A spreadsheet could be used to consider “What if” scenarios.
3. The solution is chosen using the manager’s experience as well as the information produced by the MIS.
4. The solution is implemented and reviewed. Again the MIS can provide the data on which the solution is evaluated.

Often solutions do not proceed smoothly and there may have to be backtracking from one stage to another.

Desirable features of an MIS

- **Be flexible** - allowing for different ways of analysing data and evaluating information.
  - **Be able to support** a range of skills and knowledge.
- **Provide interpersonal communication** with other people in the organisation.
- Not require **extensive periods of concentration** as managers switch between different tasks.
Make it easy to **interrupt** the work and return to it at a later time

**Protect** a manager, from information overload.

**Systems Life Cycle**
The construction of a specialist computer system often involves large teams of people, and it is absolutely critical that they are managed correctly. If they are not, the project will be at best inefficiently run or at worst go belly-up. There are a good number of sophisticated computer projects that have attracted publicity for all the wrong reasons, usually with the waste of many millions of euros of public money.

There are a number of ways that computer projects can be managed. We will look at

- the **systems life cycle**
- the **waterfall model**
- prototyping.

The **systems life cycle** was the traditional way in which projects were carried out. Each stage was completed before the next was started.

You will have done something fairly similar with your project. This system had its drawbacks, in that experience in a later stage could not inform work that had been done previously.

In the **waterfall model**, it is possible to rework earlier stages in the light of experience gained at a later stage. Each stage is signed off and the next stage is proceeded with. However the end user is rarely involved in the development stage, even though they may well be involved in signing off. It is therefore critical that the analysts and the programmers understand the end-users’ requirements. This can be quite difficult with the waterfall model.
The waterfall model has disadvantages, which can be overcome using prototyping, in which a model of the system is developed in partnership with the end-user. The features are worked out with the end user using a **prototype**, and the end user can have a considerable input into the development of a project. The approach is shown below:

**Benefits are:**
- Misunderstandings are detected at early stages
- the user will notice any missing functions, incomplete or inconsistent requirements.
- can be built quickly to demonstrate systems
- it can be used for training before the system is finished

**Drawbacks are:**
- Project management can be discoordinated or even sloppy.
- Meetings with end users can become time consuming.

Ebook_mis.doc
The final result could be completely different to what was requested in the first place.

There are several different ways of prototyping:
- **Piloting** – Test the feasibility of the design proposal
- **Modelling** – building to develop an understanding of the user’s requirements
- **Throw-away prototyping** – Pilot and modelling are throw away types – once they achieve their purpose the real system is built.
- **Evolutionary prototyping** – each prototype built is a step closer to solution.

**What Prompts a New System?**
1. The current system may not do what it should.
2. Technological developments may have made the current system outdated.
3. The current system may be too inflexible or expensive to maintain.

**Feasibility Study**
The scope and objectives of the system are specified. The aim is to understand the problem and see if it is worth continuing. A feasibility report is produced by the systems analyst which considers the five main factors which are (TELOS):
- **Technical feasibility** – investigating if the technology exists to implement the system
- **Economic Feasibility** – establishing the cost-effectiveness of the system – do the benefits outweigh the costs?
- **Legal Feasibility** – Is there any conflict with system and legal requirements e.g. Data Protection Act
- **Operational Feasibility** – are work practices and procedures able to support new system. Also considers social factors e.g. how will it affect working lives.
- **Schedule feasibility** – How long it will take to develop and if it can be done in specified time frame.

**Telos** is a Greek word meaning a target.
Once the feasibility study concludes that the project is viable, it proceeds to the **requirements analysis**. This involves:

- **Interviewing** staff at all levels of the organisation to get their views on exactly what they want.
- Sending out **questionnaires** which need to be carefully constructed to avoid ambiguous responses.
- **Examining all the documentation**, from the most day-to-day to those used by the most senior of the managers.
- **Observation** of current procedures and practices.

All of this is carried out by **systems analysts** who produce **data flow** diagrams to picture the company’s operations. Click **HERE** to see a DFD.

The analysts also consider the **costs and benefits implications**. They also consider the way the project will be implemented:

- Will it be done in-house or using consultants;
- What hardware would be used;
- What software could be used?

Finally a report is written with a recommendation to proceed or abandon the project.

The next stage is the **system design**:

- **Hardware profile**, including the technical data of the machines on which the programs will be run.
- **Software profile**, including the programming language, packages, and database management systems;
- **Inputs**, including entry screens;
- **Outputs**, such as reports;
- The **user interface**.
- The **modular design structure** for the program. The program is built up in discrete sub-units and put together;
- **Test plan** and data;
- **Conversion plan**;
- **Documentation**, including a user manual.
You will have done much of this in your Module 3 project (didn’t you?).

Then there’s the **implementation**, where the system is coded and tested. Also Hardware is installed, ready to convert from the old system to the new.

- Hardware is installed, which may need extensive work on cabling and/or redesigning offices;
- Users are trained;
- Conversion of master files, or creation of new master files.

There are several ways of **conversion**:

- **Direct changeover**, in which the old is topped and the new is introduced. Usually this is over a weekend or some other slack time. The advantage is that there is a minimum of duplication. The drawback is there can be serious disruption if the new system has errors in it.

- **Parallel conversion** where the two systems are run alongside each other, minimising disruption due to errors. However this does involve duplication of the work.

- **Phased conversion** where bits of the new system are introduced, one at a time.

- **Pilot conversion** where the system is implemented initially in a few branches.

Once the system is up and running, there is a **post-implementation review**. It is usually in the first few weeks and months that errors become apparent.

So **system maintenance** may be needed:

- **Perfective maintenance** – although the system is running well, there may be room for improvement;
- **Adaptive maintenance** – where new functions are added to take into account the changing needs of the company;
- **Corrective maintenance** to get rid of errors.
Why an MIS Might Fail

MIS systems are complex and expensive pieces of software, and many people are involved with the design both within the organisation and from outside. Often they are built by software houses to the precise requirements of the organisation. So the client organisation needs to be very clear as to what it wants, and the software house analysts need also to be very clear about the requirements.

MIS failures can be expensive and bring bad publicity to all parties. They can arise due to:

- **Inadequate analysis** - problems, needs and constraints aren’t understood in the early stages.

- **Lack of management involved in the design** – wrong expectations of a new system / no-one understands the system.
- **Emphasis on the computer system** – Need procedures for handling input and output / select the right hardware and software
- **Concentration on low-level data processing** – Information must be easily accessible and understood
- **Lack of management knowledge of ICT systems and capabilities** – managers know what they want from the system but don’t understand the technology
- **Lack of teamwork** – An ICT manager must co-ordinate the accounts, marketing, sales etc. departments and help everyone understand the benefits of the system
- **Lack of professional standards** – All systems need clear documentation that all users can understand (not just the ICT literate)

Organisations can judge how successful the implementation of an MIS system has been by applying the following evaluations:

- **High level of use** - Is it actually used? Some systems don’t become operational for reasons such as it taking too long to enter data.
- **High level of user satisfaction** - Do users like the systems?
- **Accomplishment of original objectives** - Have the objectives specified in the analysis stage been achieved?
- **Appropriate nature of use** - Is the software being correctly used?
  Has proper training been given?
- **Institutionalisation of the system** - Has it been taken on board enthusiastically?

**Questions**

1. Describe, with the aid of an example, the meaning of *formal information flow* within an organisation.

   *(AQA Jun 02 Q1) ANSWER*

2.
A company which distributes car parts has recently expanded and wants to commission a new corporate information system. It needs the system to be successful to ensure the future growth of the business.

State five factors that could cause the failure of such an information system. (5 marks)

(AQA Jun 02 Q2) ANSWER

3.

Many commercial organisations already operate using computer-based information systems, yet they often introduce new systems or replace current ones.

(a) State three reasons why a feasibility study might recommend the replacement or updating of an existing information system. (3 marks)

(b) Describe three factors that should be considered when discussing the introduction of a new information system. (6 marks)

(AQA Jun 02 Q5) ANSWER

What is a Data Warehouse?
A data warehouse is a repository of information specifically designed to make the extraction and analysis of data simple and efficient. Production systems, such as student information systems, are designed to provide for data input and transactional processing. Data warehouses, by comparison, are designed to optimise the extraction of data. They are generally read-only and may be updated less frequently than operational systems.
Further information on data warehousing is available from the Data Warehouse Information Center.

**History of the UQ Data Warehouse**

MIS began developing a data warehouse in 1995 as part of its management information strategy to enable users to access a wide range of data for management purposes simply and efficiently. An information sub-system based on student data as reported to the Commonwealth Government was used as the initial prototype.

During the initial development of this information sub-system, MIS began to evaluate ad hoc query and reporting tools as a means of providing a user-friendly interface to the Data Warehouse. Business Objects was chosen for its ease of use by non-technical users.

**The UQ Data Warehouse Today**

Since the release of the pilot official student database, the size and scope of data available to UQ staff has grown considerably, and is under constant development.

Currently, UQ staff, subject to security restrictions, can use BusinessObjects to access a wide range of datasets including:

- Student (census date snapshots, historical and current data);
- Staff (census date snapshots, historical and current data);
- Finance (General Ledger, Transactions, Allocations and Tuition Fee Allocations);
- Research (Grants and Publications); and
- Performance Measures (Graduate Destination Surveys, Aggregated Student and Staff data for Australian Higher Educational Institutions)

More detailed information regarding datasets is provided at Using BusinessObjects at UQ.