MANAGEMENT INFORMATION SYSTEMS

STUDY GUIDE

PROGRAMME	:	**MBA Year 1**
CREDIT POINTS	:	**20 points**
NOTIONAL LEARNING	:	**200 hours over 1 semester**
TUTOR SUPPORT	:	**mis@mancosa.co.za**

REF: MIS 2011

How to use this Manual

Do not try to complete the manual in a few long sessions. You will study more effectively if you divide your study into two-hour sessions.

If you want to take a break it would be a good idea to stop at the end of a section.

As you work through the manual you will come across **Activities** and Self **Assessment Exercises**. These are designed to help you study and prepare for the examinations.

ACTIVITY

Activities ask you to carry out specific tasks. In most cases there is no right or wrong answers to the Activities. The aim of the Activities is to give you an opportunity to apply what you have learned.

SELF CHECK QUESTION

Occasionally you will be required to assess your grasp of concepts by applying concepts to specific situations. Suggested answers to these activities are provided at the end of the specific unit.

READING

At this point you should read the reference given to you.

? **THINK POINT**

A think point asks you to stop and think about an issue. Sometimes you are asked to apply a concept to your own experience or to think of an example.

CASE STUDY

Requires you to demonstrate the ability to apply knowledge gained

Module Assessment

Assignment

You will be required to complete and submit an assignment. This assignment is assessed as part of your coursework. Therefore, it is very important that you complete it.

Examination

An examination will be written at the end of each semester. The assessment strategy will focus on application of theory to practice.

TABLE OF CONTENTS

READING

Prescribed:

Read the appropriate chapter in conjunction with :

Laudon K.C. and Laudon J.P. (2010). **Management Information Systems** (11th Edition) (*or higher*) Pearson Education. Upper Saddle River : New Jersey. **Page 32 – 69.**

or

Laudon K.C. and Laudon J.P. (2006). **Management Information Systems** (9th Edition) (*or higher*) Pearson Education. Upper Saddle River : New Jersey.

Recommended Reading

Beekman G (2005). **Computer Confluence** (6th Edition). Pearson Education : Upper Saddle River : New Jersey

Williams B.K and Sawyer S.C. (2005). **Using Information Technology** (6th Edition) New York : Mc Graw Hill.

McLeod and Schell (2007) **Management Information Systems** (10th Edition) Pearson Education

Use EBSCO and Emerald as well to locate journal articles pertaining to specific chapters and sections covered in this module

Chapter 1

Information Systems in Global Business Today

After completing this chapter, students should be able to answer the following questions:

- How are information systems transforming business and what is their relationship to globalization?
- Why are information systems so essential for running and managing a business today?
- What exactly is an information system? How does it work? What are its management, organization, and technology components?
- What are complementary assets? Why are complementary assets essential for ensuring that information systems provide genuine value for an organization?
- What academic disciplines are used to study information systems? How does each contribute to an understanding of information systems?
- What is a socio-technical systems perspective?

Introduction

Computers are changing every aspect of our lives from entertainment to shopping, from the work we do and where we do it, to how we communicate with friends and relatives. Even though we are still hearing negative news about the dot-com bubble from the late 1990s through 2001, the death of the Internet has been greatly exaggerated. Not only is it alive and well, but thriving. The difference between then and now is that many of the companies went bust primarily because of poor business planning or simply because their product wasn't viable to begin with. As you can see from the opening case in the text, many companies are remodeling their businesses and information systems with the Internet in mind.

1.1 The Role of Information Systems in Business Today

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. As electronic business and electronic commerce grow in popularity and more firms digitize their operations, having useful information is becoming even more important to the global business community.

This chapter gives you an overview of many of the subjects we'll touch on in this course. It will help you understand how all firms today, large and small, local and global, use information systems to achieve important business objectives, such as operational efficiency, customer and supplier intimacy, better decision making, and new products and services.

How Information Systems are Transforming Business?

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 1980s most of the job losses were in the blue-collar sector. Now it seems many of the cuts are being made in 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 on the world stage.

Information systems are the foundation for conducting business today. In many industries, survival and even existence is difficult without extensive use of information technology. No longer can we imagine going to work and conducting business without them. As a society we have come to rely extensively on the use of information appliances such as cell phones, BlackBerrys, handhelds, and other hardware. Communicating and conducting business is increasingly being carried out through the use of e-mail, online conferencing, and international teleconferencing. Internet technologies have become essential business tools.

What's New in Management Information Systems?

It seems that changes in technology are never-ending. The use of technology now extends far beyond the simple desktop computer, especially in the business world. As the text points out, three interrelated changes are affecting companies worldwide:

- The emerging mobile digital platform
- Growth of online software as a service
- Growth of "cloud computing"

Table 1-1 in the text divides the changes in management information systems into three categories and assesses the impact each change is having on businesses. It may be a fun exercise to peruse the list and see how many of the changes you've had experience with.

Globalization Challenges and Opportunities: A Flattened World

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 a South American company, or even in the United States. You can disagree with the fact that many manufacturing jobs are being moved from the United States 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. That's because the Web didn't exist. But now, that particular job category is one of the fastest growing in the United States 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.

The Emerging Digital Firm

A **digital firm** is one in which nearly all of the organization's significant business relationships with customers, suppliers, and employees are digitally enabled, and key corporate assets are managed through digital means.

When a firm goes digital, it's not about just adding a computer system to the mix. Throwing a computer system at outdated **business processes** is exactly the wrong thing to do. A truly digital firm has several characteristics that distinguish it from most of the firms claiming to be digitized:

- Significant business relationships with customers, suppliers, and employees are digitally enabled and mediated.
- Core business processes are accomplished through digital networks and span the entire organization or link multiple organizations.

- Key corporate assets — intellectual property, core competencies, and financial and human assets — are managed through digital means.
- Internal and external environments are quickly recognized and dealt with.

And the number one reason digital firms experience greater opportunities for success and profits is because they view information technology as the core of the business and a primary management tool.

SELF CHECK QUESTION 1.1

Describe the capabilities of a digital firm? Why are digital firms so powerful?

(*Answers at the end of this Section*)

Strategic Business Objectives of Information Systems

Although many managers are familiar with the reasons why managing their typical resources such as equipment and people are important, it is worthwhile to take a moment to examine the growing interdependence between a firm's ability to use information technology and its ability to implement corporate strategies and achieve corporate goals. Specifically, business firms invest heavily in information to achieve six strategic business objectives:

- Operational excellence
- New products, services, and business models
- Customer and supplier intimacy
- Improved decision making
- Competitive advantage
- Survival

Operational Excellence

Businesses continuously seek to improve the efficiency of their operations in order to achieve higher profitability. Information systems and technologies are some of the most important tools available to managers for achieving higher levels of efficiency and productivity in business operations, especially when coupled with changes in business practices and management behaviour.

New Products, Services, and Business Models

Information systems and technologies are a major enabling tool for firms to create new products and services, as well as entirely new business models. A **business model** describes how a company produces, delivers, and sells a product or service to create wealth. As successful as Apple Inc, NetFlix, and Wal-Mart were in their traditional brick-and-mortar existence, they have all introduced new products, services, and business models that have made them both competitive and profitable.

Customer and Supplier Intimacy

When a business really knows its customers, and serves them well, the way they want to be served, the customers generally respond by returning and purchasing more. The result is increased revenues and profits. Likewise with suppliers: the more a business engages its suppliers, the better the suppliers can provide vital inputs. The result is a lower cost of doing business. JC Penney is an excellent example of how the use of information systems and technologies are extensively used to better serve suppliers and retail customers. Its information system digitally links the supplier to each of its stores worldwide. Suppliers are able to ensure the continuous flow of products to the stores in order to satisfy customer demands.

Improved Decision Making

Information systems and technologies have made it possible for managers to use real-time data from the marketplace when making decisions. Previously, managers did not have access to accurate and current data and as such relied on forecasts, best guesses, and luck. The inability to make informed decision resulted in increasing costs and losing customers.

Competitive Advantage

Doing things better than your competitors, charging less for superior products, and responding to customers and suppliers in real time all add up to higher sales and higher profits that your competitors cannot match. Toyota and Wal-Mart are prime examples of how companies use information systems and technologies to separate themselves from their competition. Toyota worked its way to top of its industry with the help of its legendary information system. Wal-Mart is the most efficient retail store in the industry based in large part on how well it uses its information resources.

Survival

Firms also invest in information systems and technologies because they are necessities of doing business. Information systems are not a luxury. In most businesses, information systems and technology are the core to survival. In the text, the Laudons discuss how Citibank was the first banking firm to introduce ATMs. In doing so, they had a major competitive advantage over their competitors. In order to remain and survive in the retail banking industry, other banks had no choice but to provide ATM services to banking customers.

New federal and state statutes and regulations have resulted in giving firms no choice but to turn to information systems and technologies in order to comply with the new requirements.

1.2 Perspectives on Information Systems

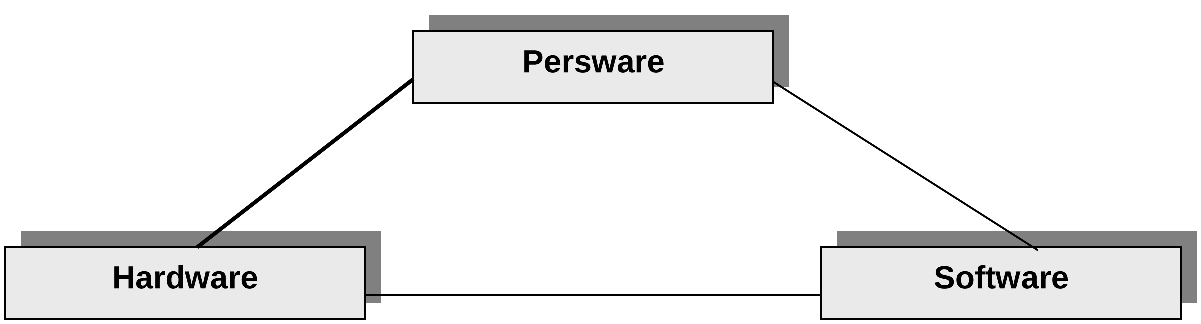
Information technology (IT) consists of all the hardware and software that a firm needs to use in order to achieve its business objectives.

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 to 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 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:

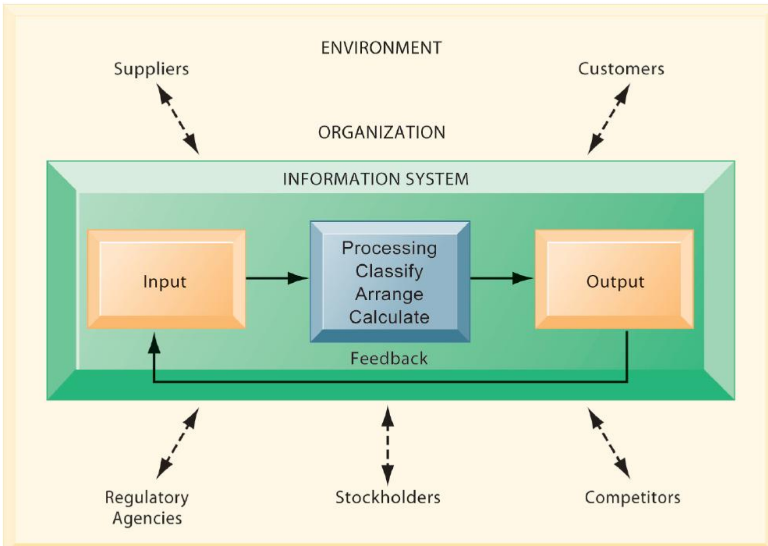
Figure 1: Persware



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. 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.

Figure 2: Functions of an Information System



Source: (Laudon and Laudon, 2010:47)

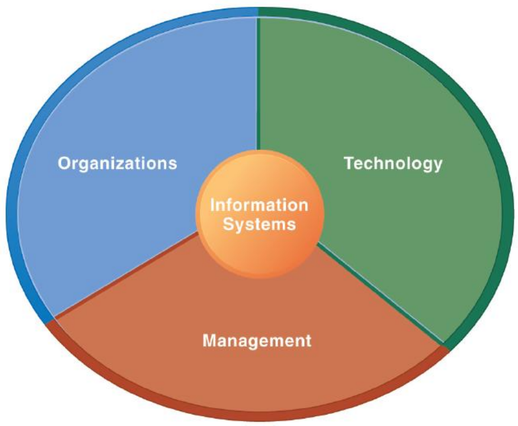
Figure 2 shows how using feedback completes the information processing loop. To be a good information systems manager, however, you must bring into that loop far more than just computer data. For instance, your information system reports that you produced 100,000 widgets last week with a "throwback" rate of 10 percent. The feedback loop tells you that the throwback rate has fallen 2 percent in the last month. Wow, you say, that's a pretty good improvement. So far, so good. But if you put that information into the broader context of the organization, 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 percent above the industry norm. Now that's information you can use — to your advantage or disadvantage!

Dimensions of Information Systems

There is a distinct difference between possessing **information systems literacy** and simple **computer literacy**. If you can combine information from internal sources and external environments, if you can use data to help you make better decisions, if you can use information to help you improve your organization, you can consider yourself "information literate."

Management information systems (MIS) deals with behavioral issues as well as technical issues surrounding the development, use, and impact of information systems used by managers and employees in the firm. As such, MIS is defined as the study of information systems focusing on their use in business and management. The dimesnsions of an information system is depicted in Figure 3 below./

Figure 3: Dimensions of an Information System



Source: (Laudon and Laudon, 2010:48)

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 has its own structure, just as workplace organizations have structures and personalities to fit their needs, or in some cases, their old habits.

The key elements of an organization are its:

- People
- Structure
- Business processes
- Politics
- Culture

In every organization you'll find **senior managers** making long-range decisions, **middle managers** carrying out the plans and goals set by senior managers, and **operational managers** handling the day-to-day operations of the company. As we'll see, information systems output must be geared to each of these levels of management.

Just as every football team needs good players at different positions, a business organization requires different employees to help it succeed. **Knowledge workers** help create new knowledge for the organization and **data workers** help process the paperwork necessary to keep an organization functioning. Without **production or service workers**, how would the company get its products and services to the customer?

A football 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 have their major **business functions,** which need many kinds of players with various talents, who are well-trained and well-informed, in order to succeed.

The larger the organization, the more formal the management structure, including the need for standardized business processes. Most of these business processes have been developed over time and help managers and employees properly complete their tasks in a more efficient manner. Many companies now integrate these business processes into their information systems to ensure uniformity, consistency, and compliance. As we'll see in upcoming chapters, many companies are even incorporating informal work processes into their information systems in an effort to capture as much corporate knowledge as possible.

An organization's culture is often an integral part of its information system. UPS's culture focuses on customer service while Wal-Mart's culture is centered on being a low-cost retailer. Each company builds its information system differently to incorporate those organizational ideals.

Management

Every good organization needs good managers. Pretty simple, pretty reasonable. Take professional football managers. They don't actually play the game; they don't score a goal, take a free kick or corner, 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.

Technology

Do you own an Internet-enabled refrigerator? (Yes, they really do exist.) Probably not, since they've 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 all the latest gadgets? Chances are you don't. Face it, you just can't keep up with all the new **computer hardware**. No one can.

Think about how hard, not to mention expensive, it is for an individual to acquire each new **computer software** program introduced to the marketplace. Think how difficult it is sometimes to learn how to use every feature of all those new products.

No matter how big your storage technology device seems to be, you're constantly running out of room to store all the new software programs and all the data you create. In order to keep track of all of the information you have stored, you will need **data management** software that is designed to organize the information so that you can readily retrieve what you are looking for.

As the products and services on the **Internet** expand everyday, your need for new **networking** and **telecommunications technology** links just seems to grow and grow.

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, and how best to present it. It's a huge job!

The **World Wide Web** allows big companies to act "small," and small companies to act "big." It has leveled the playing field so entrepreneurs can break into new markets previously closed to them. A Web site, consisting of a few pages or hundreds of pages, enables businesses to get close and stay close to their customers in new ways. It is truly a revolution in our global economy.

Now put those thoughts into a much larger context of an organization's **information technology (IT) infrastructure**. Yes, it would be nice if your company could purchase new computers every three months so you could have the fastest, 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.

SELF CHECK QUESTION 1.2

What is the organizational, management, and technology dimensions of information systems?

(*Answers at the end of this Section*)

It Isn't Just Technology: A Business Perspective on Information Systems

From a business perspective, an information system provides a solution to a problem or challenge facing a firm and provides real economic value to the business. The decision to build or maintain an information system assumes that the returns on this investment will be superior to other investments in buildings, machines, or other assets. These superior returns will be expressed as:

- Increased productivity
- Increased revenues
- Enhanced organizational performance

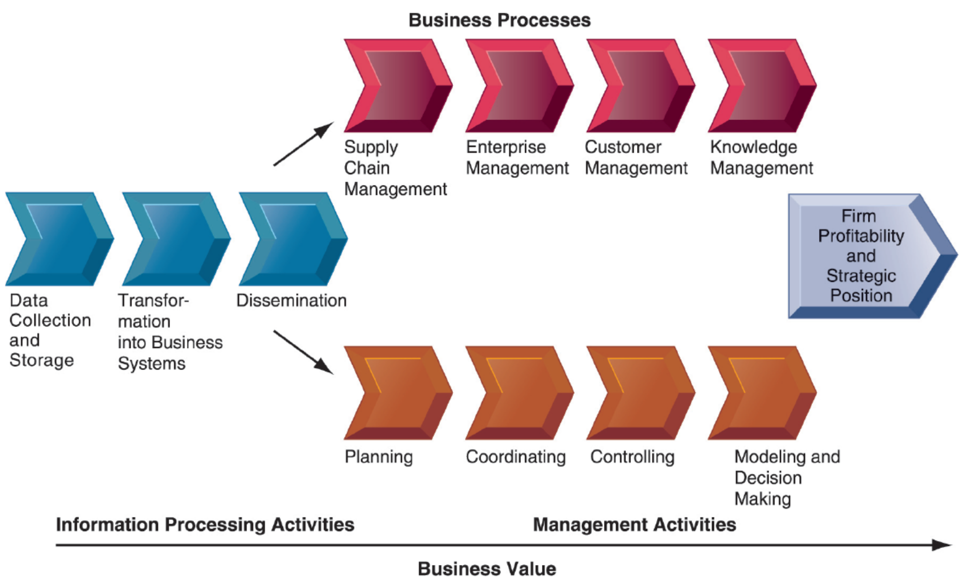
From a business perspective, an information system is an important instrument for creating value for the firm. Information systems enable the firm to increase its revenue or decrease its costs by providing information that helps managers make better decisions or that improves the execution of business processes.

There are three ways an information system can add value to a business:

- Help managers make better decisions
- Help make business processes more efficient
- Increase profitability

Figure 4 diagrams the business information value chain. We'll examine the elements of this figure in more detail throughout this module.

Figure 4: The Business Information Value Chain



Source: (Laudon and Laudon, 2010:55)

Complementary Assets: Organizational Capital and the Right Business Model

At the end of the twentieth century there was widespread fear of the havoc the Y2K bug would wreak on computer systems throughout the world. Billions of dollars and millions of hours were spent fixing the problem. As a result of the preparation, very few problems arose. All of the hype helped serve as a “wake-up” call to senior managers throughout corporate America about the increasing role information systems play in the success of their organizations. They discovered that 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 levels.

Once technology was considered “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 whole different world and actually seemed disconnected from the mainstream operations of the company.

Technology and its associated information systems are now integrated throughout the organization. Everyone is concerned about its role and impact on their work activities. End users take on greater responsibility for the success of the information systems and are actually doing a lot of the work that belonged to the techies. Even the executive levels of an organization can no longer ignore the technology as they realize the importance of managing their **organizational and management capital**.

As a firm becomes more digital, its information system continues to extend beyond the traditional role of serving the employees. Developing the **complementary assets** associated with the information systems such as developing new business models and processes, changing management behavior and organizational culture, emphasizing employee training in technology, and creating new partnerships with suppliers, customers, and even competitors, is proving to be a daunting task.

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.

1.3 Contemporary Approaches to Information Systems

The study of information systems deals with issues and insights contributed from technical and behavioral disciplines. The disciplines that contribute to the technical approach are computer science, management science, and operations research. The disciplines contributing to the behavioral approach are psychology, sociology, and economics.

Technical Approach

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.

Behavioural Approach

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 last 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.

CASE STUDY

Read the UPS Case Study on Page 53 of the text book and answer the questions that follow

(*Answers at the end of this Section*)

SUGGESTED ANSWERS TO SELF-CHECK QUESTIONS

1.1 Describe the capabilities of a digital firm? Why are digital firms so powerful?

Digital firms extensively use Internet technology for electronic commerce and electronic business to manage their internal processes and relationships with customers, suppliers, and other external entities. Core business processes, key corporate assets, and environmental responses are digitally managed. Because a digital firm relies heavily on information technology to enable, mediate, and streamline its internal and external operations, the firm is more flexible, profitable, competitive, and efficient than a traditional firm.

Supply chain management systems, customer relationship management systems, enterprise systems, and knowledge management systems are the four principal systems driving the movement toward digital firms. As the textbook suggests, these four systems are where corporations are digitally integrating information flows and making significant information systems investments.

1.2 What is the organizational, management, and technology dimensions of information systems?

Organization: Information systems are part of organizations, and in some cases (such as credit card companies and financial information services), they are the organization. Information systems will have the SOPs and the culture of an organization imbedded within them.
Management: Information systems supply tools and information needed by managers to allocate, coordinate and monitor their work, make decisions, create new products, and services and make long-range strategic decisions.
Technology: Management uses technology (hardware, software, storage, and telecommunications) to carry out their functions. It is one of the many tools managers use to cope with change.

ANSWERS - CASE STUDY

1. What are the inputs, processing, and outputs of UPS's package tracking system?

Inputs: The inputs include package information, customer signature, pickup, delivery, time-card data, current location (while en route), and billing and customer clearance documentation.

Processing: The data are transmitted to a central computer and stored for retrieval. Data are also reorganized so that they can be tracked by customer account, date, driver, and other criteria.

Outputs: The outputs include pickup and delivery times, location while en route, and package recipient. The outputs also include various reports, such as all packages for a specific account or a specific driver or route, as well as summary reports for management.

2. What technologies are used by UPS? How are these technologies related to UPS's business strategy?

Technologies include handheld computers (DIADs), barcode scanning systems, wired and wireless communications networks, desktop computers, UPS's central computer (large mainframe computers), and storage technology for the package delivery data. UPS also uses telecommunication technologies for transmitting data through pagers and cellular phone networks. The company uses in-house software for tracking packages, calculating fees, maintaining customer accounts and managing logistics, as well as software to access the World Wide Web.

UPS has used the same strategy for over 90 years. Its strategy is to provide the "best service and lowest rates." One of the most visible aspects of technology is the customer's ability to track his/her package via the UPS Web site. However, technology also enables data to seamlessly flow throughout UPS and helps streamline the workflow at UPS. Thus, the technology described in the scenario enables UPS to be more competitive, efficient, and profitable. The result is an information system solution to the business challenge of providing a high level service with low prices in the face of mounting competition.

3. What problems do UPS's information systems solve? What would happen if these systems were not available?

Some problems this information system solves relate directly to logistics and supply chain activities, not just for itself, but also for other companies. These services include supply chain design and management, freight forwarding, customs brokerage, mail services, multimodal transportation, and financial services, in addition to logistics services. Because of the advanced integration of its technology, UPS can provide these services cheaper and more efficient than most companies can create them in-house.

Arguably, UPS might not be able to compete effectively without technology. If the technology were not available, then UPS would, as it has through most of its history, attempt to provide that information to its customers, but at higher prices. From the customers' perspective, these technologies provide value because they help customers complete their tasks more efficiently. Customers view UPS's technology as value-added services as opposed to increasing the cost of sending packages.

Chapter 2

Global E-Business: How Businesses Use Information Systems

After completing this chapter, students should be able to answer the following questions:

- What are business processes? How are they related to information systems?
- How do systems serve the various levels of management in a business?
- How do enterprise applications, collaboration and communication systems, and intranets improve organizational performance?
- What is the difference between e-business, e-commerce, and e-government?
- What is the role of the information systems function in a business?

Introduction

What would happen if you walked into work one day and the management told the employees they could do anything, anything at all, that 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 that they chose.

Sally decides that she doesn't want to use FedEx to ship out the products that day even though the company has a contract that saves them lots of money. She decides to use an alternate shipping service that 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 friends pay raises also. While Bill's friends may like the idea, the rest of the employees in the company are pretty upset.

2.1 Business Processes and Information Systems

As we discussed in Chapter 1, the "digital firm" means more than just plunking down computers that have all the latest bells and whistles on every desk. The digital firm must connect each functional area and each management level to one another. Data input to the system in manufacturing must be made available to sales, accounting, and shipping. Managers in the human resources department must have access to appropriate information regardless of its origin. Information integration is the key to the digital firm.

As we go through this chapter, we'll look at the types of information systems organizations use to bring it all together. 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."

Business Processes

You can imagine from the above scenario how quickly chaos would reign in the organization without established business processes that integrate functions throughout an organization. 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 method 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.

Table 1 describes some typical business processes for each of the functional areas of business. We will see later in the chapter how these businesses processes are supported by enterprise systems.

Table 1: Business Processes

Functional Area	Business Process
Manufacturing and production	Assembling the product
	Checking for quality
	Producing bills of materials
Sales and marketing	Identifying customers
	Making customers aware of the product
	Selling the product
Finance and accounting	Paying creditors
	Creating financial statements
	Managing cash accounts
Human resources	Hiring employees
	Evaluating employees' job performance
	Enrolling employees in benefits plans

Source: (Laudon and Laudon, 2010:73)

How Information Technology Enhances Business Processes

Some processes that may have contributed to an organization's success have now outgrown their usefulness. Information systems can help an organization recognize processes that may need to be changed. An information system could be used to automate some of those processes or help managers 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 and must determine the right questions. Throwing a new-fangled computer system at the supposed problem is not the answer. And answering the wrong question with a good answer can be far more devastating to the bottom line than not doing anything at all. 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. The system should supply recommendations; humans still have the ultimate decision-making responsibility.

Information systems enhance business processes in two ways:

- Increasing the efficiency of existing processes by automating them.
- Enabling entirely new processes that are capable of transforming the business by changing the flow of information.

2.2 Types of Information Systems

There is no one single information system that will satisfy all of the needs of an organization. At first glance it can be difficult to comprehend all the different systems in a business, and even more difficult to understand how they relate to one another.

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 (strategic level systems); to how many people the company will need to make the candy bar (management level systems); to tracking customer orders (operational level systems). Within these three levels we'll discuss the four major types of systems typically used to make an organization successful.

Transaction Processing Systems

The operational level of an organization includes various units such as order processing, material movement control, payroll, accounts payable, and employee record keeping. This level is responsible for daily operations. The information systems used in this level of the organization are **transaction 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 bar than just running the assembly line, a TPS will record the sales and marketing transactions as well. 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 work 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 TPS, right down to how many truck drivers were required to deliver the product to the local convenience store.

As you can visualize, the operational level of an organization also includes functions not directly associated with the actual production of the Cybernuts 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 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.

SELF CHECK QUESTION 2.1

What are the five types of TPS in business organizations? What functions do they perform?

Give examples of each

(*Answers at the end of this Section*)

Management Information Systems and Decision-Support Systems

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

Management information systems (MIS) are designed to produce information on a periodic basis instead of on 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?" or "If we do adopt the new Cybernuts recipe, what positions are open for the 25 excess workers and what skills do they possess that the company can use elsewhere?"

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.

If there was a problem getting a shipment out to the convenience store in Paducah, Kentucky, the shipping manager may not have known about it until a customer cancelled her account 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.

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 online, 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 "on the same page."

Decision-support systems (DSS) also serve the management level of an organization, but in a somewhat different way from an MIS. An MIS uses internal data to supply useful information. A DSS uses internal data but also 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, minimize our costs, and still remain competitive?” Using a DSS, the manager in charge of the manufacturing division could determine the best answer to this 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 semi-structured. 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.

As a company is affected not only by what goes on solely 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 bar if civil war breaks out in the sugar producing countries of Central America? The price of electricity can greatly affect the profit and loss of the Cybernuts bar. Fluctuating fuel prices affect the profit margins by increasing or decreasing the distribution costs of the product. All these external events can be put into context in a decision-support system so that WorldWide’s management can make effective decisions.

Executive Support Systems for Senior Management

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. There are no easy, definable answers. 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 bar is the most successful, most popular candy bar ever made. (You could say its success is due to the effective use of the previous three information systems!) The Universal Food Products Corporation just can’t create a product that comes close to the success of Cybernuts (their 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. With an ESS, company executives can make their decision based on information, not on emotion.

Senior executives often access information through the use of a **portal**. Basically, a portal is a Web interface designed to present integrated personalized business content from a variety of sources.

As executives haven't been using computers that long or don't have time to fiddle around learning how to type, executive support systems use **digital dashboards** to make them easy to use and provide information in a real-time mode. The ESS must be able to incorporate external information with internal data to offer concise, complete information for the imprecise and incomplete scenarios executives face.

SELF CHECK QUESTION 2.2

Describe the relationship between TPS, MIS, DSS, and ESS

(*Answers at the end of this Section*)

2.3 Systems That Span the Enterprise

It's not unusual to find an organization with three or more different information systems that act as islands. The systems don't exchange information very well, if at all. Accounting and finance may have a system that serves their needs very well, but they can't collect information from the system used by manufacturing and production. Sales and marketing is doing its own thing with its system and losing valuable information from the other systems, which could help it do a better job.

Enterprise Applications

No business can afford disjointed information systems that don't work together to produce a coherent picture of the entire organization. All the functions of a business must be integrated across traditional lines of demarcation. Islands of information can be devastating to a company if data cannot be shared throughout the company. Even worse, the islands of information can create problems if each faction of an enterprise has differing information that conflicts with other islands of information. These kinds of problems are what gave rise to **enterprise applications** that share the same data anywhere it's needed in an organization. As networks of all kinds take hold, from the Internet to intranets to extranets, Web-based enterprise applications are increasingly widespread.

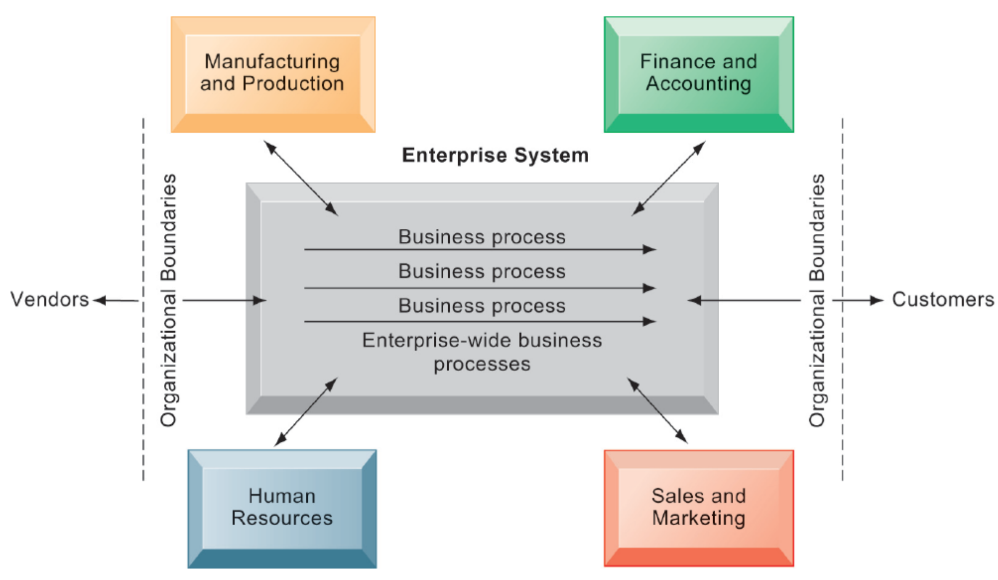
The following sections are an overview of four major enterprise applications: enterprise, supply chain management, customer relationship management, and knowledge management systems. We'll also study each of these systems in depth in future chapters.

Enterprise Systems

Enterprise systems (also known as *enterprise resource planning (ERP)* systems) indicated in Figure 5 is used to bridge the communication gap between all departments and all users of information within a company. If the World Wide Candy Company production department enters information about its processes, the data are available to accounting, sales, and human resources. If sales and marketing is planning a new advertising campaign for the CyberNuts candy bar, anyone anywhere within the organization will have access to that information. Enterprise systems truly allow a company to use information as a vital resource and enhance the bottom line.

The greatest enticement of enterprise systems is the chance to cut costs firm-wide and enhance the ability to pass information throughout the organization. The biggest drawbacks to building enterprise information systems are time, money, and people. Because the installation of the system is so invasive, it takes a tremendous amount of time to install the hardware and software, train people to use it, and rework business processes that will then inevitably change. Many companies find it more trouble than they care to handle.

Figure 5: Enterprise Systems



Source: (Laudon and Laudon, 2010:86)

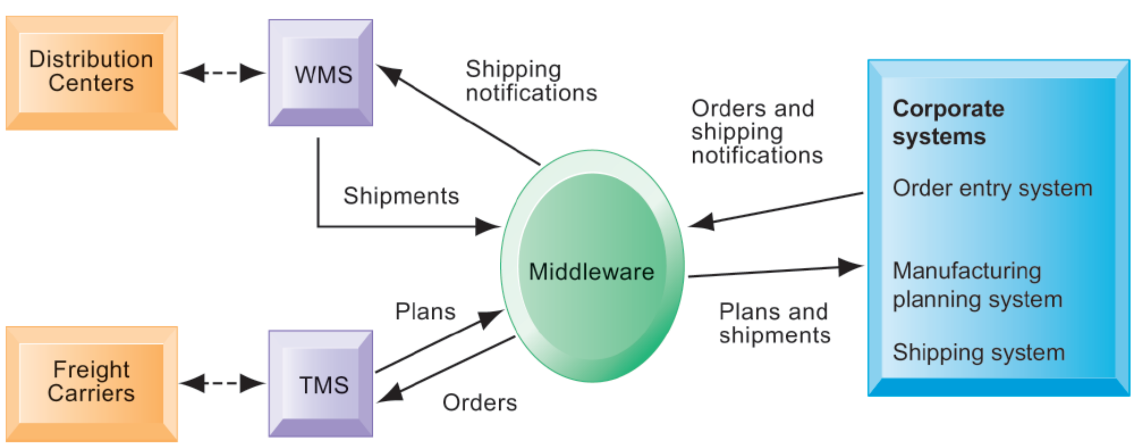
Supply Chain Management Systems

Even if you properly manage your processes, wring out excess costs from every corner of the organization, and above all, have the best products at the lowest cost, if you can't get your products to the right customers at the right time what good is all the rest? Managing your supply chain and getting products or services to customers efficiently and effectively is the real key to success.

Supply chain management systems offer new opportunities for companies to integrate data and information with their suppliers and customers and ultimately, lower costs for everyone. When WorldWide Candy installed their supply chain management system, a form of **interorganizational systems**, they created a cohesive network for buying raw materials, creating the candy bars, and getting the packaged goods to retail outlets.

Figure 6 illustrates an example of a supply chain management system. It shows how a leading manufacturer of office furniture overhauled its supply chain management system to promote optimal lowest-cost delivery plans.

Figure 6: Example of a Supply Chain Management System



Source: (Laudon and Laudon, 2010:87)

Customer Relationship Management Systems

Do you wait for the customer to complain about your poor service before you take a critical look at your business processes? Do you spend more time and money acquiring new customers than you do in keeping your existing ones? Does each functional area of your organization have a completely different and separate viewpoint of your customers? Does your sales and marketing department make promises to your customers that manufacturing and production can't possibly keep? If you answered yes to one or more of these questions you're in serious need of a good **customer relationship management** system.

CRM technology isn't just a nice looking Web site for customers to click through or more reports dumped on managers' desks that they don't have time to review. CRM systems involve business processes in all the functional areas and every management level of a firm. The ideal CRM system provides end-to-end customer care from receipt of order through product delivery.

Because of technological limitations in the past, many companies created islands of information in the various functional areas. Sales and marketing at Cybernuts may tell a customer that the product order would ship by the fifteenth. Meanwhile manufacturing and production was experiencing a delay in producing the Cybernuts candy bar because the finance department didn't purchase enough raw goods. The islands of information prevented each functional area from knowing the situations in other areas. CRM systems help solve some of these disjointed snafus.

CRM also helps a firm cut the costs of keeping good customers by supplying the entire organization with a consolidated view of the customers' needs. Unprofitable customers are more easily identified with a CRM system and the time and energy spent can be retargeted to more profitable customers.

SELF CHECK QUESTION 2.3

What is customer relationship management? Why is it so important to businesses?

(*Answers at the end of this Section*)

Knowledge Management Systems

You may not think of a knowledge management system as an integral part of the overall information system of an organization. Most of the other systems have been recognized for many years, but this one may be thought of as relatively new. **Knowledge management systems** (KMS) enable organizations to better manage processes for capturing and applying knowledge and expertise.

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 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.

Intranets and Extranets

Enterprise applications are often costly to implement. Companies that don't have the resources to invest in enterprise applications can still achieve some measure of information integration by using intranets and extranets.

Intranets and extranets use Internet technology and standards to assemble information from various systems and present it to the user in a Web page format. Extranets make portions of private corporate intranets available to outsiders.

Both of these tools make it easy for companies to disseminate information through a standard platform that requires very little work to maintain. It's a low-cost way to connect internal employees with each other or external users to company information.

Collaboration and Communication Systems: "Interaction" Jobs in a Global Economy

Globalization now allows companies to work around the clock, around the world. It's not unusual for major corporations to shift work from one time zone to another, one country to another. Somehow, the people in all the geographically-separated locations have to be able to easily communicate and share information with each other.

Many new systems for interacting with other employees, managers, vendors, and customers have been developed. You probably use some of them without realizing how essential they've become in creating an enterprise-wide information system that companies rely upon.

- **Internet-based collaboration environments:** groupware like Lotus Notes, Groove, and WebEx conferencing systems provide tools that support workgroup collaboration.
- **E-mail and instant messaging**: billions of messages flow everyday between employees, managers, suppliers, and customers
- **Cell phones and Smartphones:** provide instant communications anywhere, anytime.
- **Social networking:** more than just a way to socialize among friends, these tools give corporations another way for users to share ideas and collaborate with each other.
- **Wikis**: gaining in popularity as a way to share knowledge and ideas among collaborators. They are much easier to use and manage than more sophisticated knowledge management systems.
- **Virtual worlds:** able to house online meetings, training sessions, and lounges, this type of tool is gaining popularity as a way to meet, interact, and exchange ideas.

E-Business, E-Commerce, and E-Government

A common mistake many organizations make is thinking they can simply throw up a Web site, add an e-mail software program for customer communication, and voila′ they are ready to do business in cyberspace. They haven't addressed any of their internal processes and the 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.

The Internet, extranets, and intranets offer new opportunities to do business in cyberspace. Yet there are many problems associated with developing a company's **electronic commerce** and **electronic business**. It is easy to put up a snazzy, colorful Web site that looks very pretty and may even be easy to use. It may be a site on the Internet, an intranet, or an extranet. You must consider though, how you're going to incorporate that part of your business with your 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 nontechnical? You can't keep doing your job the same old way. Lots of businesses have tried and lots of businesses have lost big bucks.

The electronic delivery of government services via the Internet has been fairly successful. Citizens have easy access to forms necessary in many **e-government** programs such as tax payments. Rather than waste time standing in line for vehicle registration and licenses, people can complete these kinds of tasks on the Internet. Perhaps most importantly, e-government has opened the lines of communications between citizens and elected officials and made information access easier and timelier.

2.4 The Information Systems Function in Business

Many people focus on the job losses due to technological advances and changes. On the other hand, many new jobs have been created because of technology. **Information systems departments**, previously a small group of people usually assigned to the financial group, have moved into the mainstream of most companies.

The Information Systems Department

Programmers have taken on more important positions within organizations. They must understand not only the technical side of computing, but they must also know the business processes within the company so they can adapt the technology to the needs of the business. **Systems analysts** serve as the bridge between the techies and the nontechies. 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 myriad of problems and opportunities businesses face in today's technologically driven environment.

If the company is large enough, you may also find a separate **chief security officer** responsible for making sure the organization's information resources are secure, a, **chief privacy officer** who ensures the company complies with data privacy laws, and a **chief knowledge officer**. This last position is becoming more popular as digital firms increase their reliance on capturing and managing employee knowledge.

Perhaps the most important role of all, though, 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.

Organizing the Information Systems Function

There are alternative ways of organizing the IT function within a firm. A very small company will not have a formal information systems group. Large companies will have a separate information systems department, which may be organized along several different lines, depending on the nature and interests of the firm. Each functional area of the business may have its own information systems department, overseen by a corporate CIO. The information systems function may be run as a separate department similar to the other functional departments. A third arrangement found in very large firms with multiple divisions and product lines is to have an information systems department for each division reporting to a high-level central information systems group and CIO.

IT Governance

Organizations develop a strategy and policies for using information technology under the label of IT governance. Basically, management wants to make sure that the use of information technology supports the organization's overall strategies and objectives. Governance policies determine who makes what decisions about how information technology will be used in the organization.

CASE STUDY

Read the Air Canada Case Study on Page 80 of the text book and answer the questions that follow

(*Answers at the end of this Section*)

SUGGESTED ANSWERS TO SELF-CHECK QUESTIONS

2.1 What are the five types of TPS in business organizations? What functions do they perform? Give examples of each

The five types of transaction processing systems include sales/marketing systems, manufacturing/production systems, finance/accounting systems, human resources systems, and other types. Sales/marketing systems provide customer service, sales management, promotion tracking, price changes, and dealer communications. Examples include sales order information systems, sales commission systems, and sales support systems. Manufacturing/production systems provide scheduling, purchasing, shipping/receiving, and operations functions. Examples of manufacturing systems include machine control systems, purchase order systems, and quality control systems. Finance/accounting systems provide general ledger, billing, and cost accounting functions. Examples of finance/accounting systems include general ledger, payroll, accounts receivable/payable, and funds management systems. Human resource systems provide personnel records, benefits, compensation, labor relations, and training functions. Examples include employee records, benefit systems, and employee skills inventory. Other types include admissions, grade records, course records, and alumni records for a university. Examples of transaction processing systems for a university include a registration system, student transcript system, curriculum class control systems, and an alumni benefactor system.

2.2 Describe the relationship between TPS, MIS, DSS, and ESS

The various types of systems in the organization exchange data with one another. TPS are a major source of data for other systems, especially MIS and DSS. TPS are operational-level systems that collect transaction data. Examples of these are payroll or order processing that track the flow of the daily routine transactions that are necessary to conduct business. TPS provide data that are required by MIS and DSS, although these systems may also use other data. DSS not only use data from TPS but also from MIS. MIS rely heavily on data from TPS. ESS obtains most of their internal data from MIS and DSS.

2.3 What is customer relationship management? Why is it so important to businesses?

Customer relationship management is a business and technology discipline to coordinate all of the business processes for dealing with existing and potential customers. With the growth of the Web, potential customers can easily comparison shop for retail and wholesale goods and even raw materials, so better treatment of customers has become very important. Good CRM systems consolidate customer data from multiple sources and provide analytical tools for answering questions such as: What is the value of a particular customer to the firm over his/her lifetime? CRM tools integrate the firm's customer-related processes and consolidate customer information from multiple communication channels, so that the firm can put one coherent face to the customer.

ANSWERS - CASE STUDY

1. **What problems does Air Canada hope that Maintenix will solve?**

   Air Canada's old legacy systems were not able to interact with one another or with the finance and inventory systems. The inefficiencies of these systems were costing the airline engineers' time and money that could have been used on maintaining planes.

2. **How does Maintenix improve operational efficiency and decision-making?**

   The Maintenix information system provides integrated, intelligent aviation maintenance, repair, and operations software. That leads the way to enhanced visibility of fleet-wide data, timelier decision making, support of Air Canada's existing business model, and increased operational efficiencies. The Maintenix system is accessible via the Web and easy to deploy to all stations around the world. It reduces repetitive tasks and time chasing missing or incomplete information by allowing maintenance, engineering, and finance divisions to easily share information. Wireless deployment also makes Maintenix more effective, since aviation technicians, equipment, and parts are always on the move.

3. **Give examples of three decisions supported by the Maintenix system. What information do the Maintenix modules provide to support each of these decisions?**

   Three decisions supported by the Maintenix system may include:
   - *Is Part A compatible with Part B?* The maintenance engineering module establishes the configuration hierarchy, rules, and maintenance program that all of the other modules depend upon. A company uses this module to describe machinery components, part relationships and compatibility rules.
   - *Is a qualified technician located on site to perform necessary maintenance?* The line maintenance module matches a dynamic list of maintenance work requirements against finite resources at various locations. The module allows a company to ensure that qualified technicians are available before they schedule maintenance.
   - *Are the right parts, in the right quantity, available on site for maintenance?* The materials management module ensures the minimum amount of each part is always in inventory without causing engineers to be short on parts at any time.

Chapter 3

Information Systems, Organizations, and Strategy

After completing this chapter, students should be able to answer the following questions:

- Which features of organizations do managers need to know about to build and use information systems successfully? What is the impact of information systems on organizations?

- How does Porter's competitive forces model help companies develop competitive strategies using information systems?

- How do the value chain and value web models help businesses identify opportunities for strategic information system applications?

- How do information systems help businesses use synergies, core competencies, and network-based strategies to achieve competitive advantage?

- What are the challenges posed by strategic information systems and how should they be addressed?

Introduction

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.

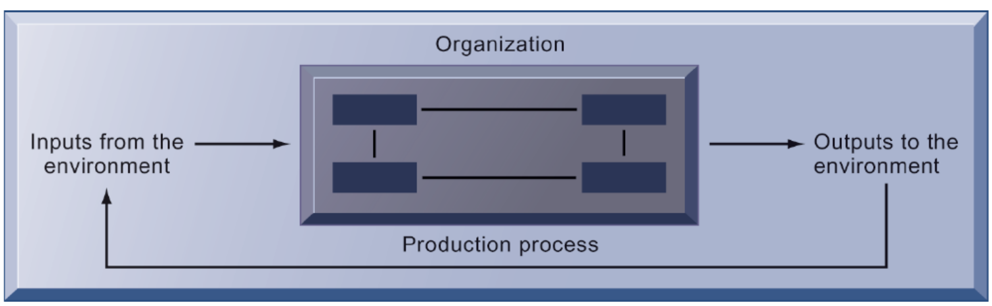
3.1 Organizations and Information Systems

You could say that this chapter relies on the chicken-and-egg theory to develop a relationship between organizations and information systems. You need to design information systems that serve the existing organization. At the same time you must be ready and willing to restructure the organization to take advantage of the improvements an information system can offer. So which one takes precedent—the organization or the information system? Actually neither one. The goal is to adapt one to the other.

What Is An Organization?

An **organization** is a stable, formal social, structure that takes resources from the environment and processes them to produce outputs (Laudon and Laudon, 2010:107). Figure 7 depicts this process.

Figure 7: The Organisation



Source: (Laudon and Laudon, 2010:87)

Organisations and Information systems are similar. Information systems use data as their main ingredient and organizations rely on people. However, the similarities are remarkable. Both are 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.

Features of Organizations

The class you're enrolled in is an organization of sorts, isn't it? Think about it – how many of the following characteristics fit your class? How many fit any organization you're in?

- Clear division of labor
- Hierarchy
- Explicit rules and procedures
- Impartial judgments
- Technical qualifications for positions
- Maximum organizational efficiency

These characteristics describe organizations that are called bureaucracies. Most of us think of them as slow, cumbersome, and unprogressive. That isn't necessarily so. Many organizations have bureaucratic characteristics and operate very well.

Routines and Business Processes

Successful organizations develop efficient **routines** for producing goods and services. Successful organizations are able to reduce costs and win a competitive advantage over others because these routines are built into business processes. However, some s*tandard operating procedures (SOPs)*, politics, and culture are so ingrained in organizations that they actually hinder the success of the group because they don't allow people to change their routines and processes as they should.

Organizational Politics

Each person in an organization ultimately has his own goals. Those goals may be aligned very well with organizational goals but perhaps they aren't. The bottom line is each person comes into an organization with different concerns and perspectives. When those viewpoints clash with others the end result is organizational politics. And, politics can essentially kill organizational changes necessary for incorporating new information systems.

Organizational Culture

Just as every society reflects cultural values like language, dress, and food, so too does every organization have its own culture. Some companies like Google are very "laid-back." The company allows employees to bring their dogs to work and ride skateboards in the hallways. Other companies like IBM require employees to adhere to a strict dress code and leave the skateboards at home. Yet both companies are very successful in their own right. However, when each company embarks on organizational change, the culture is very much a player in what they can and can't do.

Organizational Environments

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 unique 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 sales or they simply won't make any money. This type of organization must be creative in the way it generates business and in the type of 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, the turnover is fairly small. Because most state governments require people to carry insurance, the agent has a stable stream of income from premiums. Although 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. This organization doesn't have to devise ways of ingeniously using or generating data and its systems needs are mundane.

Both of these businesses are small and entrepreneurial. But they must respond to their employees, customers and potential customers in very different ways. Each of them has different business processes that must be used to meet goals of staying in business.
Disruptive Technologies: Riding the Wave: Remember typewriters? They were ubiquitous in the business world thirty years ago. How many have you seen lately? Did they fade away because they weren't a good idea when they were first invented? They weren't a good product? They didn't serve a need? As we all know, the answers to all those questions is a resounding no. They were a great invention, a great product, and served a real need. But they were supplanted by a **disruptive technology** called computers.

SELF CHECK QUESTION 3.1

What is an organization? Compare the technical definition of organization with the behavioural definition

(*Answers at the end of this Section*)

Organizational Structure

The point is that 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?"

Table 2 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 and affect you in so many ways. Remember, just as organizations affect you in many different ways, so too do you affect the organizations.

Table 2: Organisational Structures

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

Source: (Laudon and Laudon, 2010:114)

Other Organizational Features

Would you consider the same organizational structure for a softball team as you would for a theatre production group? Although 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. 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.

3.2 How Information Systems Impact Organizations and Business Firms

Change is the only constant in the relationship between information systems and organizations. As technology evolves and changes, its introduction into organizations requires changes in the firm's infrastructure and the services it can provide to its employees, customers, and suppliers.

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 to each other and 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 in some ways: 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 text discusses two major types of theories about how information systems affect organizations: economic theories and behavioral theories.

Economic Impacts

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.

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 for employee dress codes. 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 who they went to 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 human 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 (e-mail). Everyone would have a personal copy stored on computer. There is no need to print it out on paper because it will be stored electronically and can be referenced whenever it is convenient. As employees acknowledge receipt of the policy via e-mail, the HR department knows they 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 their costs of doing business. The **transaction cost theory** supports the idea that through technology businesses can reduce their costs of processing transactions with the same emphasis and zeal that they try to reduce their production costs.

We mentioned earlier that many of the job cuts taking place in businesses are now affecting white-collar, managerial positions. That follows the **agency theory** of economic impacts brought on by information systems. Now one manager can oversee ten employees (agents) rather than four employees because information is cheaper and easier to disseminate.

Organizational and Behavioral Impacts

IT Flattens Organizations

Rather than five layers of management in an organization, information technology allows companies to flatten the layers to three, maybe even two. Here’s how:

- IT pushes decision-making rights lower in the organization because lower-level employees receive the information they need to make decisions without supervision.
- Managers now receive so much more accurate information on time, they become much faster at marking decisions, so fewer managers are required.
- Management costs decline as a percentage of revenues, and the hierarchy becomes much more efficient.

Postindustrial Organizations

Postindustrial theories also support the notion that IT should flatten hierarchies. Here's why:

- Professional workers tend to be self-managing, and decision making should become more decentralized as knowledge and information become more widespread throughout the firm.
- IT may encourage task force-networked organizations in which groups of professionals come together – face to face or electronically – for short periods of time to accomplish a specific task; once the task is accomplished, the individuals join other task forces.

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, decide on 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've previously discussed, 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 to this method would be the fact that the decision-making process of this committee can be pushed to lower levels and management can check progress electronically. Perhaps the managers wouldn't be as concerned about delegating responsibility because they can keep an eye on the committee throughout the process and monitor its progress easier. 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.

Understanding Organizational Resistance to Change

Information systems are closely intertwined with an organization's structure, culture, and business processes. New systems disrupt established patterns of work and power relationships, so there is often considerable resistance to them when they are introduced. The complex relationship between information systems, organizational performance, and decision making must be carefully managed.

Technology doesn't automatically transform organizations. There is no magic wand companies can wave that will solve all their problems just because they installed the latest information system.

People using technology efficiently and effectively, however, can transform organizations. Technology can enhance communications up and down the organization and from one department to another on the same managerial level. As our dress code policy example shows, communications are much faster and better using technology. The lines of communication are shorter, clearer, and more concise.

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 political status symbol is how much information a person has access to.

The Internet and Organizations

The example used earlier of posting personnel policies to the company intranet is just 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 that allows transaction processing between businesses at much cheaper costs and provides an easy-to-use interface. The innovative ways organizations are using the Internet, intranets, and extranets to improve their business processes and lower costs is simply fascinating.

Even government bureaucracies are getting into the act. The U.S. Post Office is facing a severe threat to its core business. More and more businesses and individuals are turning to e-mail and the Web to correspond with each other.
As e-mail continues to grow as a substitute for "snail mail," the Post Office must find innovative ways of using the Internet to gain new business. It's doing so by selling postage on the Internet, and it now offers electronic bill-paying services. Companies can send bills to their customers electronically and individuals and businesses can pay all their bills over the new Internet-based service.

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 organization's people who will make or break it. Remember the triangle introduced in Chapter 1, 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.

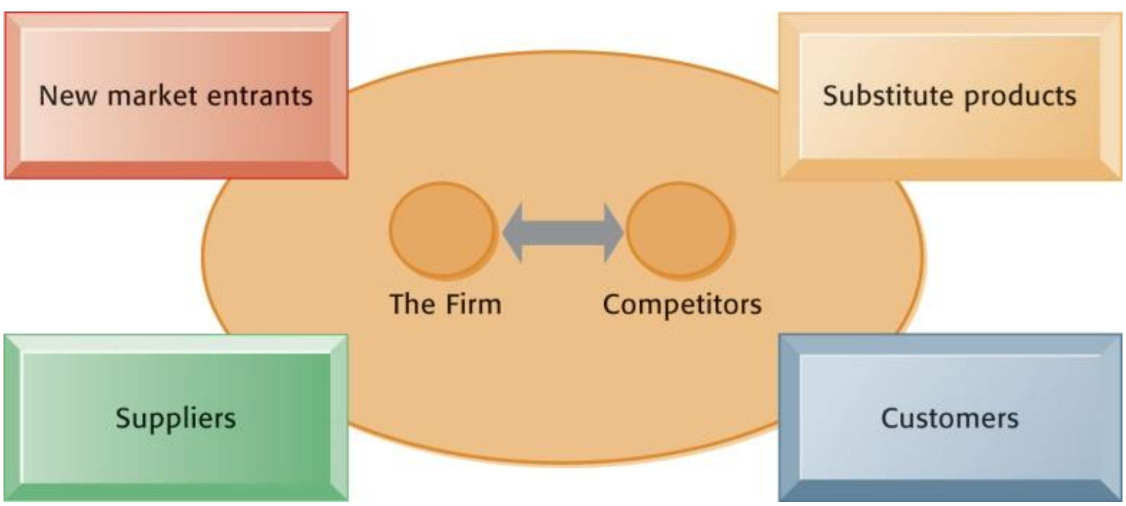
3.3 Using Information Systems to Achieve Competitive Advantage

Google, Amazon, e-Bay–the giants of the Internet. They are successful and make loads of money. They could easily rest on their laurels, kick back, and relax. If they are so successful, why do they keep working so hard to continually introduce new products and services and improve the old ones? Because someone, somewhere, is trying to take their place and become the new giant. These companies must constantly work to keep their competitive advantage and they are using information systems to do so.

Porter's Competitive Forces Model

Porter's **competitive forces model** contends that much of the success or failure of a business depends on its ability to respond to its external environment. Figure 8 shows four external forces that every business must contend with at one time or another.

Figure 8: Porter's Competitive Forces Model.



Source: (Laudon and Laudon, 2010:122)

It's important to understand from this model that a firm's success is not predicated on how well it does internally. It must also pay attention to:

- **Traditional competitors:** always nipping at your heals with new products and services trying to steal your customers.
- **New market entrants:** not constrained by traditional ways of producing goods and services, they can easily jump into your markets and lure customers away with cheaper or better products and services.
- **Substitute products and services:** customers may be willing to try substitute products and services if they decide your price is too high or the quality of your products and services is too low.
- **Customers:** fickle to say the least, they are now armed with new information resources that make it easier for them to jump to your competitors, new market entrants, or substitute products.
- **Suppliers:** the number of suppliers used may determine how easy or difficult your business will have in controlling your supply chain. Too few suppliers and you lose a lot of control.

Information System Strategies for Dealing with Competitive Forces

Many companies have found that effective and efficient information systems allow them to deal with external forces in one of four ways: low-cost leadership, product differentiation, focus on market niche, and strengthen customer and supplier intimacy.

Low-Cost Leadership

By using information systems to lower your operational costs you can lower your prices. That will make it difficult for traditional competitors and new market entrants to match your prices. This strategy works best with commodities such as computers or with household products retailers such as Wal-Mart.

Efficient customer response systems provide a company and its suppliers with an integrated view of customers. These systems provide instantaneous information to the company and its suppliers. Every staff member can have access to the information in the system to help reduce costs and prices well below that of the competition. Processes such as supply replenishment are automated between companies and suppliers. When products reach a certain re-order point, the system automatically sends a message to the supplier who can quickly send out new stock. These systems help companies achieve low-cost leadership in their industry.

Product Differentiation

A very effective use of strategic information systems is to create products or services that are so different that they create barriers for the competition. Product differentiation is at the heart of Apple Computer's success. Sure it make computers. But the company gets away with charging a premium price because it differentiates its products from all others. Competitors, like Hewlett-Packard and IBM, have tried to duplicate Apple's strategic business model but have not been quite as successful.

Apple uses product differentiation to help market its iPod and online music system to a broad swath of the population and create barriers that its competitors are having difficulty overcoming. People like to feel that they are unique individuals with their own needs and desires. One of the best strategies for dealing with competitors is to offer customers exactly what they want, when they want it, and how they want it. The Internet provides a new outlet for **mass customization** by allowing customers to order one-of-a-kind products.

For instance, by visiting the Ping Golf Club Web site, an individual can step through a series of pages that will help design golf clubs to fit her. The customer answers questions on the site about her height, arm length, hand size, and level of play. The site then advises her on the exact type of club that best fits her needs and provides all of the information necessary to order the clubs. Once ordered, Ping can produce the product in a matter of hours and use a shipping partner to deliver the clubs in less than five days. The individual feels special and Ping has gained a new customer.

Focus on Market Niche

If an organization is in a fiercely competitive market, it can choose to focus on a very narrow segment of the market rather than a broad general audience. A firm can gather very specific information about its customers using data mining techniques. Then it creates a focused differentiation business strategy to market directly to those consumers. Being able to address the needs and wants of a very small market segment is why companies are so intent on gathering consumer information from a variety of sources.

Apple Computer uses focused differentiation to help sell its computers to a narrow target market of graphic designers and educators rather than the general population of computer users.

Strengthen Customer and Supplier Intimacy

Supply chain management (SCM) systems increase supplier intimacy while customer relationship management systems increase customer intimacy. SCM systems create immense **switching costs** between a company and its suppliers because of the investment of hardware and software necessary to make the system successful. Customer relationship management systems allow companies to learn details about customers that give them the competitive advantage over traditional competitors and new market entrants.

Implementing these competitive strategies requires precise coordination of people, technology and the organization. A company can pursue one or more of these strategies but cannot isolate any of the three dimensions of an information system. They must all work in concert together to have any hope of success.

The Internet's Impact on Competitive Advantage

Try to think of one industry that has not been touched by the Internet. Its impact on Porter's Competitive Forces Model is apparent from entertainment to retail to travel to financial services.

The Internet allows traditional competitors to introduce new products and services and lure customers away. It provides a low cost avenue for new market entrants. Consumers can easily and quickly find substitute products and services through the Internet. Customers can use information provided on the Internet to create new competition between companies while suppliers can increase their market power. Table 3 summarizes the impact the Internet is having on many industries.

Not all of the news is bad though. The Internet provides new opportunities for companies to increase their customers and markets while reducing their costs. The companies we first mentioned in this section, Google, Amazon, and e-Bay are continually creating new products and services through the Internet. They are successful because they use their strategic competitive forces information systems to continually improve their competitive advantage.

Table 3: Impact of the Internet on Competitive Forces

COMPETITIVE FORCE	IMPACT OF THE INTERNET
Substitute products or services	Enables new substitutes to emerge with new approaches to meeting needs and performing functions
Customers' bargaining power	Availability of global price and product information shifts bargaining power to customers
Suppliers' bargaining power	Procurement over the Internet tends to raise bargaining power over suppliers; suppliers can also benefit from reduced barriers to entry and from the elimination of distributors and other intermediaries standing between them and their users
Threat of new entrants	The Internet reduces barriers to entry, such as the need for a sales force, access to channels, and physical assets; it provides a technology for driving business processes that makes other things easier to do
Positioning and rivalry among existing competitors	Widens the geographic market, increasing the number of competitors, and reducing differences among competitors; makes it more difficult to sustain operational advantages; puts pressure to compete on price

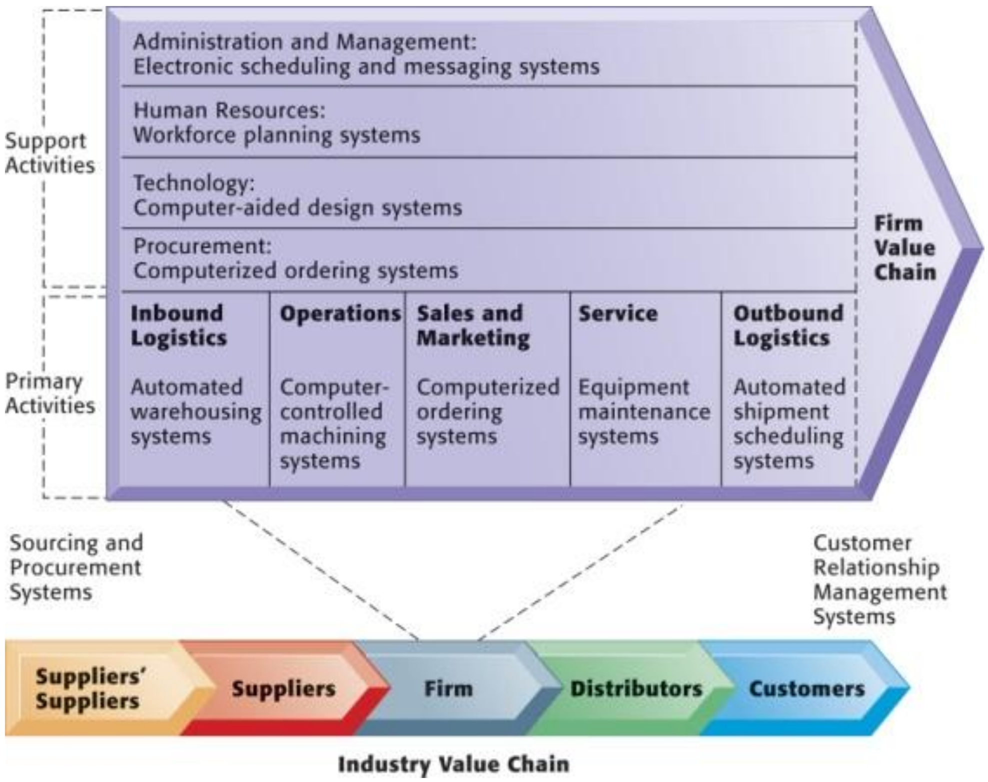
Source: (Laudon and Laudon, 2010:130)

Of course the Internet has turned many traditional management practices to dust. Customers have access to much more information and data than they ever did before. They can compare product prices across hundreds of companies with a few clicks. Before the Internet, customers may have had access to a limited number of retailers. Through the Internet, they now have access to hundreds of retailers open 24 hours a day. Once retailers had only local competition. Now they have to compete with other retailers located halfway around the world.

The Business Value Chain Model

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 in producing the product, getting it to the stores, and making the customer happy. Remember the WorldWide Candy Corporation from Chapter 2? 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 commercials you see? These are **primary activities.** Just as important are **support activities:** human resources, accounting, and finance. These functions support the primary functions of production, shipping, and sales and marketing. The **value chain model** shown in Figure 9 below will help an organization focus on these activities and determine where to focus their efforts the most.

Figure 9: The Value Chain Model.



Source: (Laudon and Laudon, 2010:131)

By effectively using an information system in a strategic role at any, or preferably all, levels of the organization, a digital firm can provide more value in their products than the competition. If they can't provide more value, then the strategic information system should help them provide the same value but at a lower price.

Benchmarking provides a way for businesses to determine how they stand up against their competitors within the same industry. For instance, if the industry standard in producing golf clubs is ten days, Ping can benchmark their production schedule of five days and determine that they are more successful than their competitors. They can also research the **best practices** of other golf club manufacturers and decide if they should fine tune their business processes to wring even more resources from the production process.

Information to formulate benchmarks and best practices can come from internal sources, other companies within the same industry, external industries, university research units, or the government.

Extending the Value Chain: The Value Web

More and more companies are incorporating the Internet in their business strategies through the use of **value webs** – Figure 10. Ford Motor Company is forming many partnerships and alliances via the Web to offer services and products that otherwise would be too difficult, costly, or time-consuming.

> "Suppliers are an integral part of our business, and our success is interdependent with theirs. We rely on more than 2,000 production suppliers to provide many of the parts that are assembled into Ford vehicles. Another 9,000 suppliers provide a wide range of nonproduction goods and services, from production equipment to computers to advertising." (Ford.com Web site)

Ford is using value webs to connect itself, suppliers, and business partners and share best practices so that each participant can improve its business processes. That in turn lowers supply costs for Ford and ensures a certain level of standardization through the manufacturing process. Suppliers can collaborate with each other via the value web to enhance their core competencies and improve the entire supply chain. Sharing information through the value web helps not just Ford but the entire vehicle manufacturing industry.

SELF CHECK QUESTION 3.2

What is a strategic information system? What is the difference between a strategic information system and a strategic-level system?

(Answers at the end of this Section)

Figure 10: The Value Web

Source: (Laudon and Laudon, 2010:133)

Synergies, Core Competencies, and Network-Based Strategies

Very seldom will you find a business that provides all of its own services, supplies, and processes throughout the entire chain. It isn't practical or efficient to do so. Almost every business relies on partnerships with other companies to produce goods and services. The most successful companies will determine the best synergies, core competencies and network-based strategies to reduce costs, improve products and services, and increase profits.

Synergies

AOL has provided dial-up Internet access for consumers and businesses since the early 1990s. In addition to providing Internet access it also creates specific content that is available only to its customers. The last few years has seen a huge increase in the demand for broadband access by customers across the U.S. AOL simply doesn't have the necessary infrastructure to provide what its customers want. But other telecommunications companies such as BellSouth and Verizon can help AOL answer the demand through their networks. AOL, in synergy with the other companies can now provide the services customers want.

> "David Scobey, President of BellSouth's Retail Markets, said, "This new relationship will make it easier for loyal AOL consumers to get all the benefits of BellSouth DSL without losing their AOL service. We think this promotion offers a compelling reason for AOL members to move to broadband." (www.timewarner.com Web site)

In early 2006, two telecommunication industry giants, Verizon and MCI, announced a partnership that will provide new services to large corporations and governments.

> "Verizon has joined forces with MCI to form Verizon Business, a leading provider of advanced communications services for large businesses, government, and international organizations. The vision: To create one truly seamless, local-to-global IP network. One that works alongside one of the world's most reliable wireless networks, providing your business with every piece of the solution you need, including the most important one of all: people.
>
> Consumers and small businesses will also benefit from combining MCI's world-class Internet backbone with Verizon's broadband offerings, providing opportunities to advance our broadband services and keep pace with the increasing demands of the multimedia marketplace." (www.verizon.com)

Both companies have superior services. However, it would have been impossible for either company to alone provide the new service. Rather than forego the opportunity altogether, they combined their synergies to create new services for customers.

Enhancing Core Competencies

Why did Ford Motor Company form an alliance with UPS instead of continuing its long-time practice of delivering vehicles to dealers itself? Because Ford wanted to concentrate on its **core competency** of manufacturing vehicles and let UPS concentrate on its **core competency** of delivering products.

> UPSLogistics' Web site says "By shaving four days off the delivery cycle and reengineering the network, Ford is realizing a $1 billion dollar reduction in vehicle inventory and more than $125 million in inventory carrying-cost reductions on an annualized basis. 'The savings will continue to grow as our precision, Web-enabled system reaches maturity and we surface and eliminate more non-value-added activities,' said Taylor. Ford and UPS Logistics Group launched the alliance a year ago to reengineer Ford's vehicle delivery system amid rising consumer demand for on-time vehicle delivery. UPS Logistics Group created UPS Autogistics as a business unit to manage the project. 'With a single network manager in place to analyze any potential problems before they occur, we've managed to avoid bottlenecks, reduce the amount of assets in the supply chain, and cut inventory carrying costs,' said Tom Kolakowski, manager of Ford North American Vehicle Logistics."

Network-Based Strategies

It's long been known in the economics field that the economics of manufacturing produces a diminishing return on investment at some point in time. But in **network economics** the opposite is true.

For example, you have a small company with 15 employees operating on a client/server network. You've already paid for the server that supports 25 employees. When you hire the 16th employee, you won't have to spend much money, if any, to support the new employee on the network. You're actually increasing the server's output without an associated increase in cost.

Technology makes **virtual companies** more feasible, cheaper, and easier to set up and tear down than before.
The Boeing Company, manufacturer of airplanes, uses virtual organizations throughout its design and manufacturing processes. It contracts with other businesses for certain types of work such as the development of new seat configurations. When the process is completed, the outside vendor is released from the job.

As more companies outsource work to other vendors, virtual companies are becoming the norm. Network technologies based on Internet standards provide the infrastructure necessary to make them successful. Companies are no longer tied to suppliers and business partners located in specific geographical areas but can find the best service provider or business partner around the world.

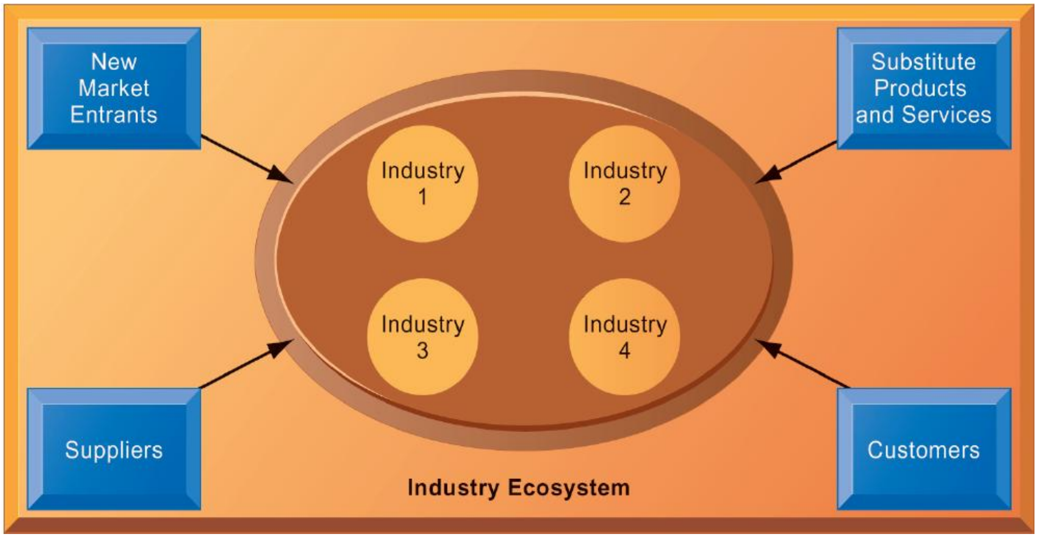
Ford Motor Company, General Motors, and DaimlerChrysler rocked the automotive industry when they announced their joint venture Covisint. The three leading competitors in this industry were joining forces to create a single Internet source for all the suppliers that served the three corporations. The Big Three automotive manufacturers became the keystone firms that created a platform used by all the niche firms that supply them. The entire network is a **business ecosystem (**Figure 11**)** for the industry. The idea is to drive down the cost of supplies and make the entire industry more efficient. While things haven't gone as smoothly as originally hoped for, the idea has been planted and is now spreading to other industries.

SELF CHECK QUESTION 3.3

How have the value chain and competitive forces models changed as a result of the Internet and the emergence of digital firms?

(Answers at the end of this Section)

Figure 11: An Ecosystem Strategic Model



Source: (Laudon and Laudon, 2010:136)

3.4 Using Systems for Competitive Advantage: Management Issues

Strategic information systems often change the organization as well as its products, services, and operating procedures, driving the organization into new behavioral patterns. Successfully using information systems to achieve a competitive advantage is challenging and requires precise coordination of technology, organizations, and management.

Sustaining Competitive Advantage

Using information systems to beat the competition and increase the value of a product is not easy. Because competitors can quickly copy strategic systems, competitive advantage is not always sustainable. Sustaining a competitive advantage constantly requires changing processes and methods of conducting business. Managers simply cannot rest on their laurels with today's fast paced, fast changing technological advances. Technology changes much faster than organizations can adapt. As soon as employees and managers become comfortable with a particular system, it's almost time to make some more changes.

Aligning IT with Business Objectives

Unfortunately the success rates for companies aligning IT initiatives with their business objectives isn't that good. Too many times failures are directly attributable to people not understanding information technology as well as they should and simply trying to ignore it for as long as they can.

Performing a Strategic Systems Analysis

Completing a strategic systems analysis is one of the first steps managers should take to help determine how they can use information systems to gain a competitive advantage. Ask yourself these questions about your own firm:

1. What is the structure of the industry in which your firm is located?
2. What are the business, firm, and industry value chains for your firm?
3. Have you aligned IT with your business strategy and goals?

Managing Strategic Transitions

A vital attribute of any manager's success is the ability to adapt to change. The pace of technological change is at its highest level ever. With each advance, the organization must use **strategic transitions,** a movement between levels of socio-technical systems, to its advantage. Making changes in the information systems should trigger a review of associated processes to make sure they are in sync. Teaming up with competitors may seem at odds with wanting to beat the competition, but in fact may be the smartest thing to do. Technological changes allow you to do both without sacrificing too much.

As we continue through the book, you should keep in mind how organizations are structured, how information needs vary from one organization to another, and how information systems can enhance or detract the characteristics of an organization. The most important thing you should remember is that at the core of every organization are people.

CASE STUDY

Read the “Can Detroit make the cars customers want?” Case Study on Page 128 of the text book and answer the questions that follow

(*Answers at the end of this Section*)

SUGGESTED ANSWERS TO SELF-CHECK QUESTIONS

3.1 What is an organization? Compare the technical definition of organization with the behavioural definition.

The technical definition for an organization defines an organization as a stable, formal social structure that takes resources from the environment and processes them to produce outputs. The technical definition of an organization focuses on three elements: capital and labor, production, and products for consumption. The technical definition also implies that organizations are more stable than an informal group, are formal legal entities, and are social structures.

The behavioral definition states that an organization is a collection of rights, privileges, obligations, and responsibilities that are delicately balanced over a period of time through conflict and conflict resolution. This definition highlights the people within the organization, their ways of working, and their relationships.

The technical definition shows us how a firm combines capital, labor, and information technology. The behavioral definition examines how information technology impacts the inner workings of the organization. The behavioral definition is the more realistic of the two.

3.2 What is a strategic information system? What is the difference between a strategic information system and a strategic-level system?

A strategic information system is a computer system at any organizational level that fundamentally changes the goals, operations, products, services, or environmental relationships of organizations, in effect changing the very nature of the firm's business. In contrast, strategic-level systems provide long-term planning information to senior executives. Strategic information systems are more far-reaching and deeply rooted, and fundamentally transform the organization itself.

3.3 How have the value chain and competitive forces models changed as a result of the Internet and the emergence of digital firms?

Internet technology has enabled a firm to extend the concept of its value chain to include all of the firm's suppliers and business partners into a single Web. The main reason for this is that the Internet greatly reduces the cost of connecting online with partners. This enables companies to work directly with companies around the world and with companies too small to build their own international network. The same is true with digital firms because they essentially exist mainly because they can operate over the Net.

Similarly, because of the Internet and digital firms, corporations find it cheaper and easier to relate to suppliers and customers, enabling the company to meet the competitive problem identified using the competitive forces model. The competitive forces model has also changed in the Internet era because firms do not just compete with each other within the same industry; they compete as part of industry sets.

ANSWERS - CASE STUDY

1. **Why is AutoNation having a problem with its inventory?**

   AutoNation is fighting an entrenched tradition that dates back to the beginning of the auto industry. The entire industry is geared towards optimizing the factory and production processes to meet the needs of the industry instead of customers. They never had to worry much about new market entrants, substitute products, or even customer intimacy. That mindset needs to change because the Internet has empowered customers and given them access to all kinds of information not previously available. AutoNation understands the necessity of changing business strategies but will the Big Three (GM, Ford, and Chrysler) get it? AutoNation is battling a hundred years of tradition.

   Why is this also a problem for auto manufacturers such as GM, Ford, and Chrysler?

   In the 1980s, new market entrants from foreign companies, Toyota, Nissan, Mitsubishi, began exerting pressure on the Big Three U.S. manufacturers. The Internet helped customers begin exerting their influence through access to information. The Big Three are now having to change their business strategies, albeit very slowly.

   How is this problem impacting the business performance of AutoNation and of the auto manufacturers?

   The increasing influence being exerted by the two competitive forces—new market entrants and customers—is pressuring AutoNation and manufacturers to alter their business strategies. AutoNation must develop ways to strengthen its customer intimacy in order to remain competitive. Manufacturers need to change their focus from employees to customers.

2. **What pieces of data do AutoNation need to determine what cars to stock in each of its dealerships?**

   AutoNation has begun focusing on the customer by collecting marketing data and implementing mass customization techniques for its direct mail campaigns. It needs to collect demographic data like income levels, ages, occupations, family configurations, and recreational interests of its customers to understand the types of vehicles people are most likely to buy. With the oil crisis of 2008 causing gasoline prices to rise above $4 a gallon, it may be helpful for AutoNation to collect external data about driving habits.

How can it obtain these data?

AutoNation can use its own marketing databases and data from its Web site coupled with external databases from the U.S. Census Bureau, local Chambers of Commerce, industry-specific research, and national retail organizations. By marrying internal and external data it can obtain a consolidated view of customers configured for each locale in which it does business.

3. What is AutoNation's solution to its problem?

AutoNation is already gathering much of the data it needs and using data mining techniques to obtain information it can share with manufacturers to increase its customer intimacy. By jointly applying the data results, both AutoNation and the manufacturers can build products that satisfy customer needs and wants.

What obstacles must AutoNation overcome to implement its solution?

AutoNation must work with manufacturers to change the focus from optimizing production processes towards factories and workers to one of benefiting customers. AutoNation's attempts to integrate customer data with auto manufacturing processes flies in the face of a hundred years of tradition. AutoNation must also change entrenched attitudes prevalent with auto executives, as shown by LaNeve's lack of concern about inventory levels and his impression that the industry is not in crisis. It is!

How effective will the solution be?

Answers will vary but should incorporate elements of Porter's Competitive Forces Model.

Chapter 4

Ethical and Social Issues in Information Systems

After completing this chapter, students should be able to answer the following questions:

- What ethical, social, and political issues are raised by information systems?
- What specific principles for conduct can be used to guide ethical decisions?
- Why do contemporary information systems technology and the Internet pose challenges to the protection of individual privacy and intellectual property?
- How have information systems affected everyday life?

Introduction

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.

4.1 Understanding Ethical and Social Issues Related to Systems

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, have the Web site greet you by name, and supply you with 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 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 15^{th}, wear a size 10 dress, live in a small two-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 and more 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 ten 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.

Even though the Internet is about 40 years old and the World Wide Web is close to 15 years old, our society is just beginning to address the ethical issues and dilemmas raised by these technological advances. It's difficult to measure one person's **ethics** against another person's desire to make money or wreak havoc that's made much easier by the Internet. The U.S. government is just beginning to pass laws against cybercrimes but it's difficult to stay one step ahead of the cybercriminals.

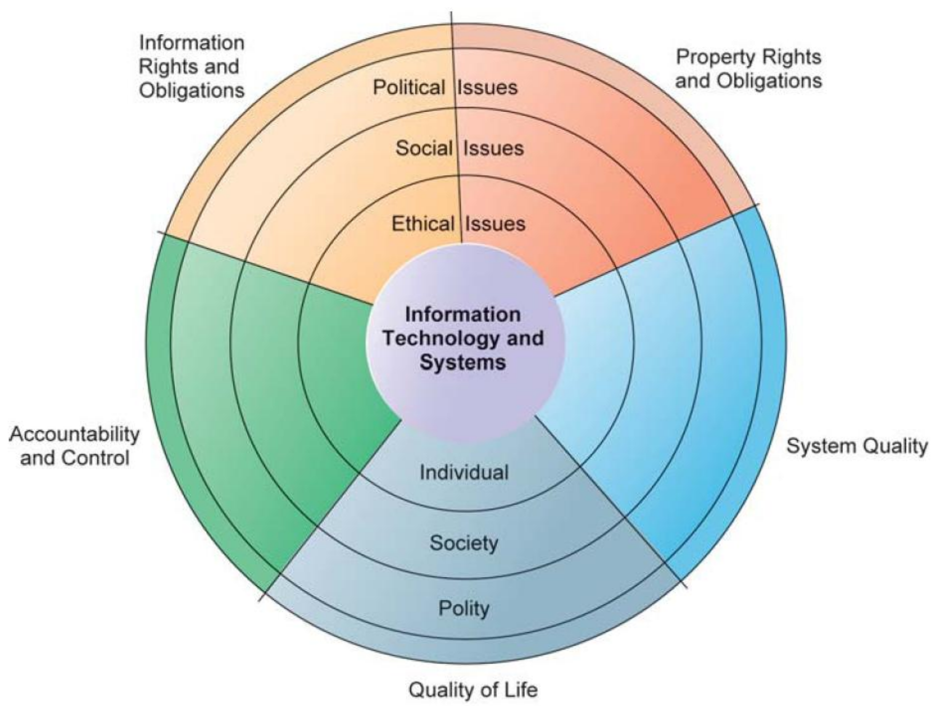
A Model for Thinking About Ethical, Social, and Political Issues

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 'gray area.'"

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. Figure 12 depicts the relationship between ethical, social and political issues.

Figure 12: Relationship between ethical, social, and political issues in an information society



Source: (Laudon and Laudon, 2010:153)

Understanding Ethical and Social Issues Related to Systems

You may love the idea that a gardening Web site or a mail order catalogue 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, have the Web site greet you by name, and supply you with information about a book or CD by your favourite author or artist.

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How you act, individually and as groups, in this grey 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.

SELF CHECK QUESTION 4.1

In what ways are ethical, social, and political issues connected?
Give some examples. *(Answers at the end of this Section)*

4.2 Ethics in an Information Society

Did you ever hear the old warning: "Just because you can, does not mean you should?" Well, a lot of things are possible on the Internet nowadays, but that does not mean you should do them.
Ethics is easily managed in small groups because the group itself tends to control the individual's behaviour. It is referred to as "self-policing." The larger the group, the harder it is to manage the actions of individuals. Now stretch that to a huge number of people with many frames of reference and experiences.

Responsibility to the group becomes harder to police and accountability for an individual's actions is harder to enforce.

Basic Concepts: Responsibility, Accountability, and Liability

Every action causes a reaction. When you are using the Internet, computers on campus, or your employer's computer, you should be aware of the following:

- **Responsibility:** accepting potential costs, duties, and obligations for your decisions
- **Accountability:** determining who should take responsibility for decisions and actions
- **Liability:** legally placing responsibility with a person or group
- **Due Process:** ensuring the laws are applied fairly and correctly

Responsibility, accountability, and liability are all yours when it comes to your actions in cyberspace. Every Internet Service Provider has a "usage policy," even the so-called anonymous e-mailers that hide your real identity. Hotmail is a popular Internet e-mail service that allows you to mask your real identity. You could send out all the, shall we say unethical, threatening, nasty, aberrant, e-mail you like. You think: “Hey, no one will really know who I am. This is cool."

And then here comes the message from Hotmail to cease and desist. Your free e-mail account is cancelled because you violated Hotmail's usage policy. Then your local Internet Service Provider contacts you and tells you are terminated, baby! You violated its usage policy by your actions. By now you are really mad, not to mention embarrassed (at least we hope so). It is true. It happens.

"Using information technology in a socially responsible manner means that you can and will be held accountable for the consequences of your actions." Some people seem to absolve themselves of responsibility by putting the onus on the computer - "Hey, the computer messed up," or "Since it was an anonymous username I did not think I'd get caught." It just does not work that way in society – face-to-face or on the Internet. No one can hide behind the technology. Humans control the computers, not the other way around.
And if you have received threatening, aberrant e-mails or flames in chat room or discussion groups, and haven't reported them according to the usage policies, you may be as much a part of the problem as the perpetrator!

? THINK POINT

Think of instances where you have witnessed unethical behaviour regarding the use of technology in your organisation.

Candidate Ethical Principles
It is safe to say you will find yourself in situations where your ethics are challenged. What should you do? Try the following:

- Separate fact from fiction.
- Remember, no matter how thin you slice it, there's always two sides.
- Determine who's really involved.
- Compromise; it does not always have to be an "either-or" outcome.
- Anticipate the outcome; it will help you devise better solutions.

You should study the ethical principles outlined in the text, as we will be incorporating them into the discussions throughout the remainder of this chapter.

Some Real-World Ethical Dilemmas
Individuals, companies and corporations are being forced to deal with these new ethical and social issues in ways never before imagined. Employ the ethical analysis we just discussed to the real-world situations presented here and in the text.

No issue has been harder for organizations to deal with than that of e-mail. Should companies be allowed to read employees' e-mails, especially if they are personal? Should employees be allowed to send personal e-mails to begin with? Should e-mails be used against a person or company in a court of law, and how? A recent example of this issue is the Microsoft versus Department of Justice antitrust trial. Many e-mails written by Microsoft's executives have been used against them. E-mails are not as anonymous as people think – "Sending an e-mail message is more like sending a postcard than sending a sealed envelope."(CNN Headline News, April 28, 1996).

So in your opinion, what is right? Is it okay for an employee to download the latest picture from Playgirl's Web site and use it as a screensaver? Is it okay to run a personal commercial Web site from your workplace computer using the company's computer resources? Is it okay to e-mail discriminatory jokes over the company’s network that would not be allowed over the water cooler? Is it okay to send e-mail telling everyone that the boss is a jerk, then get mad when the company fires you?

Is it okay for the company to use technology to monitor your computer usage every minute you are on the job? Is it okay for the company to use technology to monitor your keystrokes so they can determine how much work you are doing? Is it okay for you to use the company's computers and networks to surf Macy's Web site and order the latest fashions during your lunch break? Should a company be allowed to remove Solitaire from employee computers?

What if Ester is using her computer to surf gardening Web sites three hours a day while you have to do her work? What if Joe and Sipho play the newest Internet game during their coffee break every morning and afternoon, which bogs down the entire company's network?
What is the best way for companies and employees to handle these situations? What is the right thing to do?

4.3 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 the Internet Age
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.

SELF CHECK QUESTION 4.2

Name and describe four "quality of life" impacts of computers and information systems
(Answers at the end of this Section)

Internet Challenges to Privacy
Technical Solutions
According to South African law you must inform someone if you are taping a telephone conversation with him or her. On the other hand, you can legally record that person's Internet transmissions without any need to inform them you are doing so. This type of disparity exists because our laws have not kept up with emerging technologies. There are some tools that can help you block someone from tracing your Internet activities as the text discusses. However, if you use your company's computers for most of your Web-browsing or e-mail activities, you may want to check with your Information Technology department before you install the tools.

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 at creating a

product of value based on their experiences, knowledge, and education. In short, intellectual property is brainpower.

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 does not need to carry the copyright symbol © in order for it to be protected. Copyright laws and intellectual property rights cannot be violated on the Internet any more than they can in other mediums. While this is not 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 therefore be okay to use it however you want. The question you should be asking yourself is, "Is it ethically right and legal?"

The Business Software Alliance (BSA) is an organization working to prevent software piracy and the illegal use of copyrighted material around the world. And do not think the problem is limited to the 17-year old computer wizard locked in his bedroom. This crime can be committed by anyone, as this news clip shows:

> *Seventeen high-tech professionals were indicted on federal charges for participating in an Internet piracy ring that hijacked software worth more than $1 million. The government said 12 of those indicted are members of an underground organization while the five others are employees of Intel Corp. The individuals indicted were charged with conspiracy to infringe on copyrights, which carries a maximum sentence of five years in prison, a $250,000 fine and restitution.* (AP Newswire, May 5, 2000)

Perhaps the most notorious copyright infringement and intellectual property case in 2000 and 2001 involved the music industry. MP3, one of the most popular methods of illegally downloading music from Web sites, lost a court battle waged by the music industry. MP3 was forced to pay millions of dollars to the industry for lost revenues. The rock group Metallic sued Napster.com because it was allowing people to trade copyrighted material illegally. Napster.com lost that battle and is now trying to help the music industry devise a method of charging for downloaded music. So before you copy your favourite sound clip, remember you are actually stealing someone else's property as surely as if you walked into that person's home and took the CD.

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 1900's, and some simply do not make sense in this day and age. That is what we were referring to in the opening paragraphs of this lecture 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.

Computer crime is one area that has been extremely hard for our society and our governments to keep up with the rapid change. 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. We spoke earlier about anonymity not being a license for socially unacceptable behaviour. 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.

Other Issues

As managers, you should be acutely aware of the health issues caused by computer usage, especially **repetitive stress injury (RSI)**. Why? Because these health issues costs businesses huge amounts of money each year in medical treatment claims and lost productivity. **Carpal tunnel syndrome**, a subset of RSI, is the most serious health issue plaguing businesses. **Computer vision syndrome** is increasing as people continually use computer screens and handheld devices that strain eyesight.

It does not 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 is 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 have heard of road rage, the anger people experience when driving. We are now experiencing road rage on the Information Superhighway, and it is called **techno stress.** Managers should encourage their employees to take frequent breaks from their computers and to recognize and understand the dangers of isolation from humans. 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 Employee Conduct for Computing in today's workplace.

Some corporations are confused about what to include and how to approach this new dilemma. 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 won't go away and will only continue to grow. If you work for a company that does not have a policy, you should encourage it to establish one immediately. If you are a manager in a company, you should get busy and establish a policy for your employees – it is the only fair thing to do.

? THINK POINT

Does your organisation have a code of ethics? If not, what are some of the rules that you would include regarding the use of technology?

CASE STUDY

Read the "Should Google Organize your Medical Records?" Case Study from Page 184 of the text book and answer the questions that follow

(*Answers at the end of this Section*)

SUGGESTED ANSWERS TO SELF-CHECK QUESTIONS

4.1 In what ways are ethical, social, and political issues connected? Give some examples

Ethics refers to principles of right and wrong that individuals use to guide their behavior. Individuals act within a social environment that, in turn, exists within a political environment. Ethical dilemmas are problems that affect society and often are addressed in the political arena. For example, new computer technology makes it easier to gain private information about individuals, creating an ethical dilemma for the potential user of that information (whether or not to invade the privacy of the individual). Society will respond by demanding new laws to regulate the use of data. Students will be able to give a range of examples of this connection.

4.2 Name and describe four "quality of life" impacts of computers and information systems

The textbook describes nine "quality of life" impacts of computers and information systems. These include balancing power, rapidity of change, maintaining boundaries, dependency and vulnerability, computer crime and abuse, computer forensics, employment, equity and access, and health risks.

Balancing power describes the shift toward highly decentralized computing, coupled with an ideology of "empowerment" of thousands of workers and decentralization of decision making to lower organizational levels. The problem is that the lower-level worker involvement in decision making tends to be trivial. Key policy decisions are as centralized as in the past.
The rapidity of change impact suggests that information systems have increased the efficiency of the global marketplace. As a result, businesses no longer have many years to adjust to competition. Businesses can now be wiped out very rapidly, and along with them, jobs. The maintaining boundaries impact suggests that portable computers and telecommuting have created the condition where people can take their work anywhere with them and do it at any time. As a result, workers find that their work is cutting into family time, vacations, and leisure, weakening the traditional institutions of family and friends and blurring the line between public and private life.

The dependency and vulnerability impact suggests that businesses, governments, schools, and private associations are becoming more dependent on information systems, and so they are highly vulnerable to the failure of those systems.

The computer crime and abuse impact suggests that computers have created new opportunities for committing crimes and have themselves become the target of crimes. Computer forensics is the newest field and deals with recovering, storing, and handling data from computers as well as finding information in electronic data and presenting the information to a court.

The employment impact suggests that redesigning business processes could potentially cause millions of middle-level managers and clerical workers to lose their jobs. Worse, if reengineering actually works as claimed, these workers will not find similar employment because the demand for their skills will decline. The equity and access impact suggests that access to computer and information resources is not equitably distributed throughout society. Access is distributed inequitably along racial, economic, and social class lines (as are many other information resources). Poor children attending poor school districts are less likely to use computers at school. Children from wealthy homes are five times more likely to use PCs for schoolwork than poor children. Whites are three times more likely to use computers at home for schoolwork than African-Americans. Potentially, we could create a society of information haves and have-nots, further increasing the social cleavages in our society.

Health risks have been attributed to computers and information technologies. For instance, business now spends $20 billion a year to compensate and treat victims of computer-related occupational diseases. Those illnesses include RSI (repetitive stress injury), CVS (computer vision syndrome), and techno stress.

ANSWERS - CASE STUDY

1. **What concepts in the chapter are illustrated in this case? Who are the stakeholders in this case?**

   Chapter concepts illustrated in this case include:

   - Responsibility – accepting the potential costs, duties, and obligations for decisions. Google must assume the bulk of responsibility for securing the data and ensuring it's used only for authorized purposes.
   - Accountability – a feature of systems and social institutions: It means that mechanisms are in place to determine who took responsible action. Again, Google must ensure accountability of its systems and those responsible for creating and maintaining the system.
   - Liability – a feature of political systems in which a body of laws is in place that permits individuals to recover the damages done to them by other actors, systems, or organizations. Federal and state governments must pass and enforce laws protecting medical data and its uses. Google must assume liability for the system.

   Of the five moral dimensions discussed in the chapter, at least three play a major role in the proposed system:

   - Information rights and obligations
   - Accountability and control
   - System quality

   Stakeholders in this case include patients and health-care consumers, doctors and other medical professionals, insurance companies, health-care related businesses like pharmaceutical companies, governments, and storage providers like Google, Microsoft and Revolution Health Group.

2. **What are the problems with America's current medical recordkeeping system? How would electronic medical records alleviate these problems?**

   Current records are paper-based, making effective communications and access difficult. The current system for recording and storing medical information makes it difficult, if not impossible, to systematically examine and share the data. It's also very expensive and time-consuming to maintain paper-based medical records.

   Google's proposed electronic medical record system would allow consumers to enter their basic medical data into an online repository and invite doctors to send relevant information to Google electronically. One feature of the system will include a 'health profile' for medications, conditions, and allergies, reminder messages for prescription refills or doctor visits, directories for nearby doctors, and personalized health advice. The application will also be able to accept information from many different recordkeeping technologies currently in use by hospitals and other institutions. The intent of the system is to make patients' records easily accessible, especially in emergencies, and more complete and to streamline recordkeeping.

3. **What management, organization, and technology factors are most critical to the creation and development of electronic medical records?**

   Management: Electronic recordkeeping promises to reduce costs associated with maintaining health data. However, the upfront costs of implementation are daunting, especially to doctors who maintain their own practices. Managers would have to ensure data was not used for profiling patients or use the data to deny medical procedures. Managers would also have to ensure data was not misused for purposes other than what is intended.

   Organization: The new system promises to make data more organized and easier to retrieve. Organizations must ensure that data is not used for profiling and not used in the data analysis technology called nonobvious relationship awareness. Government, private, and non-profit organizations must pass new laws, similar to the HIPAA law, that provides adequate protection of consumer health data. That would help reassure patients and make them more likely to use the system.

   Technology: New systems must be able to mesh with other versions of medical record-keeping applications. The software must be created around universal standards making implementation easier and more efficient. Above all else, technology must be created to prevent security breaches. Systems must be available one-hundred percent of the time, especially to obtain medical information for emergency patients.

   All three factors must work together to prevent privacy invasions and ensure medical data is not misused or abused.

4. **What are the pros and cons of electronic patient records? Do you think the concerns over digitizing our medical records are valid? Why or why not?**

   Pros of electronic patient records include more efficient access and dissemination of medical data, especially in emergencies. The costs of gathering, storing, and disseminating medical data promise to be lower with electronic health records. Electronic health records stand to provide much-needed organization and efficiency to the healthcare industry. Proponents of electronic health records argue that computer technology, once fully implemented, would enhance security rather than threaten it.

   Cons of electronic patient records, first and foremost, include privacy concerns over how the data will be captured, stored, and used. Security breaches already occur with some medical data systems and Google's proposed system is subject to the same threats. People are worried that sensitive information legitimately accessible via electronic health records might lead to their losing health insurance or job opportunities.

5. **Should people entrust Google with their electronic medical records? Why or why not?**

   Student answers will vary according to how they view privacy, access to medical data, and lower costs. Some elements students should consider include:

   - Google's reassurances that its security is iron-tight and that businesses and individuals should have confidence in its ability to store and protect data.
   - Because Google hasn't provided much detail about its security practices, other business people maintain their concerns, "Businesses are hoping Google will pick the right tools to secure the infrastructure, but they have no assurances and no say in what it will pick."

6. **If you were in charge of designing an electronic medical recordkeeping system, what are some features you would include? What are features you would avoid?**

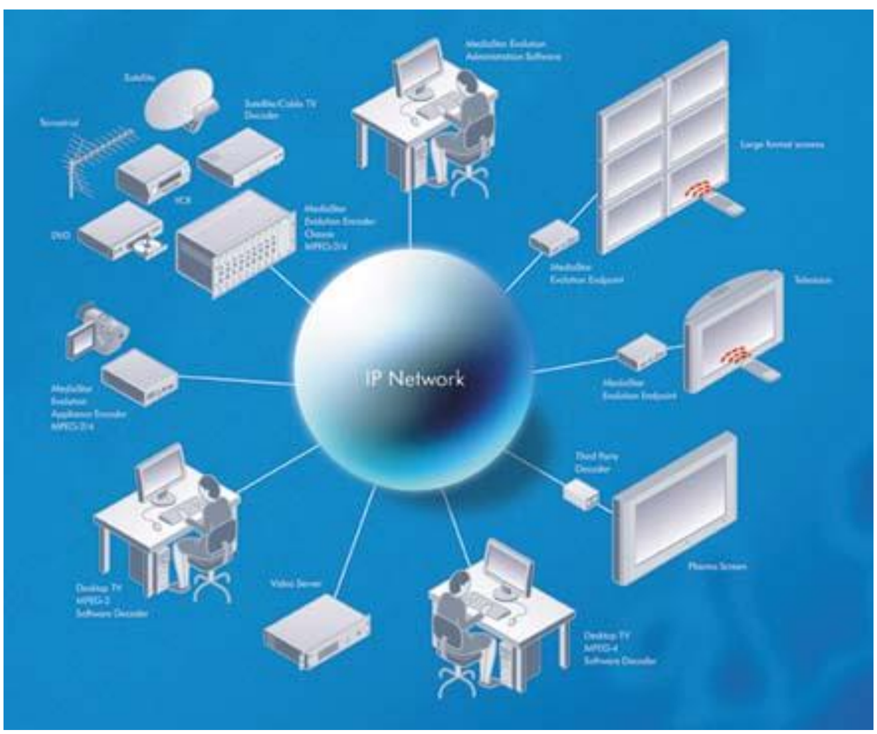
   Answers will vary based on students' exposure to security systems and electronic recordkeeping systems. Some features that should be included are security, universal standards for gathering, storing, and disseminating data, and universal standards for transmission technologies. Some features to avoid may include unrestricted access to data and unencrypted transmissions.

Chapter 5

IT Infrastructure and Emerging Technologies

After completing this chapter, students should be able to answer the following questions:

- What is IT infrastructure and what are its components?
- What are the stages and technology drivers of IT infrastructure evolution?
- What are the current trends in computer hardware platforms?
- What are the current trends in software platforms?
- What are the challenges of managing IT infrastructure and management solutions?



Introduction

As information becomes a valuable resource of a digital firm, the infrastructure used to care for it takes on added importance. We'll examine all of the components that comprise today's and tomorrow's IT infrastructure and how best to manage it.

5.1 IT Infrastructure

When you mention the phrase "information technology infrastructure," most people immediately think of just hardware and software. However, there is more to it than just those two. In fact, the most important and often most-ignored component is that of services. Integrating all three components forces a business to think in terms of the value of the whole and not just the parts. Including all three components in any discussion of IT infrastructure truly fits the cliché that the whole is greater than the sum of its parts.

Defining IT Infrastructure

If you define a firm's IT infrastructure in terms of *technology* you limit the discussion to the hardware and software components. By broadening the definition to that of *service-based*, you are then bringing into the discussion the services generated by the first two components. Also, you are including the *persware* element that we discussed in Chapter 1. As technology advances the types of hardware and software available, it becomes more critical for the firm to focus on the services that a firm can provide to its customers, suppliers, employees, and business partners.

To round out the list of IT infrastructure components you need to add the following services to computing hardware and software:

- Computing services: provide platforms that ensure a coherent digital environment
- Telecommunications services: determine appropriate data voice, and video that connect employees, customers, and suppliers
- Data management services: not just store, but manage massive amounts of corporate data and make it available for users to analyze
- Application software services: enterprise resource planning, customer relationship management, supply chain management and knowledge management systems
- Physical facilities management services: physical installation of computing, telecommunications, and data management services
- IT management services: plan and develop infrastructures, coordinate IT services among business units, account for IT expenditure, and provide project management services
- IT standards services: develop policies that ensure interoperability of all IT infrastructure components
- IT education services: train employees to properly use IT investments
- IT research and development services: research future IT projects and investments

SELF CHECK QUESTION 5.1

What is IT infrastructure and what are its components?

(Answers at the end of this Section)

Evolution of IT Infrastructure

Reviewing the evolution of corporate IT infrastructure offers some insight into where we may be headed. Figure 13 diagrams the stages in IT Infrastructure evolution.

- **General-purpose mainframe and minicomputer era (1959 – present):** the **mainframe** era began with highly centralized computing with networks of terminals concentrated in the computing department. While early models contained proprietary software and data, today's mainframes are able to process a wide variety of software and data. It's interesting to note that IBM began this era and remains the sole supplier of mainframe computing. While the experts and pundits predicted the death of mainframes in the mid 1980s, they have evolved and remain a strong, viable component in many IT infrastructures because of their ability to store and process huge amounts of data and transmissions. **Minicomputers** helped usher in the concept of decentralized computing.

- **Personal computer era (1981 to present):** it's interesting to note that the advances developed for personal computer in the home have given rise to much of the advances in corporate computing in the last 25 years. As the home user became more comfortable with using computers, and more applications were developed for personal computers, employees demanded increased use of computers in the workplace. While the **Wintel PC** standard has dominated this era, open-source software is starting to put a big dent into that stronghold.

- **Client/server era (1983 to present):** as the desktop and laptop personal computers became more powerful and cheaper, businesses began using them to replace mini-computers and some mainframe computers by networking them together. Think of an octopus, with the body representing the server and the tentacles representing the clients. At the heart of every network is a **server**. It can be a mainframe, midrange, minicomputer, workstation, or a souped-up personal computer. It's where some of the data, applications software, and other instructions are stored that network users need in order to communicate with and process transactions on the network. **Web servers**, as the name implies, provide Web pages to users. The **client** computer is the node on the network that users need to access and process transactions and data through the network. Rather than one server trying to do it all, each server is assigned a specific task on an

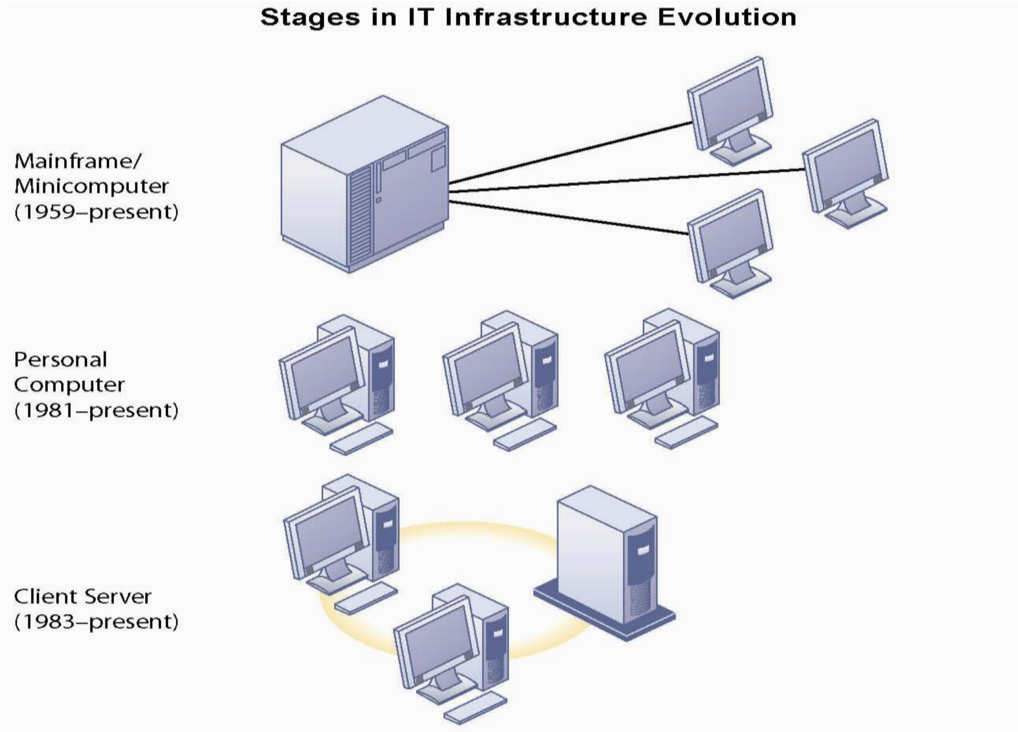
application server. Dividing tasks among multiple servers allows faster, more efficient responses that cost a business less to process than would a mainframe or one computer trying to do it all. Large companies use a **multitiered client/server architecture** that has several different levels of servers.

- **Enterprise Internet computing era (1992 to present):** Perhaps no other era has seen the explosive growth in functionality and popularity as this era. The problems created by proprietary, closed systems are being solved by the standards and open-source software created in this era. The promise of truly integrated hardware, software, and services is coming true with the technological advances in the last fifteen years. On the other hand, the promises of delivering critical business information painlessly and seamlessly across all organizational levels are made all the more difficult to meet because of the ever-changing landscape of technology products and services.

- **Cloud Computing era (2000 to Present):** It almost seems as though we've come full circle with the concept of cloud computing. This model of computing relies on the massive computing centers owned by the likes of Google, IBM, Microsoft, and even Amazon.com. "What is Google's cloud? It's a network made of hundreds of thousands, or by some estimates 1 million, cheap servers, each not much more powerful than the PCs we have in our homes. It stores staggering amounts of data, including numerous copies of the World Wide Web. This makes search faster, helping ferret out answers to billions of queries in a fraction of a second. Unlike many traditional supercomputers, Google's system never ages. When its individual pieces die, usually after about three years, engineers pluck them out and replace them with new, faster boxes. This means the cloud regenerates as it grows, almost like a living thing." (*Google and the Wisdom of Clouds*, BusinessWeek, Dec 24, 2007)

As you realize that each era built upon previous advances made in hardware, software, and services, let your imagination drift for a moment to the possibilities that the future holds. It truly is an exciting time to be involved in technology.

Figure 13: Stages in IT Infrastructure Evolution



Source: (Laudon and Laudon, 2010:193)

Technology Drivers of Infrastructure Evolution

Here are some of the reasons why we've evolved so much in the last 20 years.

- **Moore's Law and Microprocessing Power:** perhaps no other law holds as much weight in the evolution of computers as Moore's Law. Take a moment to visit the Web site that describes it in more detail < http://www.intel.com/technology/silicon/mooreslaw/index.htm >. Microprocessor chips using transistors have helped increase computing power exponentially. However, **nanotechnology** is the promise of the future. This new technology is being developed because of the limitations of the older technology.

- **The law of mass digital storage:** as the amount of digital information expands, so too does our need and desire for more storage. In the early evolution of computing, storage needs were based on written text. Now we need the extra storage for photos, music, and video. How much storage does the average user really need? Is it the chicken-or-the-egg syndrome: give me more storage and I'll find something to do with it or, I now have all these new applications therefore I need more storage. One thing is certain, users will demand more storage and the technologists will develop it.

- **Metcalfe's Law and Network economics:** if you build a network for ten users, you'll spend the necessary money for the basic equipment. If you already have the equipment in place, you can add one more user at nominal costs. However, the eleventh user will bring value to the network far beyond what it costs to add him/her.
- **Declining communications costs and the Internet:** one of the biggest drivers in the exploding use of computers is directly attributable to the Internet. It's getting cheaper every day to connect to the Internet because of declining communication costs. As more and more users connect to the Internet, businesses must find ways to meet the expectations and demands of users.

- **Standards and network effects:** nothing has helped grow the Internet more than having **technology standards** in place allowing suppliers to create and build products that work seamlessly with each other. Users have come to rely on the interoperability of products.

SELF CHECK QUESTION 5.2

What are the stages and technology drivers of IT infrastructure evolution?
(Answers at the end of this Section)

5.2 Infrastructure Component

What if you bought a car that didn't include tires, a steering wheel, a radio, or a heater? After purchasing this vehicle, you had to shop around for the missing parts. When you entered a store, you are confronted with eight different steering wheels, six different radios, and nine different heaters. You quickly realize how incompatible the parts are with different brands of vehicles and wished that the manufacturers simply put all the parts together for you. Once assembled, you drive to the gas station only to realize that your car can't use that brand of gasoline. How frustrating.

In part, that is what has happened to computers and peripherals over the years. In the early days of personal computers, the printer you had your eye on may not have worked with your brand of computers. You had to buy a scanner built specifically for your computer. You couldn't connect to the Internet unless you had the correct modem for your Internet Service Provider. If you wanted to share photos with your friends, each of you had to have four different software programs, each of which would process the others' photos.
Now expand these examples to a corporate enterprise system. The evolution we are now experiencing is aiming to fix these problems and make computing ubiquitous anytime, anywhere. Let's look at the seven major components of systems necessary to see us through to this goal.

Computer Hardware Platforms

The microprocessor is the heart of any computing device no matter how small or large. Two companies produce most microprocessing chips, Intel and Advanced Micro Devices (AMD).

Since the network is becoming commonplace and the heart of computing, network service providers must have the necessary server backbone in place to meet increasing demand. **Blade servers** are meeting the needs of service providers cheaper and easier than traditional big-box servers. IBM offers mainframe computers that can also provide the network processing although they are more expensive and require Unix software.

Operating System Platforms

Operating systems tell computers what to do, when to do it, and how. Operations such as logging on, file management, and network connectivity are controlled by the operating system. By far the most prolific operating system is Microsoft Windows in various versions. Windows is also one of the operating systems used by mobile computing devices like hand-held PDAs and cell phones.

Unix and **Linux** are often associated with large networks that require less application overhead and faster processing. Linux open-source software is becoming the operating system of choice for organizations looking to save money. Businesses and governments across the globe are adopting the Linux platform as a way to reduce IT spending and license costs.

Enterprise Software Applications

Integrating applications into seamless processes across the organization is the goal of enterprise software applications. Customer relationship management and supply chain management systems are the two most popular applications in this category. We explore them more extensively in later chapters. These applications are becoming popular and more affordable for even small and medium-size business thanks to the proliferation of networks.

Data Management and Storage

Businesses and organizations are gathering more and more data on customers, employees, and even the business itself. Managing and storing the data so they are easily accessible and provide meaningful information to the organization is becoming a science in and of itself. **Storage area networks (SANs)** provide a cohesive, economical way to consolidate data from across any and all systems within the business. Online users want instant access to data and SANs help companies provide it.

Networking/Telecommunications Platforms

As we continue the march towards convergence of all things digital, networking and telecommunications platforms will merge into one. Rather than having one platform for networking computer devices and a separate platform for telecommunications, we'll see one company providing a combination of telephone services, cell phone connectivity, computers and peripheral devices, handheld PDAs, and wireless services all rolled into one. Many telecommunications companies are now merging with Internet service providers to offer a complete package of digital services.

Internet Platforms

The Internet and its technology standards continue to expand the services businesses are able to provide their employees, customers, suppliers, and business partners. Intranets and extranets built on Internet technologies give businesses an easy and inexpensive method of providing services that were cost prohibitive a few years ago.

Rather than purchase all of the hardware necessary to support Web sites, intranets, and extranets, many small and medium-sized companies use **Web hosting services** instead. It's cheaper and easier to have these service-providers take care of hardware, software, and security issues while the business concentrates on its core processes.

Consulting and System Integration Services

Systems used in many medium and large-sized companies and organizations are so complex that most businesses simply can't manage all of them on their own. Integration services provided by the likes of IBM and Hewlett-Packard are necessary to simply keep up with changes. In many ways it makes more business sense for a company such as Frito-Lay to concentrate on its core processes of making snack food and let IBM take care of the technology issues.

These services become more critical as many companies merge their old **legacy systems** with newer technologies such as wireless computing. The legacy systems, some as old as 20 or 30 years, simply can't be thrown away but must work seamlessly with today's technologies. Companies choose not to totally replace legacy systems because it's too expensive, involves too much training, and carries too much organizational change. It's easier to use middleware and other technologies to merge old and new systems.

SELF CHECK QUESTION 5.3

What are the current trends in computer hardware and software platforms?

(Answers at the end of this Section)

5.3 Contemporary Hardware Platform Trends

If some of these IT infrastructure components like storage and telecommunications have gotten so cheap, why does it seem like companies are spending more and more money on information technology? Because users are demanding better, faster, and easier ways to use computers and more ways to communicate with others.

Let's look at some of the newer hardware technologies that are helping companies meet the growing technology demand of employees, customers, suppliers, and business partners.

The Emerging Mobile Digital Platform

Anytime, anywhere, 24/7, 365. That's what computer users now expect. Technology manufacturers are meeting the demand with a host of new communication devices like cell phones and smart phones. The newest gadgets on the market are **netbooks**. They are miniaturized subnotebooks that are built specifically for wireless communications and Internet access. Even though they may be small in size, they still pack a lot of computing power. Amazon.com advertises a netbook with a 1.6 gigahertz processor, 1 gigabyte RAM, 160 gigabyte hard drive and high speed connectivity anywhere. That's a lot of computing capacity for just 2.5 pounds. The best part is how inexpensive netbooks are compared to other computers like laptops and desktops.

> "Analysts expect the popularity of netbooks to continue to rise. Mobile-phone service providers, which have an interest in promoting wireless Web-enabled machines, are likely to step up in-store netbook marketing in the coming months. Vendors including Acer and Dell are expected to unveil models richer in features such as longer battery life, larger screens, and better wireless-network compatibility. Researchers at iSuppli expect that netbooks will account for 18% of portable computer sales in 2012, up from about 8% this year." (BusinessWeek, *Invasion of the Netbooks*, Nov 18, 2008)

Grid Computing

Take a moment and think about how much time you *don't* use your personal computer. It's actually quite a lot. In fact, most computers are idle more time than not. What if you could combine all the idle time of hundreds or thousands of computers into a continuous, connected computing capacity to capture, process, manage, store, and retrieve data? You wouldn't have to purchase mammoth, super computers to realize this capability and capacity. You just have to turn to **grid computing**.

Three reasons why grid computing is appealing to companies include:

- Cost savings
- Computational speed
- Computational agility

Cloud Computing and the Computing Utility

Most companies don't build their own electrical generating plants or their own water treatment facilities. They purchase only the utilities they need, even in peak demand times. Why not do that with computing capacity. If JCPenneys.com needs fifty percent more capacity during the 30-day Christmas buying period, why should it have to purchase that much infrastructure only to have it sit idle the other eleven months of the year.
On-demand computing, another term for cloud computing, mirrors other utilities that provide necessary infrastructure from centralized sources. It's cheaper and helps companies reduce the total cost of ownership of IT technology. They can also take advantage of newer technologies than what they are able to buy and maintain on their own. **Utility computing,** yet a third term for cloud computing, also gives companies a chance to expand services that perhaps they wouldn't be able to provide if they had to buy all the hardware and software.

> "What will research clouds look like? Tony Hey, vice-president for external research at Microsoft, says they'll function as huge virtual laboratories, with a new generation of librarians—some of them human—"curating" troves of data, opening them to researchers with the right credentials. Authorized users, he says, will build new tools, haul in data, and share it with far-flung colleagues. In these new labs, he predicts, "you may win the Nobel prize by analyzing data assembled by someone else." Mark Dean, head of IBM's research operation in Almaden, Calif., says that the mixture of business and science will lead, in a few short years, to networks of clouds that will tax our imagination. "Compared to this," he says, "the Web is tiny. We'll be laughing at how small the Web is." And yet, if this "tiny" Web was big enough to spawn Google and its empire, there's no telling what opportunities could open up in the giant clouds." (*Google and the Wisdom of Clouds*, BusinessWeek, Dec 24, 2007)

The technology is still in its infancy. As you can see from the quote below, there are still major issues with this technology.

> "Weeks after Amazon's S3 cloud storage service went down due to a software error, and in the midst of continued MobileMe issues, two more online services have suffered problems. Gmail was unavailable for a couple of hours on Monday because of a software glitch, and online storage service The Linkup (TLU) shut down its service last Friday after losing nearly half of the data it had stored. The appeal of these services is obvious—they should be a reliable, scalable, cost-effective resource you can access from anywhere. But the recent disruptions show some of the risks of online services. What do you do when they go down?" (Storms in the cloud leave users up creek without a paddle, Peter Bright, Published: August 13, 2008 arstechnica.com)

Autonomic Computing

As companies rely more and more on IT to meet the user demands, they can't afford to have any system downtime at all. Downtime costs money. **Autonomic computing** is a step towards creating an IT infrastructure that is able to diagnose and fix problems with very little human intervention.

Autonomic computing features systems that can:
- Configure themselves
- Optimize and tune themselves
- Heal themselves when broken
- Protect themselves from intruders and self-destruction

While this type of computing is still rather new, it promises to relieve the burden many companies experience in trying to maintain massive, complex IT infrastructures.

Virtualization and Multicore Processors

Server computer hardware prices have fallen over the years to the point where they're relatively cheap. Hence, the problem. Rather than increase the efficiency and utilization of existing hardware, many companies just buy more of it and stick it on the shelf. Not much thought is given to the total cost of ownership (TCO) of all the hardware. As it turns out, the TCO is as much or more than the original purchase price. And, the hardware utilization rates are extremely low. We'll examine the concept of TCO more at the end of this chapter.

For example, let's say you leave your kitchen light burning twenty four hours a day. You only spend about four hours a day actually in the kitchen. You end up wasting twenty hours of electricity for those four hours of use.

Of course this is a simplified example but you get the idea of how computer usage is wasted running all those servers for a fraction of the time they're actually used. It's not unusual for a company to have one server for this application and another server for that application. The applications are stored on separate servers using different operating systems. It's a very wasteful configuration.

Enter **virtualization**. It's the process of running multiple operating systems and application programs on one machine and increasing the overall utilization rates of the device. Instead of having ten servers running ten different applications, virtualization consolidates the programs onto one or two servers.

As businesses require more and more computing capacity, hardware and chip manufacturers are answering the need with **multicore processors**. Rather than a single chip on a single processing core, you purchase a machine with two or more processors. It reduces the overall number of servers or processors, thus reducing the total cost of ownership, including electricity costs.

The magazine article excerpt below sums up how the contemporary hardware platform trends we've looked at are helping business reduce their IT infrastructure costs.

"As the U.S. enters what appears likely to be a painful recession, a major shift is taking place in how businesses assess technology products. They're under terrific pressure to cut costs. According to a newly revised forecast from market researcher IDC, growth in U.S. tech spending will decline to 0.9% in 2009, down from a previous forecast of 4.9% growth. But rather than just slice budgets across the board, many companies are switching to a handful of new technologies that save them money.

These technologies existed during the last recession, but they were immature. Now they're established, and the downturn seems likely to hasten their adoption. Chief among them are software delivered over the Internet, known as cloud computing, such as Google Apps; so-called virtualization software, which allows companies to run multiple applications on a single server computer; and open-source software, which is created collaboratively by multiple companies and is typically less expensive than the traditional kind. "These are tools that management can use to get through a crisis," says Michael Hickey, president of the Business Insight Div. of Pitney Bowes in Stamford, Conn., who just bought software from on-demand supplier Salesforce.com." (BusinessWeek.com, SAP and Microsoft, Watch Your Back, Nov 13, 2008)

5.4 Contemporary Software Platform Trends

What if you bought a beautiful new car with all the fanciest equipment inside, but when you tried to start the engine nothing happened? How can that be, you ask? The car cost a lot of money and it's brand new! However, as soon as you put some gasoline in the tank, it starts right up and you're moving down the road.

You can have all the computer hardware money can buy, but if you don't have the right software, you can't do very much with the hardware and you've wasted a lot of money. Let's review some information about software platform trends that helps get the most out of your hardware.

Linux and Open-Source Software

In the early 1990s, a graduate student at the University of Finland wanted to build an operating system that anyone could download from the Internet, no one would own, and hundreds or thousands of people would work together on the creation, maintenance, and improvement. He began working on what is now known as **Linux**, a Unix-like operating system. He posted his program to a Web page and allowed anyone to change and improve the code. Its use has expanded rapidly since its small size and low cost make it ideal for information appliances. It's also less crash-prone than most other operating systems. That's a feature that makes it very attractive to companies running e-commerce Internet businesses.

Open-source software has proven to be more secure than other leading software programs precisely because its code is so readily available. Security problems in proprietary software are usually discovered by those working inside the software manufacturer. That task is often restricted by the number of employees dedicated to the task, resource allocation, and organizational problems that don't confound the open-source software movement.

Open-source software isn't limited to Linux but includes applications such as Mozilla Firefox web browser and free office suite software such as OpenOffice.

> "OpenOffice.org 3 is the result of over twenty years' software engineering. Designed from the start as a single piece of software, it has a consistency other products cannot match. A completely open development process means that anyone can report bugs, request new features, or enhance the software. The result: OpenOffice.org 3 does everything you want your office software to do, the way you want it to." (OpenOffice.org)

Software for the Web: Java and Ajax

Java fulfills the need for interactive programming over the Internet. What makes this language so enticing is that it is operating system-independent and processor-independent. This means 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 many of these problems.

Java creates miniature programs called "applets," which perform very small, specialized, one-at-a-time tasks. When a user wants to perform a task, the coding for it 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. 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 used on handheld computers and many other non-computer appliances.

Java also reduces the "bloatware" problem of huge software application programs that contain 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 simply use a Java applet instead of a huge spreadsheet program. This becomes an even more important feature as more applications move to smaller computing devices that don't have the capacity to hold large software programs.

Java is included with most **Web browsers,** working in the background to make it easier to accomplish tasks.

Ajax

Dozens of Web sites you use on a regular basis now include some form of interactivity. That is, you fill in a form to pay your credit card bill online, renew your driver's license, or apply for a loan. A new technique that enables and improves these processes is a combination of Asynchronous JavaScript and XML languages called **Ajax**. Ajax works in the background of interactive Web pages, exchanging small pieces of data that make Web-based processes run seamlessly.

Web Services and Service-Oriented Architecture

Web services use Internet technology to link application programs together without having to create custom coding. And, as the name suggests, they are Web-based, making them more universally accepted within a business or across traditional organizational boundaries, extending to customers, suppliers, and business partners.

The distinct advantage of building Web services is their reusability. That is, you can build one Web service that can be used by many different businesses. This kind of functionality promises a whole slew of new Internet-related development companies to spring up in the next few years as this idea takes hold.

> When it comes to consumer Web services, Microsoft is hardly the hottest name around. MySpace and Facebook are the sites of choice for social networking. For photo sharing, Netizens turn to Flickr. And much to Microsoft's consternation, Google is the king of the Web search mountain. Microsoft's history, though, is one seizing key markets initially staked out by others. And now the Redmond giant is zeroing in on Web services like never before. The company has rolled out its Windows Live strategy –- a collection of technologies that blends PC applications with services that run over the Web. So far, Microsoft has rolled out 20 Windows Live products, from a customizable Web portal to a service that lets users view all of their e-mail accounts within the same application. Now, Microsoft is in the early stages of rolling out technology on top of which companies and individuals can more easily build their own Web services. Of course, Microsoft gets a piece of the business and puts itself at the core of the new Web world. (BusinessWeek April 17, 2006)

As we use the Web for more applications, computer languages are evolving to keep up with new and innovative uses. **Hypertext markup language** (HTML) has worked well for displaying text and graphics. However, current computing environments demand more.

XHTML (Extensible Hypertext Markup Language) combines HTML language with the **XML** language to create a powerful tool for building more useful Web pages. **XML** is designed to control data on a Web page or site and make it more manageable.

A white paper written by Jon Bosak, Sun Microsystems, explains XML:

> XML gives us a single, human-readable syntax for serializing just about any kind of structured data – including relational data – in a way that lets it be manipulated and displayed using simple, ubiquitous, standardized tools. The larger implications of a standard, easily processed serial data format are hard to imagine, but they are obviously going to have a large impact on electronic commerce. And it seems clear that electronic commerce is eventually going to become synonymous with commerce in general.
>
> XML can do for data what Java has done for programs, which is to make the data both platform-independent and vendor-independent. This capability is driving a wave of middleware XML applications that will begin to wash over us around the beginning of 1999. However, the ability of XML to support data and metadata exchange shouldn't be allowed to distract us from the purpose for which XML was originally designed. The designers of XML had in mind not just a transport layer for data but a universal media-independent publishing format that would support users at every level of expertise in every language.

It's all part of the evolution of the Internet.

Four software standards and communication protocols provide easy access to data and information via Web services:

- **XML,** eXtensible Markup Language: describes data in Web pages and databases
- **SOAP,** Simple Object Access Protocol: allows applications to exchange data and instructions
- **WSDL,** Web Services Description Language: describes a Web service so that other applications can use it
- **UDDI,** Universal Description, Discovery, and Integration: lists Web services in a directory so users can find them

A Web **service-oriented architecture** combines separate applications like a secure, third-party billing transaction with a payment system into one cohesive unit.

Mashups and Widgets

You may be familiar with mapping services on the Web such as Mapquest.com or Google maps. These applications provide an easy method to find your way around town. Separately, you may have used a shopping site to locate stores that carry products you're most interested in. What if you could combine these two separate applications into one and make your Web-based searches easier and faster? That's the idea behind **mash-ups.** If you'd like to see an example of how convenient mashups are, visit MotoMap.com to get a map and details of motor cross and dirt bike trails across the United States.

It's not unusual for you to use one Web site to review your favorite books, movies, or music. Then you go to another Web site to tell your friends all about it. Instead of just giving them a link to the movie review site, why not embed parts of that site into your own Web site? You can by using **Web widgets**. They are small software programs that you add to a site or even your desktop to provide additional functionality.

Software Outsourcing

Earlier we described how businesses were going to outside vendors to meet their hardware needs. Organizations are now doing much the same for their software needs. Three external sources for software outsourcing are:

- software packages from a commercial vendor
- software as a service
- outsourcing custom application development to an outside software firm

Software Packages and Enterprise Software

Rather than design, write, test, and maintain legacy systems, many organizations choose to purchase **software packages** from other companies that specialize in certain programs. Let's face it; there isn't much difference in accounting needs and methodologies for a snack food manufacturer than there is for a paper manufacturer. So why not purchase a pre-written, fully tested, software program regardless of the business you are in?

Software as a Service (SaaS)

Small and mid-size companies in need of sophisticated software can rent only what they need and can afford through online **software as a service (SaaS)** providers**.** For instance, Right Now Technologies provides applications services via the Internet for customer service and marketing programs. Businesses can outsource their accounting needs to a Web-based service such as Intuit's online payroll services.

Because these services are Web-based, data are accessible from virtually any computer connected to the Internet. The road-warriors love having instant access to documents from wherever they are. Workers can collaborate with others in distant offices through a Web-based SaaS, and no one has to worry about their files being compatible with others—they are.

There is some danger to outsourcing your information resources to this kind of service. Remember, all your data are stored on another company's server computers and you have little control of it. What happens if the service provider goes out of business? How secure are data stored on the servers? What kind of scalability and capacity planning has the service completed? These are just some of the issues managers must address when they consider using SaaS providers versus in-house technology support.

Software Outsourcing

Companies are discovering that it's cheaper and easier to hire third party vendors for software related tasks such as system maintenance, data management, and program development. Much as they've outsourced mundane and repetitive tasks to mainly overseas locations, many companies are **outsourcing** all kinds of software related work. The Internet has made this option more viable than it ever was.

Businesses must exercise caution when using software outsourcing. If things can go wrong, they likely will. **Service level agreements (SLA)** help protect both customers and the service providers. Here are the main points of SLAs:

- defines responsibilities of the service provider and level of service expected by the customer
- specifies the nature and level of services provided
- criteria for performance measurement
- support options
- provisions for security and disaster recovery
- hardware and software ownership and upgrades
- customer support, billing and conditions for termination

5.5 Management Issues

The speed and computing capacity of technology continues to advance at dizzying speeds and in ways we can hardly dream. Star Trek is no longer a vision for the 24th century but for next week. Keeping up with all the advancements can be a major task in itself.

Dealing with Platform and Infrastructure Change

To be sure, it's extremely hard to figure out ahead of time how much computing capacity a company will need. It's like gazing into a crystal ball and trying to discern the future. Managers need to design **scalability** into their systems so that they don't under- or over-build their systems. The idea is to initially build the system for what the company thinks they need, but to design it in such a way that increasing capacity is a fairly easy thing to do. If the system is more successful than originally thought, or as the number of users increases, capacity can be increased without having to start over from scratch.

Management and Governance

Technology continues to proliferate in every business, large and small. Users are more familiar and comfortable with technology and usually see it as a helpful addition to their workload. Sometimes though that can lead to disagreements about who will manage an organization's IT infrastructure. Will you have highly centralized control that may stifle the ability of users to get the job done but provide for a cohesive, secure computing environment? Or will you have a decentralized governance of information technology that can also create a myriad of problems for the company? Unfortunately, there are no absolute right or wrong answers. These questions must be answered individually for each organization.

Making Wise Infrastructure Investments

Electronic business, electronic commerce, and digitization of the corporate world continue to grow. The Internet is touted as being 24/7, anytime, anywhere. For that model to work, hardware, software, and data must be available 24/7, anytime, anywhere. Companies are rethinking their strategic models for creating, processing, storing, and delivering data to meet the demands of employees, customers, suppliers, and business partners. If a company fails to do so they risk losing business and thousands or millions of dollars. Because of easy Internet access and competition, customers can simply go elsewhere if the company doesn't adjust to the new world.

Competitive Forces Model for IT Infrastructure Investment

Does your company spend too little on IT infrastructure thereby foregoing opportunities for new or improved products and services? Or does your company spend too much on IT infrastructure thereby wasting precious resources that could be utilized elsewhere?

By using a competitive forces model for IT infrastructure investment – Figure14, your company could align its IT spending with its needs.

- Inventory the market demand for your firm's services
- Analyze your firm's five-year business strategy
- Examine your firm's IT strategy, infrastructure, and cost for the next five years
- Determine where your firm is on the bell curve between old technologies and brand new ones
- Benchmark your service levels against your competitors
- Benchmark your IT expenditures against your competitors

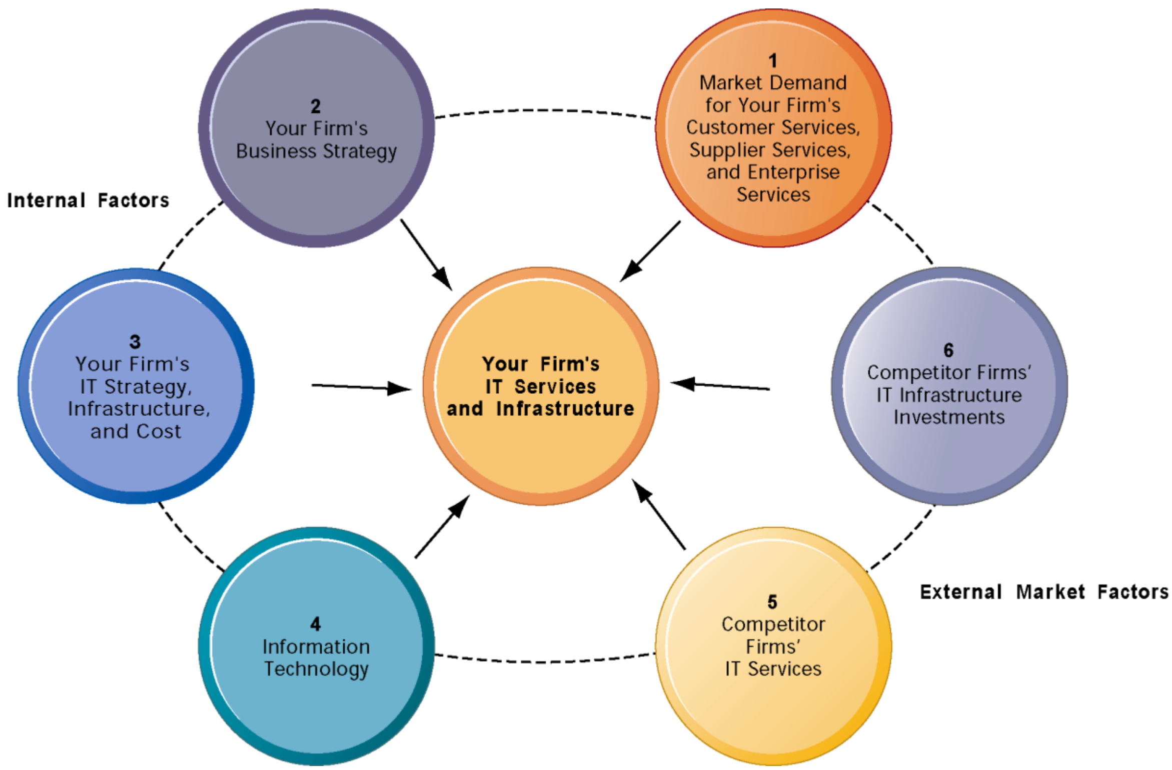
Some of these tasks are very difficult because of how quickly technology improvements come into the market place. Even so, it's worth the effort.

CASE STUDY

Read the "Amazon Case Study from Page 231 of the text book and answer the questions that follow

(*Answers at the end of this Section*)

Figure 14: Competitive Forces Model for IT Infrastructure



Source: (Laudon and Laudon, 2010:223)

Total Cost of Ownership (TCO) of Technology Assets

The cost issue is becoming more important to businesses and companies as computer technology and networks grow. Depending on the configuration of the network, a company can save or lose many dollars. What's most important to remember is that the **Total Cost of Ownership (TCO)** should extend past the hard dollars spent on hardware and software. The cost should incorporate such items as employee training, their ability to perform necessary functions given the network configuration, and lost productivity when the network is down. The TCO should also include the amount of money spent on communications wiring (telephone wires, fiber-optic cable, etc.) and security and access issues. Table 5-4 in the text can help you determine the TCO cost components you need to consider for your organization.

SUGGESTED ANSWERS TO SELF-CHECK QUESTIONS

5.1 What is IT infrastructure and what are its components?

- Technical perspective is defined as the shared technology resources that provide the platform for the firm's specific information system applications. It consists of a set of physical devices and software applications that are required to operate the entire enterprise.
- Service perspective is defined as providing the foundation for serving customers, working with vendors, and managing internal firm business processes. In this sense, IT infrastructure focuses on the services provided by all the hardware and software. IT infrastructure is a set of firm-wide services budgeted by management and comprising both human and technical capabilities.

IT infrastructure today is composed of seven major components.

- Internet Platforms – Apache, Microsoft IIS, .NET, UNIX, Cisco, Java
- Computer Hardware Platforms – Dell, IBM, Sun, HP, Apple, Linux machines
- Operating Systems Platforms – Microsoft Windows, UNIX, Linux, Mac OS X
- Enterprise Software Applications – (including middleware), SAP, Oracle, PeopleSoft, Microsoft, BEA
- Networking/Telecommunications – Microsoft Windows Server, Linux, Novell, Cisco, Lucent, Nortel, MCI, AT&T, Verizon
- Consultants and System Integrators – IBM/KPMG, EDS, Accenture
- Data Management and Storage – IBM DB2, Oracle, SQL Server, Sybase, MySQL, EMC Systems

5.2. What are the stages and technology drivers of IT infrastructure evolution?

Five stages of IT infrastructure evolution include:

- General-purpose mainframe and minicomputer era (1959 to present): consists of a mainframe performing centralized processing that could be networked to thousands of terminals and eventually some decentralized and departmental computing using networked minicomputers.
- Personal computer era (1981 to present): dominated by the widespread use of standalone desktop computers with office productivity tools.
- Client/server era (1983 to present): consists of desktop or laptop clients networked to more powerful server computers that handle most of the data management and processing.

- Enterprise computing era (1992 to present): defined by large numbers of PCs linked together into local area networks and growing use of standards and software to link disparate networks and devices into an enterprise-wide network so that information can flow freely across the organization.
- Cloud computing era (2000 to present): a model of computing where firms and individuals obtain computing power and software applications over the Internet, rather than purchasing their won hardware and software.

- Web server: software that manages requests for Web pages on the computer where they are stored and that delivers the page to the user's computer.
- Application server: software that handles all application operations between browser-based computers and a company's back-end business applications or databases.
- Multitiered client/server architecture: client/server network in which the work of the entire network is balanced over several different levels of servers.

Technology standards: Growing agreement in the technology industry to use computing and communication standards. Technology standards unleash powerful economies of scale and result in price declines as manufacturers focus on the products built to a single standard. Without economies of scale, computing of any sort would be far more expensive than is currently the case.

5.3. What are the current trends in computer hardware and software platforms?

a) Hardware

Mobile platform: more and more business computing is moving from PCs and desktop machines to mobile devices like cell phones and smartphones. Data transmissions, Web surfing, e-mail and instant messaging, digital content displays, and data exchanges with internal corporate systems are all available through a mobile digital platform. Netbooks, small low-cost lightweight subnotebooks that are optimized for wireless communication and Internet access, are included.

Grid computing: connects geographically remote computers into a single network to create a "virtual supercomputer" by combining the computational power of all computers on the grid.

Cloud computing: a model of computing where firms and individuals obtain computing power and software applications over the Internet, rather than purchasing their own hardware and software. Data are stored on powerful servers in massive data centers, and can be accessed by anyone with an Internet connection and standard Web browser.

Autonomic computing

Benefits of autonomic computing include systems that automatically do the following:

- Configure themselves
- Optimize and tune themselves
- Heal themselves when broken
- Protect themselves from outside intruders and self-destruction
- Reduces maintenance costs
- Reduces downtime from system crashes

Virtualization

Benefits of server virtualization include:

- Run more than one operating system at the same time on a single machine.
- Increase server utilization rates to 70 percent or higher.
- Reduce hardware expenditures. Higher utilization rates translate into fewer computers required to process the same amount of work.
- Mask server resources from server users.
- Reduce power expenditures.
- Run legacy applications on older versions of an operating system on the same server as newer applications.
- Facilitates centralization of hardware administration.

Multicore processors

Benefits of multi-core processors:

- Cost savings by reducing power requirements and hardware sprawl
- Less costly to maintain as fewer systems need to be monitored.
- Performance and productivity benefits beyond the capabilities of today's single-core processors.
- Able to handle the exponential growth of digital data and the globalization of the Internet.
- Able to meet the demands of sophisticated software applications under development.
- Run applications more efficiently than single-core processors – giving users the ability to keep working even while running the most processor intensive task in the background.
- Able to increase performance in areas such as data mining, mathematical analysis, and Web serving.

b) Software

Open-source software provides all computer users with free access to the program code so they can modify the code, fix errors in it, or to make improvements. Open-source software is not owned by any company or individual. A global network of programmers and users manage and modify the software. By definition, open-source software is not restricted to any specific operating system or hardware technology. Several large software companies are converting some of their commercial programs to open source.

Linux is the most well-known open-source software. It's a UNIX-like operating system that can be downloaded from the Internet, free of charge, or purchased for a small fee from companies that provide additional tools for the software. It is reliable, compactly designed, and capable of running on many different hardware platforms, including servers, handheld computers, and consumer electronics. Linux has become popular during the past few years as a robust low-cost alternative to UNIX and the Windows operating system.

Thousands of open-source programs are available from hundreds of Web sites. Businesses can choose from a range of open-source software including operating systems, office suites, Web browsers, and games. Open-source software allows businesses to reduce the total cost of ownership. It provides more robust software that's often more secure than proprietary software.

Java: Java is a programming language that delivers only the software functionality needed for a particular task. With Java, the programmer writes small programs called applets that can run on another machine on a network. With Java, programmers write programs that can execute on a variety of operating systems and environments. Further, any program could be a series of applets that are distributed over networks as they are needed and as they are upgraded. Java is important because of the dramatic growth of Web applications. Java is an operating system-independent, processor-independent, object-oriented programming language that can run on multiple hardware platforms. It provides a standard format for data exchange on Web sites.

Ajax: Ajax is short for Asynchronous JavaScript and XML. It allows a client and server to exchange small pieces of data behind the scene so that an entire Web page does not have to be reloaded each time the user requests a change. It's another Web development technique for creating interactive Web applications that make it easier and more efficient for Web site users to complete forms and other interactive features.

Web services offer a standardized alternative for dealing with integration across various computer platforms. Web services are loosely coupled software components based on XML and open Web standards that are not product specific and can work with any application software and operating system. They can be used as components of Web-based applications linking the systems of two different organizations or to link disparate systems of a single company. Web services are not tied to a particular operating system or programming language. Different applications can use them to communicate with each other in a standard way without time-consuming custom coding. XML provides a standard format for data exchange, enabling Web services to pass data from one process to another

ANSWERS - CASE STUDY

1. What technology services does Amazon provide? What are the business advantages to Amazon and to subscribers of these services? What are the disadvantages to each? What kinds of businesses are likely to benefit from these services?

Amazon provides cloud computing, also known as on-demand computing or utility computing. Similar to other utility providers like electric, water, and natural gas, Amazon provides computing capacity to businesses that want to pay only for what they use.

Amazon can generate extra revenue from other businesses by offering its excess capacity to those that need it. Like most companies, Amazon used only a small portion of it total computing capacity at any one time. Its infrastructure is considered by many to be among the most robust in the world. Subscribers to the Simple Storage Service (S3) can use only what they need without having to purchase their own hardware and software. That reduces the total cost of ownership for small and medium-size businesses. The system is scalable and reliable for both Amazon and subscribers. The Elastic Compute Cloud (EC2) service enables businesses to utilize Amazon's servers for computing tasks without having the overhead costs. Risks associated with incorporating the technology are minimal for businesses—Amazon takes most of the risks.

Companies may want to go with more established names in computing; Amazon is not known as a technology company—its reputation is more as a retailer. It's combating this perception by not requiring service contracts. However, its competitors like IBM, HP, and Sun Microsystems may follow Amazon's lead and offer utility computing without requiring service-level agreements. Some companies are wary of using a supplier that doesn't offer SLAs which guarantee the availability of services in terms of time. The growth of Amazon Web Services (AWS) could be harmful to its Web services line as well as its retail line if the company doesn't position itself to handle a dramatic increase in demand on its infrastructure.

Customers may experience outages in the service and not have any recompense since there are no service level agreements—only Amazon's word that it will maintain 99.9 percent availability.

Businesses, large and small, can benefit from using AWS. The service relieves small business from the TCO of having its own systems. AWS creates the opportunity for others to work at Web scale without making the mistakes that Amazon has already made and learned from. Large businesses can use AWS as an auxiliary unit without having to increase their hardware and associated TCO.

2. **How do the concepts of capacity planning, scalability, and TCO apply to this case? Apply these concepts both to Amazon and to subscribers of its services**.

   Amazon must provide hardware capacity planning and scalability for not just its own needs but for all its subscribers. Overestimates will create a drain on Amazon's financial assets. Underestimating capacity and scalability will create shortages for its own business and its subscribers. Too many instances of non-availability will create the impression that Amazon can't manage the service. Estimating scalability for such a large, diverse number of users without breaking down is a huge task. Amazon must bear the total TCO of its services, all the while ensuring it can profit from it. The services' subscribers benefit from not having to worry about these issues and not bearing the brunt of TCO issues.

3. **Search the Internet for companies that supply utility computing. Select two or three such companies and compare them to Amazon. What services do these companies provide? What promises do they make about availability? What is their payment model? Who is their target client? If you were launching a Web startup business, would you choose one of these companies over Amazon for Web services? Why or why not? Would your answer change if you were working for a larger company and had to make a recommendation to the CTO?**

   Sun Microsystems offers utility computing through grid computing. It charges $1 per cpu hour. It provides platforms for its target users in computational mathematics, computer aided engineering, electronic design automation, financial services, life sciences computing tasks. Software developers use Sun's Network.com service for building, testing, and deploying new applications to their customers. It promises 99.9 percent availability.

   Hewlett-Packard (HP) provides utility computing for PCs, server storage, mail and messaging, print, and centralized data center infrastructure through its distributed grid technology. It targets small, medium and large sized companies for a variety of computing services. Costs were not available on its web site. Availability was listed as 99.9 percent.

   Amazon seems to be an easier service to incorporate into a start-up business because it has been geared towards small and medium sized businesses since its inception. It doesn't bring the same baggage to the table as the larger, more diverse companies do.

4. **Name three examples each of IT infrastructure hardware components and software components that are relevant to this case. Describe how these components fit into or are used by Amazon's Web services and/or the customers that subscribe to these services.**

   Amazon's Web services use the following hardware components:
   - client/server architecture as the server
   - grid computing
   - distributed processing
   - storage area networks

- virtualization
- multicore processors

Customers using Amazon's Web services utilize the following hardware components:
- client/server architecture as the client
- distributed processing
- storage area networks

Amazon's Web services use the following software components:
- Linux and Unix operating system software
- Java, Ajax, and HTML as the provider
- XML
- Software as a Service (Saas) as the software provider

Customers using Amazon's Web services utilize the following software components:
- Windows operating system or Mac OS
- Java, Ajax, and HTML as the recipient
- Software as a Service (Saas) as the software user
- Mashups, widgets, cloud computing could be used by customers

5. Think of an idea for a Web-based startup business. Explain how this business could utilize Amazon's S3 and EC2 services.

Students will present a variety of startup business ideas in this question. They should address the following components:
- Costs associated with S3 data storage
  - Estimates of how much data will be stored
  - Costs per gigabyte of data
- Access procedures for S3 data storage—they may have to research Amazon's site to determine what the processes are
- Costs associated with EC2
  - Estimate the number of instance-hours the business will consume
  - Estimate the inbound and outbound data traffic
  - Estimate the AMI costs
- Access procedures for EC2
- Interfaces that may be required between the business and Amazon's services
- Processes that may be necessary in case of outages

Chapter 6

Foundations of Business Intelligence: Databases and Information Management

After completing this chapter, students should be able to answer the following questions:

- What are the problems of managing data resources in a traditional file environment and how are they solved by a database management system?
- What are the major capabilities of database management systems (DBMS) and why is a relational DBMS so powerful?
- What are some important principles of database design?
- What are the principal tools and technologies for accessing information from databases to improve business performance and decision making?
- Why are information policy, data administration, and data quality assurance essential for managing the firm's data resources?

Introduction

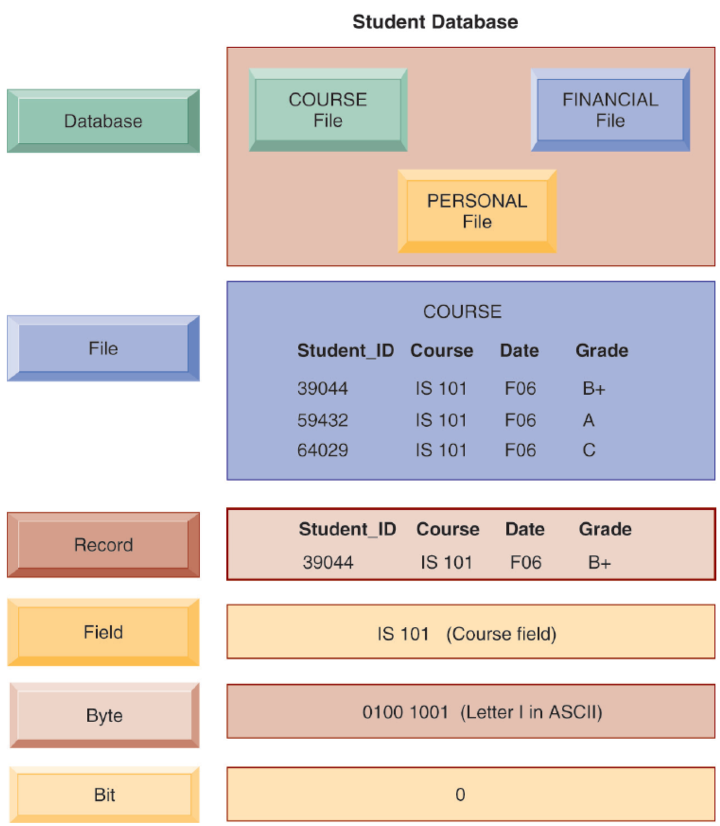
Information is becoming as important a business resource as money, material, and people. Even though a company compiles millions of pieces of data doesn't mean it can produce information that its employees, suppliers, and customers can use. Businesses are realizing the competitive advantage they can gain by compiling useful information, not just data.

6.1 Organizing Data in a Traditional File Environment

Why should you learn about organizing data? Because it's almost inevitable that someday 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. The data hierarchy is depicted in Figure 15 below.

File Organization Terms and Concepts

Figure 15: The data hierarchy



Source: (Laudon and Laudon, 2010:237)

The first few terms, **field**, **record**, **file**, **database**, are depicted in Figure 6-1, which shows the relationship between them.

An **entity** is basically the person, place, thing, or event on which you maintain information. Each characteristic or quality describing an entity is called an **attribute**. In the table below, each column describes a characteristic (**attribute**) of John Jones' (who is the **entity**) address.

First Name	**Last Name**	**Street**	**City**	**State**	**Zip**	**Telephone**
John	**Jones**	**111 Main St**	**Center City**	**Ohio**	**22334**	**555-123-6666**

Suppose you decide to create a database for your newspaper delivery business. In order 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 first name and last name, street address, city, state, zip, 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 about whom you are maintaining information. The attributes are customer's name (first and last), address (street, city, state, zip code), ID, and date last paid. This is a very simplistic example of a database, but it should help you understand the terminology.

Problems with the Traditional File Environment

Building and maintaining separate databases is usually the main cause of "islands of information." It may begin in all innocence, but it can quickly grow to monstrous proportions. Let's look at some of the problems traditional file environments have caused.

Data Redundancy and Inconsistency: Have you ever gotten two pieces of mail from the same organization? For instance, you get two promotional flyers from your friendly neighborhood grocery store every month. It may not necessarily be that you're a popular person. It's probably because your data was somehow entered twice into the business's database. That's **data redundancy**. Now, let's say you change residences and, consequently, your address. You notify everyone of your new address including your local 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 new address and one 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. That's **data inconsistency.** Just from these two simple examples you can see how data redundancy and inconsistency can waste resources and cause nightmares on a much larger scale.

Program-Data Dependence: Some computer software programs, mainly those written for large, mainframe computers, require data to be constructed in a particular way. Because the data are specific to that program, it can't be used in a different program. If an organization wants to use the same data in a different program, it has to reconstruct it. Now the organization is spending dollars and time to establish and maintain separate sets of data on the same entities because of **program-data dependence**.

Lack of Flexibility: The Sales and Marketing manager needs information about his company's new production schedule. However, he doesn't need all of the data in the same order as the Production manager's weekly report specifies. Too bad. The company's database system lacks the flexibility to give the Sales manager the information he needs, how he needs it, and when he would like to receive it.

Poor Security: Traditional file environments have little or no security controls that limit who receives data or how they use it. With all the data captured and stored in a typical business, that's unacceptable.

Lack of Data Share and Availability: What if the CEO of a business wants to compare sales of Widget A with production schedules. That might be difficult if production data on the widgets is maintained differently by the sales department. This problem happens far more frequently in older traditional file environments that lack the ability to share data and make it available across the organization.

SELF CHECK QUESTION 6.1

Why is file management important for overall system performance?

(Answers at the end of this Section)

6.2 The Database Approach to Data Management

The key to establishing an effective, efficient **database** is to involve the entire organization as much as possible, even if everyone will not immediately be connected to it or use it. Perhaps they won't be a part of it in the beginning, but they very well could be later on. Database management systems make it easy, fast, and efficient to relate pieces of data together to compile useful information.

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. Doing so makes it easier, cheaper and more efficient to use the data across the entire organization. It makes it easier to use in applications and makes it available through many different delivery methods.

A **Database Management System** (DBMS) is basically another software program like Word or Excel or e-mail. 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.

Physical views of data are often different from the *logical views* of the same data 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 focuses on 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 its physical location on the storage device to a *logical* view in the output device, whether screen or paper.

How a DBMS Solves the Problems of the Traditional File Environment

If you have just one database that serves the entire organization, you eliminate the islands of information and, in turn, most of the problems we discussed earlier. If you only have one database you reduce the chances of having redundant and inconsistent data because each entity has only one record. You construct the data separate from the programs that will use them. The data are available to whoever needs them, in the form that works best for the task at hand. Securing just one database is much easier than controlling access to multiple databases.

Relational DBMS

A **relational database** stores data in tables. The data are then extracted and combined into whatever form or format the user needs. The tables are sometimes called files, although that is actually a misnomer, since you can have multiple tables in one file.

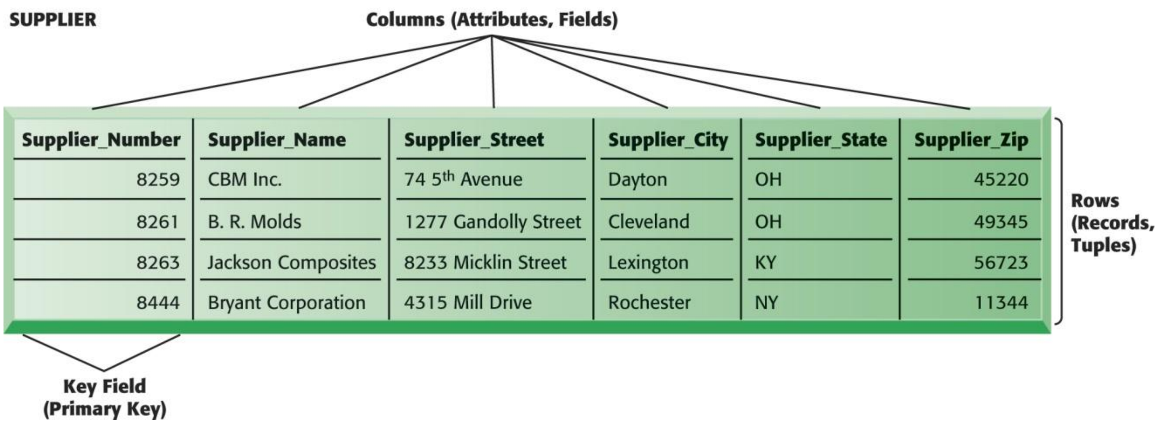
Data in each table are broken down into **fields.** A field, or column, contains a single attribute for an entity. A group of fields is stored in a **record** or **tuple** (the technical term for record). Figure 16 shows the composition of a relational database table.

SELF CHECK QUESTION 6.2

List some benefits of a DBMS and the solutions it provides for the problems of a traditional file environment.

(Answers at the end of this Section)

Figure 16: A Relational Database Table


SUPPLIER

Supplier_Number	Supplier_Name	Supplier_Street	Supplier_City	Supplier_State	Supplier_Zip
8259	CBM Inc.	74 5th Avenue	Dayton	OH	45220
8261	B. R. Molds	1277 Gandolly Street	Cleveland	OH	49345
8263	Jackson Composites	8233 Micklin Street	Lexington	KY	56723
8444	Bryant Corporation	4315 Mill Drive	Rochester	NY	11344

Source: (Laudon and Laudon, 2010:242)

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.

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 **foreign key**. For instance, in the customer table below the primary key is the unique customer ID. That primary key is then stored in the order table as the foreign key so that the two tables have a direct relationship.

Customer Table		Order Table	
Field Name	Description	Field Name	Description
Customer Name	Self-Explanatory	Order Number	***Primary Key***
Customer Address	Self-Explanatory	Order Item	Self-Explanatory
Customer ID	**Primary Key**	Number of Items Ordered	Self-Explanatory
Order Number	**Foreign Key**	**Customer ID**	**Foreign Key**

There are two important points you should remember about creating and maintaining relational database tables. *First*, you should ensure that attributes for a particular entity apply only to that entity. That is, you would not include fields in the customer record that apply to products the customer orders. Fields relating to products would be in a separate table. *Second*, you want to create the smallest possible fields for each record. For instance, you would create separate fields for a customer's first name and last name rather than a single field for the entire name. It makes it easier to sort and manipulate the records later when you are creating reports.

Wrong way:

Name	**Address**	**Telephone number**
John L. Jones	**111 Main St Center City Ohio 22334**	**555-123-6666**

Right way:

First Name	**Middle Initial**	**Last Name**	**Street**	**City**	**State**	**Zip**	**Telephone**
John	**L.**	**Jones**	**111 Main St**	**Center City**	**Ohio**	**22334**	**555-123-6666**

Operations of a Relational DBMS

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.

Object-Oriented DBMS

Many companies are moving away from strictly text-based database systems. Data as objects can be pictures, groups of text, voice, and audio. **Object-oriented databases** bring the various objects from many different sources and get them working together. If you combine the capabilities of a relational DBMS and an object-oriented database, you create an **object-relational DBMS**.

The next time you go to your dentist’s office, you might see a good example of an object-oriented database management system. Many sophisticated dental database programs include a traditional text-based record of your treatment history, and will also include objects such as computer-stored X-ray films, and maybe a digital photograph of the inside of your mouth. All these objects are maintained as a database record. When you visit your dentist, she can retrieve your record on the computer terminal, update your treatment history, and take new X-rays and a new digital photo, all on the computer. On the screen, she can compare last year’s X-rays with this year’s. She may even use a graphic tooth chart to mark which teeth need attention.

Capabilities of Database Management Systems

There are three important capabilities of DBMS that traditional file environments lack.

Data definition: Marketing looks at customer addresses differently from Shipping, so you must make sure that all database users 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. Creating the data definitions sometimes gets shortchanged. Programmers who build the definitions 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 definitions.

Data dictionary: Each data element or field should be carefully analyzed when the database is first built or as the elements are later added. Determine what each element will be used for, who will be the primary user, and how it fits into the overall scheme of things. Then write down all the element’s characteristics and make them easily available to all users. This is one of the most important steps in creating a good database. Each data definition is then included in the data dictionary.

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.

Users and programmers can consult the data dictionary to determine what data elements are available before they create new ones that are the same or similar to those already in the data dictionary. This can eliminate data redundancy and inconsistency.

Querying and Reporting

Data manipulation language: This is the third important capability of a DBMS. It’s a formal language used 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 to build their own queries and reports. Data manipulation languages are getting easier to use and more prevalent. **SQL (Structured Query Language)** is the most prominent language and is now embedded in desktop applications such as Microsoft Access.

Designing Databases

Don't start pounding on the keyboard just yet! That's a common mistake that may cause you many headaches later on. You have a lot of work to do before you touch the computer.

First, you should think long and hard about how you use information in your current situation. Think 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 end 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.

Normalization and Entity-Relationship Diagrams

We mentioned before that you want to create the smallest data fields possible. You also want to avoid redundancy between tables and not allow a relationship to contain **repeating data groups**. You do not want to have two tables storing a customer's name. That makes it more difficult to keep data properly organized and updated. What would happen if you changed the customer's name in one table and forgot to change it in the second table? Minimizing redundancy and increasing the stability and flexibility of databases is called **normalization.**

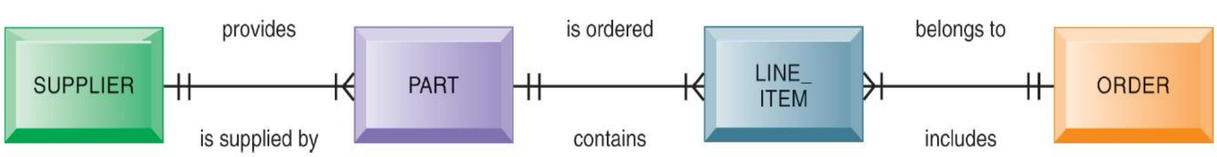
Your goals for creating a good data model are:

- Including all entities and the relationships among them
- Organizing data to minimize redundancy
- Maximizing data accuracy
- Making data easily accessible

Whichever relationship type you use, you need to make sure the relationship remains consistent by enforcing **referential integrity**. That is, if you create a table that points to another table, you must add corresponding records to both tables.

The entity-relationship is shown in Figure 17 below:

Figure 17: An Entity-Relationship Diagram



Source: (Laudon and Laudon, 2010:248).

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 through again. 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.

Distributing Databases

A **distributed database,** which is stored in more than one physical location, is usually found in very large corporations that require immediate, fast access to data at multiple sites. There are two ways to structure distributed databases:

1. Partition a central database so that each remote processor has the necessary data to serve its local area.
2. Replicate the central database at all remote locations.

As the book points out, there are lots of disadvantages so you should be careful to determine if this is the right way for you to run your business.

6.3 Using Databases to Improve Business Performance and Decision Making

Corporations and businesses go to great lengths to collect and store information about their suppliers and customers. What they haven't done a good job of in the past is fully using the data to take advantage of new products or markets. They're trying, though, as we see in this section.

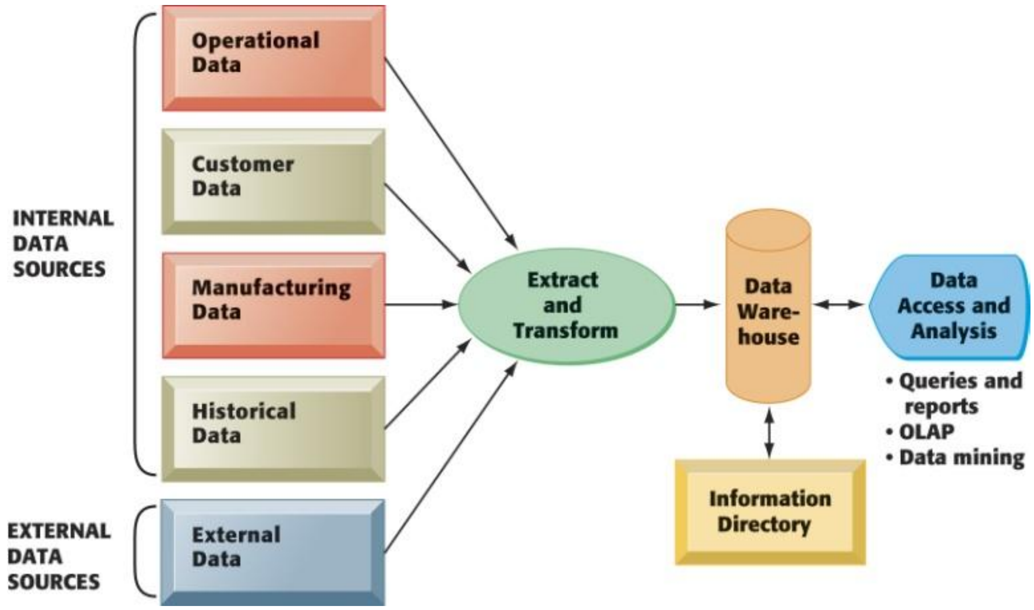
Data Warehouses

As organizations want and need more information about their company, their products, and their customers, the concept of **data warehousing** (Figure 18) 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 by using data warehousing.

What is a Data Warehouse?

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 that a company wants to maintain information on.

Figure 18: Components of a Data Warehouse



Source: (Laudon and Laudon, 2010:251)

As Figure 18 shows, the data come from a variety of sources, both internal and external to the organization. They are then stored together in a data warehouse from which they can be accessed and analyzed to fit the user's needs.

Interactive Session: Organizations: The Internal Revenue Service Uncovers Tax Fraud with a Data Warehouse? (see p. 224 of the text) describes how a data warehouse is improving the IRS' ability to manage and make use of the data it had collected. The agency has recouped many billions of dollars in tax revenue that was lost under the old system.

Data Marts

Since the data warehouse can be cumbersome because of its size and sheer volume of data, a company can break the information into smaller groups called **data marts.** It's easier and cheaper to sort through data marts that tend to be more focused on a particular subject. 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 data warehouses and data marts correctly can give management a tremendous amount of information that can be used to trim costs, reduce inventory, put products in the right stores at the right time, attract new customers, or keep old customers happy.

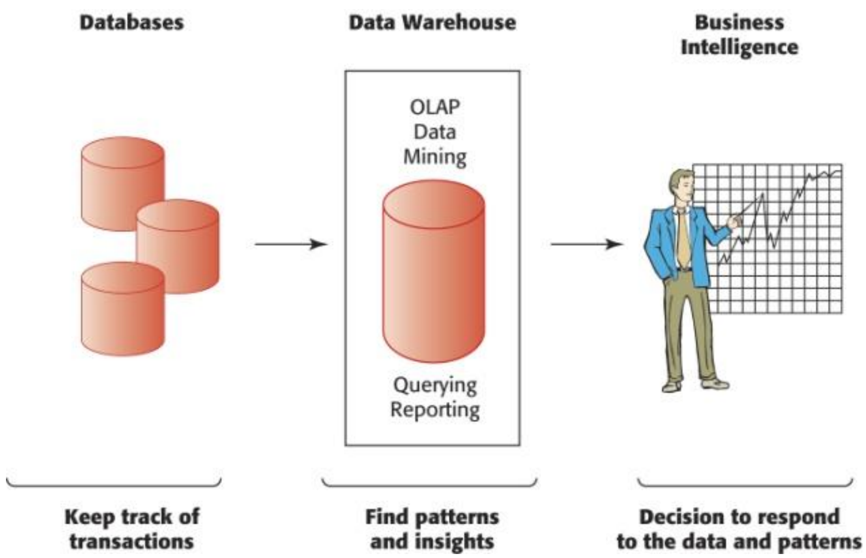
Business Intelligence, Multidimensional Data Analysis, and Data Mining

Businesses collect millions of pieces of data. Using the right tools, a business can use its data to develop effective competitive strategies that we discussed in previous chapters. Rather than guessing about which products or services are your best sellers, **business intelligence** provides concrete methods of analyzing exactly what customers want and how best to supply them.

Three benefits of using business intelligence include:

- Capability to amass information
- Develop knowledge about customers, competitors, and internal operations
- Change decision-making behavior to achieve higher profitability

Figure 19: Business Intelligence.

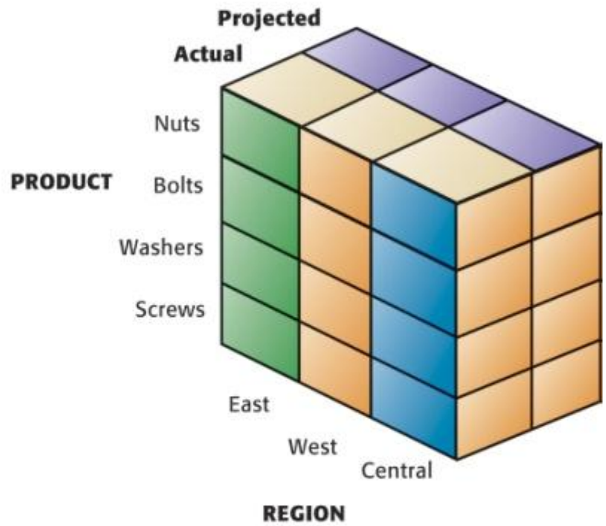


Source: (Laudon and Laudon, 2010:255)

Online Analytical Processing (OLAP)

As technology improves, so does our ability to manipulate information maintained in databases. Have you ever played with a Rubiks Cube–one of those 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 **online analytical processing (OLAP)** works. In theory, it's easy to change data around to fit your needs. Figure 20 represesnts a multidimensional data model.

Figure 20: Multidimensional Data Model.



Source: (Laudon and Laudon, 2010:255)

Data Mining

Data mining technology allows a digital firm to get more information than ever before from its data. One danger in data mining 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, data mining 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 information managers can use to make sure more stock is targeted to convenience stores. Data mining could also reveal that when customers purchase white socks, they also purchase bottled water 62 percent of the time. We seriously doubt there is any correlation between the two purchases. The point is that you need to beware of using data mining as a sole source of decision making and make sure your requests are as focused as possible.

These are the five types of information managers can obtain from data mining:

- *Associations*: determine occurrences linked to a single event
- *Sequences*: determine events that are linked over time
- *Classification*: discover characteristics of customers and make predictions about their behavior
- *Clustering*: discover groups within data
- *Forecasting*: use existing values to forecast what other values will be

Many companies collect lots of data about their business and customers. The most difficult part has been to turn that data into useful information. Organizations are using **predictive analysis** to create new opportunities for connecting with their customers by extracting information more easily and more precisely from their data warehouses. Firms are using better data mining techniques to target customers and suppliers with just the right information at the right time.

For instance, based on past purchases, Chadwick's clothing retailer determines that a customer is more likely to purchase casual clothing than formal wear at certain times of the year. Based on its predictive analysis, the retailer then tailors its sales offers to meet that expected behavior.

Text Mining and Web Mining

Much of the data created that might be useful to businesses is stored not in databases but in text-based documents. Word files, emails, call center transcripts and services reports contain valuable data that managers can use to assess operations and help make better decisions about the organization. Unfortunately, there has not be an easy way to mine those documents until recently. **Text mining** tools help scrub text files to find data or to discern patterns and relationships.

Because so much business is taking place over the Web, businesses are trying to mine data from it also. There are three categories of **Web mining** processes:

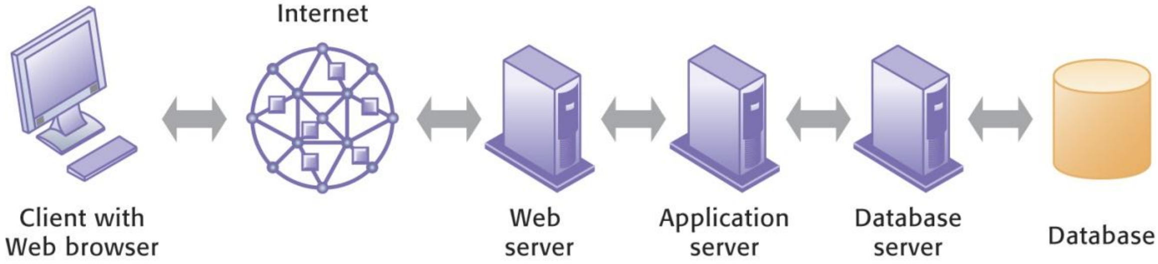
- Web content mining: extract knowledge from the content of Web pages – text, images, audio, and video
- Web structure mining: data related to the structure of a Web site – links between documents
- Web usage mining: user interaction data recorded by Web servers – user behavior on a Web site

Databases and the Web

Web browsers are far easier to use than most of the query languages associated with the other programs on mainframe computer systems. Companies realize how easy it is to provide employees, customers, and suppliers with Web-based access to databases rather than creating proprietary systems. It's also proving cheaper to create "front-end" browser applications that can more easily link information from disparate systems than to try to combine all the systems on the "back-end". That is, you link internal databases to the Web through software programs that provide a connection to the database without major reconfigurations. A **database server,** which is a special dedicated computer, maintains the DBMS. A software program, called an **application server,** processes the transactions and offers data access. A user making an inquiry through the Web server can connect to the organization's database and receive information in the form of a Web page.

Figure 21 shows how servers provide the interface between the database and the Web.

Figure 21: Linking Internal Databases to the Web.



Source: (Laudon and Laudon, 2010:258)

CASE STUDY

Read the Terrorist Watch Case Study from Page 269 of the text book and answer the questions that follow

(*Answers at the end of this Section*)

The benefits of using a Web browser to access a database include:

- Ease-of-use
- Less training for users
- No changes to the internal database
- Allows a business to keep its old legacy system instead of replacing it
- Cheaper than building a new system
- Creating new efficiencies and opportunities
- Provide employees with integrated firmwide views of information

6.4 Managing Data Resources

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.

Establishing an Information Policy

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

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, emphasizes the importance of this resource. This function helps 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
- Developing data dictionaries
- Monitoring the usage of data by techies and non-techies

Data governance describes the importance of creating policies and processes for employing data in organizations. Making sure data are available and usable, have integrity, and are secure is one part. Promoting data privacy, security, quality, and complying with government regulations like the Sarbanes-Oxley Act is the second part.

You need to get the non-techies talking and working with the techies, preferably together in a group that is responsible for **database administration.** 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.

Ensuring Data Quality

Let's bring the problem of poor data quality close 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? Because of the bad data, you could lose your financial aid or perhaps get a rather nasty e-mail from Mom and Dad. Think of the time and difficulty getting the data corrected.

Data quality audits verify data accuracy in one of three ways:

- Survey entire data files
- Survey samples from data files
- Survey end users about their perceptions of data quality

It's better for the company or organization to uncover poor quality data than to have customers, suppliers, or governmental agencies uncover the problems.

Whether a company creates a single data warehouse from scratch or puts a Web-front on old, disparate, disjointed databases, it still needs to ensure **data cleansing** receives the attention it should. It's too expensive, both monetarily and customer oriented, to leave bad data hanging around. A special type of software helps make this job easier by surveying data files, correcting errors in the data, and consistently integrating data throughout the organization.

SUGGESTED ANSWERS TO SELF-CHECK QUESTIONS

6.1 Why is file management important for overall system performance?

Information cannot be used effectively if it is stored in a disorganized, inflexible manner. Without proper file management, it may be difficult and even impossible to extract information from an automated system. Retrieving a simple report can be timely and costly, if the information is not properly managed. File management must also be flexible enough to accommodate new pieces of information or to combine different pieces of information in changing ways. When computer files are poorly managed, poor performance, high costs, and minimal flexibility will result.

6.2 List some benefits of a DBMS and the solutions it provides for the problems of a traditional file environment.

A DBMS can reduce the complexity of the information systems environment, reduce data redundancy and inconsistency, eliminate data confusion, create program-data independence, reduce program development and maintenance costs, enhance flexibility, enable the ad hoc retrieval of information, improve access and availability of information, and allow for the centralized management of data, their use, and security.

ANSWERS - CASE STUDY

1 What concepts in this chapter are illustrated in this case?

Consolidating multiple databases into a single cohesive one is a primary goal of the FBI's Terrorist Screening Center (TSC). The organization is integrating at least 12 different databases; two years after the process began, 10 of the 12 have been processed. The remaining two databases are both fingerprint databases, and not technically watch lists.

Using data warehouses to serve all the agencies that need information is the second major concept taken from this chapter. Agencies can receive a data mart, a subset of data, that pertains to its specific mission. For instance, airlines use data supplied by the TSA system in their NoFly and Selectee lists for prescreening passengers, while the U.S. Customs and Border Protection system uses the watch list data to help screen travelers entering the United States [presumably in transportation other than an airplane]. The State Department screens applicants for visas to enter the U.S. and U.S. residents applying for passports, while state and local law enforment agencies use the FBI system to help with arrests, detentions, and other criminal justice activities.
Managing data resources effectively and efficiently is the third major concept in this case. No information policy has been established to specify the rules for sharing, disseminating, acquiring,

standardizing, classifying, and inventorying information. Data administration seems to be poor. Data governance that would help the organizations manage the availability, usability, integrity, and security of the data seems to be missing. It would help increase the privacy, security, data quality, and compliance with government regulations. Lastly, data quality audits and data cleansing are desperately needed to decrease the number of inconsistent record counts, duplicate records, and records that lacked data fields or had unclear sources for the data.

2. Why was the consolidated terror watch list created? What are the benefits of the list?

The FBI's Terrorist Screening Center, or TSC, was established to organize and standardize information about suspected terrorists between multiple government agencies into a single list to enhance communications between agencies. A database of suspected terrorists known as the terrorist watch list was born from these efforts in 2003 in response to criticisms that multiple agencies were maintaining separate lists and that these agencies lacked a consistent process to share relevant information concerning the individuals on each agency's list.

3. Describe some of the weaknesses of the watch list. What management, organization, and technology factors are responsible for these weaknesses?

Management: policies for nomination and removal are not uniform between governmental departments. The size of the list is unmanageable – it has grown to over 750,000 records since its creation and is continuing to grow at a rate of 200,000 records each year since 2004. However, obvious non-terrorists are included on the list – a six-year old child and Senator Ted Kennedy. There is no simple or quick redress process for removal from the list. The watch list has drawn criticism because of its potential to promote racial profiling and discrimination.

Organization: Integrating 12 different databases into one is a difficult process – 2 databases remain to be integrated. Balancing the knowledge of how someone is added to the list is difficult – information about the process for inclusion must be protected if the list is to be effective against terrorists. On the other hand, for innocent people who are unnecessarily inconvenienced, the inability to ascertain how they came to be on the list is upsetting. Criteria for inclusion on the list may be too minimal. The government agencies lack standard and consistent procedures for nominating individuals to the list, performing modifications to information, and relaying those changes to other governmental offices.

Technology: The poor quality of the database leads to inaccurate data, redundant data, and erroneous entries. The TSA needs to perform an intensive data quality audit and data cleansing to help match imperfect data in airline reservation systems with imperfect data on the watch lists. While government agencies have been able to synchronize their data into a single list, there is still more work to be done to integrate that list with those maintained by airlines, individual states, and other localities using more information to differentiate individuals.

4. If you were responsible for the management of the TSC watch list database, what steps would you take to correct some of these weaknesses?

Student answers will vary. Some suggestions include performing data quality audits and using data cleansing software to correct many of the imperfections of the data. Information policies and data governance policies need to be developed to standardize the procedures for nomination and removal from the lists. The policies could also address the problem with inconsistent record counts, duplicate records, and records that lacked data fields or had unclear sources for their data. The TSA should develop consistent policies and methods to ensure that the government, not individual airlines, is responsible for matching travelers to watch lists.

5. Do you believe that the watch list represents a significant threat to individuals' privacy or Constitutional rights? Why or why not?

Most students will probably answer that the watch list does represent threats to privacy and Constitutional rights. The TSA is developing a system called "Secure Flight" but it has been continually delayed due to privacy concerns regarding the sensitivity and safety of the data it would collect. Similar surveillance programs and watch lists, such as the NSA's attempts to gather information about suspected terrorists, have drawn criticism for potential privacy violations. The watch list has drawn criticism because of its potential to promote racial profiling and discrimination.

Chapter 7

Telecommunications, the Internet and Wireless Technology

After completing this chapter, students should be able to answer the following questions:

- What are the principal components of telecommunications networks and key networking technologies?
- What are the main telecommunications transmission media and types of networks?
- How do the Internet and Internet technology work, and how do they support communication and e-business?
- What are the principal technologies and standards for wireless networking, communication, and Internet access?
- Why are radio frequency identification (RFID) and wireless sensor networks valuable for business?

Introduction

Anytime, anywhere, anyway, is the mantra of many computer users. Improved telecommunications technologies, the process of electronically communicating information, are making it possible.

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!

7.1 Telecommunications and Networking in Today's Business World

This section 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!

Networking and Communication Trends

For the most part, all of us have grown up with separate service providers and networks for our land-based telephones, cellular phones, and computers. We've been used to the idea that television cable service was separate from satellite service. Radio was separate albeit free. If we wanted a new music album or movie, we went to the local store. Now all of these telecommunication services are converging on the Internet and either blurring or destroying the lines of demarcation. It will become harder to determine where one ends and another starts as high-speed **broadband** network connections continue to expand and companies continue to develop products that meet consumer demands.

> "Technology's general impact on the world will most likely become more pervasive and comprehensive than ever in 2006. However the technology-based products and services with the greatest impact on the bottom line will likely be those that permanently change common human behaviors. Among them will likely be products and services whose trade name ultimately becomes part of the dictionary." (Deloitte TMT Trends: Predictions, 2006; www.deloitte.com)

SELF CHECK QUESTION 7.1

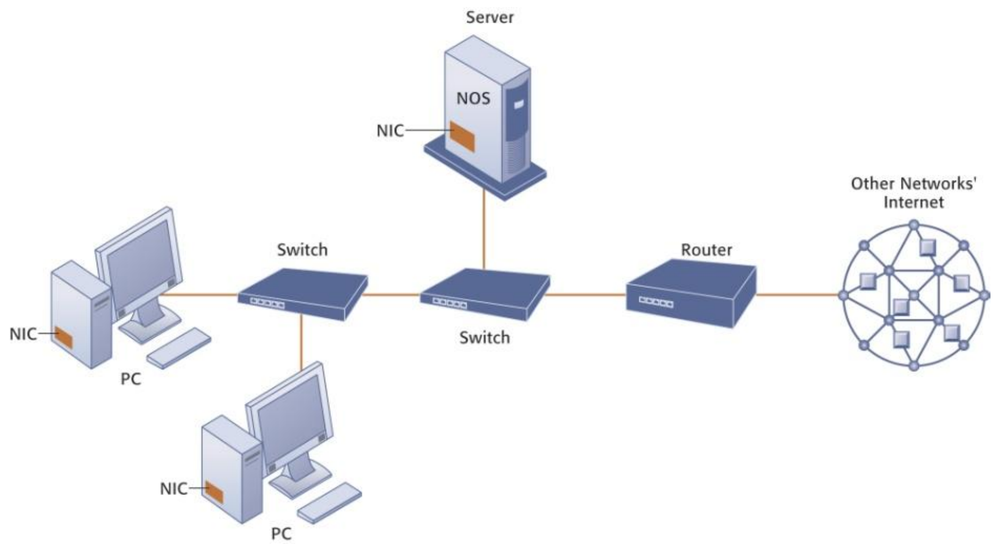
What is a telecommunications system? What are the principal functions of all telecommunications systems?

(Answers at the end of this Section)

What Is a Computer Network?

Before we go much further, let's make sure you understand how computer networks are configured. Figure 22 shows a simple network structure.

Figure 22: Components of a Simple Network.



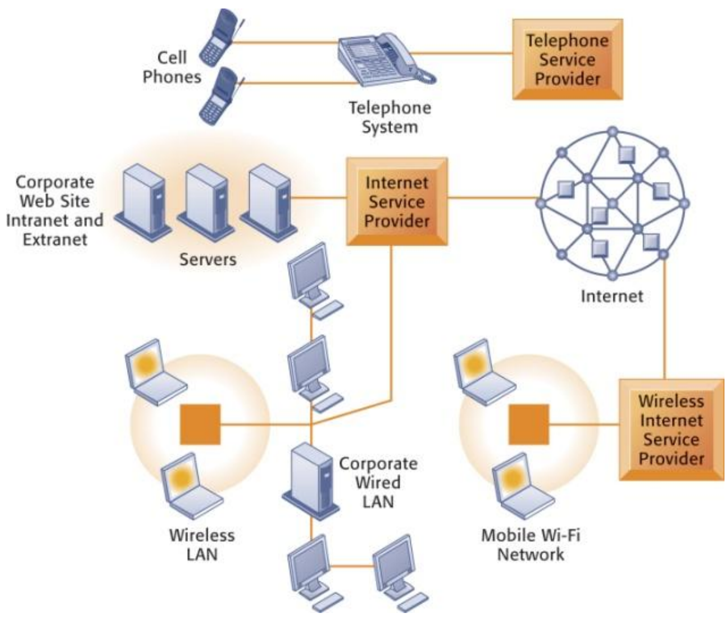
Source: (Laudon and Laudon, 2010:278)

What you should keep in mind is that you can continually add components to this kind of network and expand it exponentially. You can take a simple desktop computer and by way of a **Network Interface Card (NIC),** incorporate it into an existing network. To share network resources such as printers, and to route communications on a LAN, you require special software called a **network operating system (NOS). Hubs** and **switches** help route traffic on the network to the right computing device. When two or more networks are connected to each other, you need a **router** that sends data transmissions to the correct network device. Very large networks may require multiple routers so transmissions flow more quickly.

Networks in Large Companies

Compare Figure above that diagrams a simple computer network to Figure below that diagrams a corporate network infrastructure. You'll see that the network you might use in a large company isn't all that different from what you might use in your home. Obviously there will be more computing devices and servers but basically you'll have the same network infrastructure.

Figure 23: Corporate Network Infrastructure.



Source: (Laudon and Laudon, 2010:279)

Most corporations, large or small, will use a combination of public and private transmission mediums, including networks built separately for voice communication and computer transactions. Slowly, the separate networks are converging into one network that can transmit any type of data generated by any type of device.

Key Digital Networking Technologies

Let's look at three key technologies necessary for network computing.

Client/Server Computing

The client/server network facilitates computing on all kinds of networks including the Internet. Instead of one huge mainframe with individual nodes, smaller computers called servers connect to many clients. This type of network is ideal for companies that are continually expanding their networks or replacing hardware components.

Packet Switching

Think about 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 bit of food. You buy all the things, load them all into your cart, and head for the checkout line. You pay for your food while it's being bagged. Assuming you bought lots of items, not all of them are packed into the same bag. You might 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 routing 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 for transmission errors when data travel from one location to another.

TCP/IP and Connectivity

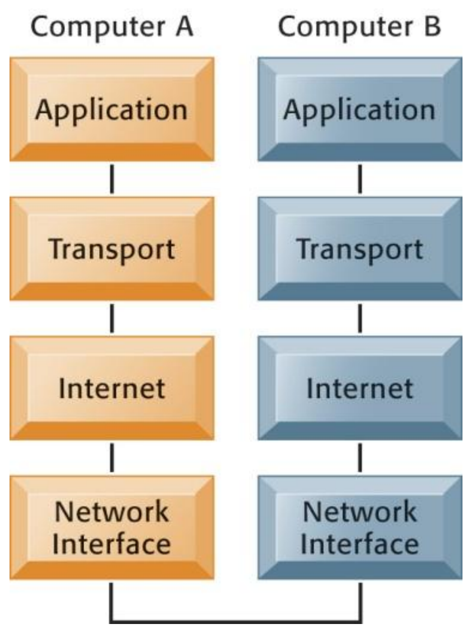
How does your Internet Service Provider manage to send your e-mail to the right place? We're talking millions and millions of people sending e-mail and using the World Wide Web every day. How do you keep from getting Mary's e-mail intended for Billy in Atlanta? Notice that each computer user connected 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.

The most popular model for connecting networks is the **Transmission Control Protocol/Internet Protocol (TCP/IP).** Even though this protocol was originally created for what we now call the Internet, it is easily transferred to networks of all sizes. It provides the easiest methodology for communicating between computers through standardized protocols that ignore the hardware and software platforms of the individual pieces of equipment.

Companies can create Web-based interfaces for different databases for data input/output and accessing information without actually combining the data physically in one huge computer. They do so by using TCP/IP models. With these protocols, they can reduce the disruption to the organization and decrease the overall costs of adding to their network.

Figure 24 shows you how TCP/IP works.

Figure 24: The Transmission Control Protocol TCP/IP Reference Model.



Source: (Laudon and Laudon, 2010:279)

The most important benefit of the TCP/IP model is that it allows two computers to communicate even if they are based on different hardware and software platforms.

7.2 Communications Networks

It's likely that as a company grows, so will its networking needs and capabilities.

Signals: Digital vs. Analog

Everything going into a computer system must be transformed into the *digital signals* of the computer. That is, a computer understands only zeros and ones. However, in the networking world much of the data are transmitted over telephone lines. These lines don't recognize zeros and ones. They only understand what are called *analog signals* – continuous waveform signals. To change the signals back and forth between analog and digital transmission methods, you need a **modem.**

Types of Networks

There are many different types of networks that organizations can use to connect their employees, managers, customers, suppliers, and business partners. It's important that the right one is used.

Local Area Networks

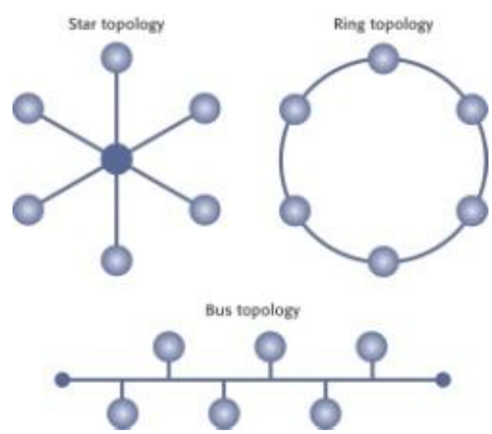
The **local area network (LAN)** is probably the most common network setup. You can have as few as two computers or as many as you can possibly wire together in the local area. Other devices such as printers and even network-enabled pianos can be a part of a LAN. You can set up a LAN for local area processing within your company and then connect it to a larger outside network that could be linked to distant locations.

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.

The **topology** of a LAN can vary greatly:

- **Star:** if the host computer goes down, the whole network goes down
- **Bus:** all computers in the network are linked with cables and are treated equally
- **Ring:** no central host computer; if one computer goes down the rest can still process data and transactions

Figure 25: Network topologies.



Source: (Laudon and Laudon, 2010:285)

Generally, larger LANs will use a star topology with a central host computer, although you could use a bus or star topology as well. Applications software and data are on the server computer and available to a wider audience of users. This is an excellent setup for collaborative work teams.

Metropolitan and Wide Area Networks

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. A WAN may take on a derivative name such as **MAN (metropolitan area network)** simply to describe its physical location.

Physical Transmission Media

Somehow all the computing devices in a network must eventually be connected to one another. Here are a few of your options.
Twisted Wire, Coaxial Cable, and Fiber Optics and Optical Networks

Twisted pair wire and **coaxial cable** are very common transmission media that have been around for years. A twisted pair 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 and is faster, lighter, and more durable than traditional transmission media. One other major difference between them is in the area of security. Signals transmitted over twisted pair 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.

Fiber-optic cable has a very high transmission capacity and is able to transmit data at higher speeds than other methods. Thus, **optical networks** are becoming more popular as a way to transmit larger multimedia files such as voice and video.

Wireless Transmission Media

Some experts call us a wired nation. If you consider all the methods we use to communicate, we should be referred to as a *wireless* nation. Our paging systems and cellular telephones use **microwave** and satellite technologies to transmit our voice and data communications from one place to another. We have **cell phones**, 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!

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 a Web site you are using a combination of twisted pair wire, fiber-optic cable, microwave stations, and satellites to get from your computer to another computer.

Transmission Speed

When you transmit the latest information from a Web site to your personal computer, the speed at which it moves across all the transmission media is measured in bits per second (BPS). The speed at which the bits are transmitted in each cycle is referred to as **hertz.** If you transmit one million bits in each cycle, you would call that rate megahertz (one million bits per a single cycle). 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 4 shows the speeds of the transmission media that we've covered in this section so you can compare one to another.

Table 4 Speeds of Transmission Media

MEDIUM	SPEED
Twisted wire	Up to 1 Gbps
Microwave	Up to 600 + Mbps
Satellite	Up to 600 + Mbps
Coaxial cable	Up to 1 Gbps
Fiber-optic cable	Up to 6 + Tbps

Mbps = megabits per second
Gbps = gigabits per second
Tbps = terabits per second

Source: (Laudon and Laudon, 2010:287)

7.3 The Global Internet

The latest research numbers from the Pew Internet and American Life Web site show that 75 percent of American adults (including 91 percent of Americans age 18 to 29) use the Internet. (Pew Internet and American Life Web site, http://www.pewinternet.org Oct 2008)

Try picking up a newspaper or magazine, listening to the radio or television, or simply talking to people, and you'll be hard-pressed not to hear something about the Internet and how it's changing businesses and the way people buy and sell items.

What is the Internet?

SELF CHECK QUESTION 7.2

What is the Internet? List and describe alternative ways of accessing the Internet.

(Answers at the end of this section)

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. Internetworking is the idea that computer networks are connected to other networks allowing data to flow freely.

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

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

The Internet consists of computer networks spread all over the world, 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 Earthlink or America OnLine. In many areas the ISP is a small local company connected to a larger network. With recent mergers in the entertainment and Internet industries, some cable TV companies like TimeWarner may serve as the ISP for home users.

One way of physically connecting to the Internet is with a **Digital Subscriber Line (DSL).** It uses regular telephone lines to carry both voice and data transmissions at very high speeds.

Since many home computer users already have cable TV installed in their homes, the telecommunications industry is using **cable Internet connections** to pump data into the home. If you have many people on the same cable line, each individual accessing the line will notice progressively slower speeds as the number of users increases. It is much faster than the dial-up modem, though.

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

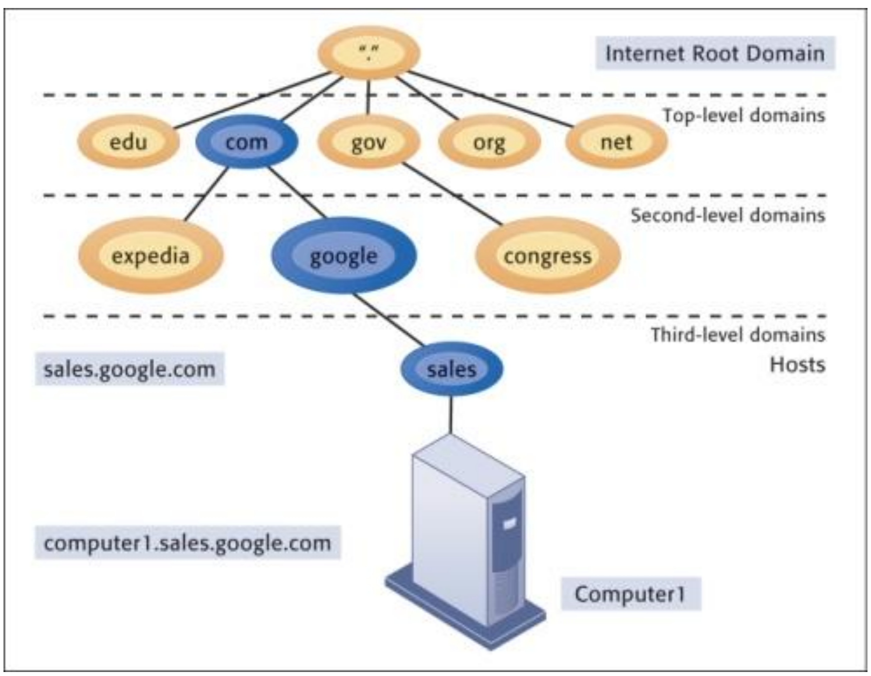
Internet Addressing and Architecture

Every address used on the Internet whether it’s an e-mail address or a Web site address is nothing more than a series of numbers called an **Internet Protocol address** or IP for short. Computers spread out around the Internet and various networks convert the series of numbers such as 195.128.15.11 to an easily read address such as www.USAToday.com.

The Domain Name System

The Domain Name System was devised because it’s much easier for people to read letters and words than to work with series of numbers. The DNS uses a hierarchical breakdown of addresses as Figure 26 shows.

Figure 26: The Domain Name System.



Source: (Laudon and Laudon, 2010:289)

Domain names used in e-mail addresses and Web site addresses are easily obtained through several services such as <A HREF=“http://www.networksolutions.com” target=”new”>Network Solutions and <A HREF=“http://www.register.com” target=”new”>Register.com. How do you get a domain name? Be the first to request a unique name and pay the required fee. That’s all there is to it.

SELF CHECK QUESTION 7.3

Describe the capabilities of next-generation networks including Internet2? How do they differ from those of the existing public Internet? What benefits can they provide?

(Answers at the end of this section)

Internet Architecture and Governance

Even though no one owns the Internet as a whole, parts of it are owned and controlled by many different private and public entities. Network channels in the United States are largely private while in other foreign countries, for example China, the government owns the backbone. To ensure continuity and connectivity throughout the world, various organizations have been established to help administer the Internet:

- Internet Architecture Board: defines the overall structure of the Internet
- Internet Corporation for Assigned Names and Numbers (ICAAN): assigns IP addresses
- World Wide Web Consortium: sets standards for the Web

The Future Internet: IPv6 and Internet2

As the Internet and other networks continue to proliferate, it’s becoming very difficult to work with the limited number of IP addresses available in the old system. Therefore new IP addressing schemas are being developed along with an expanded Internet architecture. **IPv6** is an initiative designed to increase the available IP addresses to handle the burgeoning number of users on the Internet.

If experts’ predictions are correct about the increasing usage and reliance on the Internet, and there’s no reason to believe they aren’t, we need to improve and change the current configuration to meet future demand. The **Internet2** project may help. The Next Generation Internet project has similar goals of advancing the use of the Internet in ways that will enhance our lives. Here’s how the <A HREF=“http://www.internet2.com” target=”new”>Internet2 Web site compares the two projects:

> Internet2 is a collaborative effort by more than 180 U.S. universities, working with partners in industry and government, to develop advanced Internet technologies and applications to support the research and education missions of higher education. Internet2 is a project of the University Corporation for Advanced Internet Development (UCAID).

> The Next Generation Internet (NGI) initiative is a multi-agency federal research and development program that is developing advanced networking technologies, developing revolutionary applications that require advanced networking, and demonstrating these capabilities on testbeds that are 100 to 1,000 times faster end-to-end than today's Internet.

Don't worry that personal users of the "old" Internet will be left behind. New technologies developed for Internet2 and NGI will trickle down to the traditional Internet and make it easier for everyone to use.

Internet Services and Communication Tools

With the recent introduction of new communication and information appliances**,** such as smart phones, PDAs, cell phones, and mobile data networks, organizations have found it necessary to upgrade their networks to incorporate these new technologies.

Internet Services

We keep complaining about information overload, yet we crave more. The Internet provides access to data about any topic you can imagine through software-based services such as discussion groups, newsgroups, chat functions, instant messaging, **Telnet,** and **FTP** (**file transfer protocol**)**.** Keep in mind that false information is as readily available as is true and correct information. Just be careful about the source of information you access.

The most useful feature of **e-mail** is the ability to attach files to a message and send them to colleagues anywhere in the world. This feature alone makes it a valuable tool for telecommuters and for collaborating with coworkers, wherever they may be. Unfortunately the effectiveness of e-mail as a viable communication tool is diminished by spam and junk mail. The sheer numbers of e-mail message sent are overwhelming some corporate e-mail servers. Some businesses are now encouraging "no e-mail Fridays."

Companies are using **chat** and **instant messaging** as a viable alternative to e-mail.

Use one of the search engines or directly access a popular portal page such as <A HREF="http://www.yahoo.com" target="new">Yahoo! <A HREF="http://www.msn.com" target="new">MSN.com and you'll probably see a link to instant messaging services. AOL's instant messaging technology is available to anyone, even those who don't use AOL as their service provider. Most IM services let you set up private chatrooms and will tell you when family, friends, or colleagues are online so you can "talk" to them. Some cell phones also allow you to send and receive IM messages from wherever you are.

Voice over IP

Internet telephony has vastly improved over the last few years and is now becoming a popular way for a growing number of people to communicate over the Internet. Companies such as <A

HREF="http://www.skype.com" target="new">skype allow you to make long distance telephone calls free (from PC to PC) or for a much reduced price (PC to regular telephone). The **VoIP (Voice over Internet Protocol)** technology threatens traditional telephone companies unless they adapt their business model to include this technology.

Here are a couple excerpts from the Web site, VoIP-Info.org

> "Internet and computer technology have already changed the way people live, work and communicate. VoIP (Voice over Internet Protocol) is one of the converged technologies behind this communication revolution.
>
> An ever growing number of Internet connections around the world allow VoIP which turns Internet infrastructure into a giant global telephone network. VoIP works in conjunction with other technology such as 3G cellular network and wireless (Wi-Fi) that eventually could create a huge global mobile phone network.
>
> It is the good news for consumers who can make phone calls worldwide at a very low or no cost and with great features that traditional telephone companies can't offer for free now.
>
> Looking forward, we believe Internet Telephony innovations are far beyond what we can imagine now. Let's utilize those technology advances and enjoy the feature-rich, low cost and evolutionary communication tools."
>
> "VoIP on WiMax will make the latest 3G technologies obsolete before they are completely installed. The reason is because 3G cell phone technology is capable of 2Mbs while WiFi is at 11Mbs in bursts and WiMax will be even greater therefore 3G is not needed as VoIP over WiMax is going to provide more data, faster speeds and greater numbers of users.
>
> WiFi and WiMax may actually solve the goals of conquering the digital divide. There will be a small price for this disruptive technology. There will be small legal battles fought such as this one over territory with government agencies and private sector. In the WiFi Online Newsletter commenting on a Wall Street Journal Article we saw Verizon fighting with the City of Philadelphia over their city wide WiFi and if you think about it they do potentially have quite a bit to lose don't they?"
>
> (http://www.einfoxp.com, copied Nov 2008)

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 technologies in order to improve the networking experience not just for companies, but also for home users. By combining all the divergent networks into converged networks**,** businesses are able to save money. More importantly, they are able to offer more efficient use of all the new technology.

Unified Communications

You use email. Then you switch to the telephone. Then you move to electronic conferencing. On to instant messaging. Each of these has a separate channel and separate platform. Don't you wish you could merge them all into one **unified communication** package and save yourself time, aggravation, and headaches? Now you can thanks to a single universally accessible service that lets you switch back and forth between all these methods of communicating with others.

"Unified Communications from Cisco combines all forms of business communications into a single, unified system that provides powerful new ways to collaborate. Cisco Unified Communications gives companies the ability to:

- **Collaborate across any workspace:** Advanced collaboration tools make it possible to create high quality, secure, adaptive workspaces throughout your organization. When co-workers, partners, vendors, and customers can collaborate more effectively, organizations can quickly adapt to market changes and build competitive advantage.
- **Accelerate decision making:** Sophisticated unified communications capabilities such as presence, instant messaging, and rich media services help ensure that information reaches the right person right away. This dramatically improves end-user and enterprise productivity.
- **Innovate across the value chain:** Embedding unified communications capabilities into business applications allows organizations to transform business processes, and enjoy new levels of customer satisfaction and innovation.
- **Integrate with other industry-leading applications:** Cisco Unified Communications is open. It integrates with other industry-leading applications and a wide variety of endpoints, so workers can collaborate in real time using their choice of tools and applications." (www.Cisco.com, Nov 2008)

Virtual Private Networks

Companies all over the world are building **virtual private networks (VPN**) to help reduce costs and make it easier for customers, suppliers, and employees to communicate. And why not? The Internet technology offers organizations a much cheaper alternative to the high cost of building and maintaining their own technology or using other technologies that aren't built on the open standards of the Internet. VPNs also offer companies an extra layer of security protection through the tunneling process because of the "wrapping" effect not offered with generic transmissions.

The World Wide Web

In 1989, a scientist named Tim Berners-Lee created a software program to help him keep track of his personal information. He eventually offered the software to other users and called it the World Wide Web. In 1991, commercial use of the Internet was permitted for the first time and that's when its use started to explode. In 1993, Netscape Communications Inc. 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 **Web sites** using a point-and-click method instead of textual commands.

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 20 years ago, it's amazing to realize how much it has permeated everything we do in our personal and business lives.

Hypertext

We discussed protocols before: 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 **Uniform Resource Locator (URL**) address on a Web site, it will generally start with http://www. Most software browser programs now automatically insert that for you so you can simply enter the domain of the Web site you want to access. A URL that begins with https: indicates a site using secure socket layers that offers more secure transmission protocols than the plain http.

Web Servers

All Web sites are stored on Web servers scattered throughout the Internet. Rather than a small business owning and maintaining their own Web server computers, they can pay a Web hosting service to maintain the site. It's often cheaper and easier and the small business doesn't have to worry about downtime, scalability issues, or security.

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/paper.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. Generally the home page is the first page you'll see when you initially access a Web site. It's usually identified through the file name index.htm or default.html.

Searching for Information on the Web

Search engines and directories use various 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 keyword search.

Some 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 correct 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 search for FTP sites, videos, blogs, newswires, business news, stock quotes, and weather using these search engine capabilities.

Search result listings show you which Web sites contain information related to your search words or phrases. The listings may also include sponsored links to sites related to your search request. Sponsored links are part of a burgeoning business known as **search engine marketing**. It provides businesses a new way to connect to potential customers through the special links at the top of the search result list or a special box on the right side of the search result page. Each time a user clicks on a sponsored link, the advertiser pays a fee to the search engine.

Many search engine home pages such as altavista.com have **shopping bots** available at a single click. Other shopping bot sites, such as <A HREF="http://www.pricingcentral.com" target="new">Pricingcentral.com gather information from many sources and combine it for ease in comparing prices and availability. Keep in mind that some of the prices available through these kinds of sites may not be the absolute lowest you could find on your own. Some companies pay a service fee to the shopping bot sites to have their products listed regardless of whether they are the lowest price. Buyer, beware.

Web 2.0

Making the Web convenient, easy to use, and having it work for us, is the idea behind **Web 2.0** services.

Let's say you're looking for a new home in a new city that you're not familiar with. You'd like to see information about local schools and perhaps crime statistics for your new neighborhood. You could spend hours researching data and trying to figure out how all the information correlates. Or, you could use a mashup and have the computer connect the dots for you.

You don't have to search for information at all if you don't want to. Perhaps you're an avid reader of **blogs** about golf. Rather than checking the blogs everyday for new information, you register your information needs with a **RSS (Real Simple Syndication)** service. When new information is available you'll automatically receive a notification on your desktop similar to the newscast ticker tapes you see on your television screen. What began as a convenient method of receiving blog updates has now spread across a variety of news, sports and information services to provide a convenient method of staying connected.

Wikis are becoming popular as a way to share information between employees, managers, suppliers, partners, and even customers. For instance, your collaborative team is devising a new advertising campaign. You have lots of input that previously was passed around the team via email. But that's unwieldy and doesn't give any of your team members a convenient method of searching for information. Who wants to sort through 83 emails looking for one piece of information?

Instead your team could use a wiki to post ideas, information, or details of the latest version of your campaign in one consolidated location. All your team members could post comments, edit comments from others, and collectively store all the files associated with the project. Searching for a particular piece of data is easy and fast. Wikis are much easier to use than more sophisticated knowledge management systems and the software is much cheaper.

Web 3.0: The Future Web

The same individual, Tim Berners-Lee, who began the Web, is now involved in creating **Web 3.0**, also called the **semantic Web**. Basically, data and content on the Web are currently stored in individual files that don't easily connect one to another. A Word file may be stored on a corporate database server while a spreadsheet file about the same subject is stored on your laptop. What if all that data were automatically connected so when you try to find all the information you need about your company's latest marketing campaign, the semantic Web would do it for you?

> "Tim Berners-Lee is far from finished with the World Wide Web. Having invented the Web in 1989, he's now working on ways to make it a whole lot smarter.
>
> For the last decade or so, as director of the World Wide Web Consortium (W3C), Berners-Lee has been working on an effort he's dubbed the "Semantic Web." At the heart of the Semantic Web is technology that makes it easier for people to find and correlate the information they need, whether that data resides on a Web site, in a corporate database, or in desktop software.
>
> The Semantic Web, as Berners-Lee envisions it, represents a change so profound that it's not always easy for others to grasp. This isn't the first time he's encountered that problem. "It was really hard explaining the Web before people just got used to it because they didn't even have words like click and jump and page," Berners-Lee says.
>
> When you use the word "silos," that's the word we hear when somebody in the enterprise talks about the stovepipe problem. Different words for the same problem: that business information inside the company is managed by different sorts of software, and you have to go to a different person and learn a different program to see it. Any enterprise CEO really ought to be able to ask a question that involves connecting data across the organization, be able to run a company effectively, and especially to be able to respond to unexpected events. Most organizations are missing this ability to connect all the data together." (BusinessWeek Online, April 9, 2007)

Intranets and Extranets

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, passwords and **firewalls,** which are 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 give more people in an organization the ability to use these Nets for very creative purposes and 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 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 have a Frequently Asked Questions (FAQ) page available for common questions and answers. Perhaps you 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 a popular way for companies to provide information to customers and suppliers quickly and efficiently. It's much less costly to put the information on an 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 customers to order products and track shipments.

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 your own network that is connected to the Internet, which in turn is connected to the other networks.

7.4 The Wireless Revolution

SELF CHECK QUESTION 7.4

Name and describe the technologies used for wireless transmission?

(Answers at the end of this Section)

Much as we've seen a convergence in wired digital devices such as computers, televisions, and telephones, we're seeing a widespread convergence in wireless technology and the services it offers. If content can be digitized it can be transmitted over wireless networks. That includes voice, documents, photographs, music, movies, television shows, you name it. Why should we wait to show pictures of our vacation until we get home when we can instantly transmit them over the Internet via a photo-equipped cell phone? Why can't we take a thousand songs loaded on a wireless device with us wherever we go?

On the ground, wireless communications use a variety of gadgets such as paging systems, e-mail handheld devices such as the BlackBerry PIM, cell phones**,** and **personal digital assistants** such as the Palm. One of the hottest emerging communication appliances is the **smart phone** equipped with Web browser software. Some merchants are teaming with Web portals to use global positioning systems to pinpoint your location. Once the merchants know you're in the local area, they offer you discounts on meals, clothing, and movies if you respond within the hour. As you're walking down the sidewalk, you can use your smart phone to locate restaurants, check movie schedules, review sports scores, take and send photographs, and use maps to find your way.

Cellular Systems

Interestingly enough, the United States is not among the most "wired wireless" countries in the world; that honor goes to South Korea, Japan, and many European countries. Many developing nations are bypassing traditional, old-fashioned communication infrastructures and going straight to wireless. It's easier and cheaper.

Cellular Network Standards and Generations

Unfortunately each world region has adopted different standards for wireless networks and very often the standards don't allow for cross transmissions. Two major standards used in the world are:

- Global System for Mobile Communication (GSM): bandwidth is based on time division multiple access and is used in Europe, China, and Asia, and some regions of the United States.

- Code Division Multiple Access (CDMA): transmits over several radio frequencies and randomly assigns users to a range of frequencies over time. It is used mostly in the United States.

Just as we've experienced generations of computers and computer languages, we allocate generational labels to wireless phone systems. Basically, we are working with two generations of cell technology:

- **2.5G networks:** appeared in the late 1990s and early 2000s and provides increased data transmissions based on the 2G technology. It's an interim fix until 3G technology is more fully refined.
- **3G networks:** appeared in the early 2000s and are based on packet-switch technology that allows large amounts of data transmission. Supports voice, video, graphics and wireless broadband Internet access.

Wireless Computer Networks and Internet Access

In order for wireless networks to work in tandem with each other it is necessary to create standards such as we have with Internet protocols and other network technologies.

Bluetooth

The **Bluetooth** wireless technology standard comes installed on some computers, which helps create small **personal area networks (PANs).** It's more appropriate to use Bluetooth technology in battery-powered devices that are within close proximity to each other. Bluetooth technology is mostly used to connect keyboards, printers, computers, and handheld devices all within very close range.

> "Bluetooth, as you likely know, eliminates cabling between electronic products and accessories, such as between computers and printers or between phones and headsets. Bluetooth users with handhelds or laptops can exchange files, business cards and calendar appointments. Bluetooth is more oriented toward user mobility and eliminating short-distance cabling; " (Techworld.com Mar 16, 05)

Even though the Bluetooth technology got off to a slow start in the early 2000s, it is now being used for all kinds of applications, even automobiles. Vehicles are coming equipped with Bluetooth technology and allow the use of hands-free cell phones, stereos, global positioning systems, and security devices.

Wi-Fi

We mentioned earlier that today's computing environment should be referred to as "wireless." The recent proliferation of wireless technology is technically known as the **802.11** networking standard. It's more commonly, and easily, called **Wi-Fi** for wireless fidelity. Wi-Fi can be installed on your existing computers and connect them through a router hub via access points. If you have several computers at home or in the office, a Wi-Fi network can help save money by negating the need for additional phone lines for Internet access or to use a single peripheral device such as a printer among several different computers. Each computer requires a wireless NIC (network interface card) containing a built-in radio and antenna. These cards are relatively inexpensive and you can avoid duplicating more expensive equipment by using a wireless network.

Wi-Fi and Wireless Internet Access

You can access Wi-Fi networks in public areas such as libraries, Internet cafes, hotels, and airports. Access points to a wireless network are called **hot spots** and are proliferating in many public places. You should be aware of the dangers in using these hot spots. They lack strong security measures typical of wireless networks. You may experience interference problems as more users try to access the network.

One of the biggest challenges facing the Wi-Fi industry is creating enough hotspots all around the country to provide blanket coverage without interruption. Currently there are still not enough continuous connections and many times users are dropped without warning. It's similar to the situation cell phones users have experienced with dropped calls and service interruptions.

Security is also a major concern because the Wi-Fi networks are intentionally built for openness and easy access. We address Wi-Fi network security more extensively in Chapter 8.

WiMax

Unfortunately there are still large regions of the United States that must continue to rely on old telephone systems for Internet access. That prevents users from taking advantage of new high-speed access and many of the feature-rich applications available on the Internet. And because of limitations in frequency ranges associated with Wi-Fi, Bluetooth, and other technologies, many users are left out of the Internet evolution. A new technology called **WiMax** is being developed to help fill the gaps all across the country. WiMax increases the range of transmissions up to approximately 30 miles and increases the transmission speeds significantly over that available on regular telephone lines and dial-up modems.

Broadband Cellular Wireless and Emerging Wireless Services

Cellular telephone companies are continuing the march towards total convergence of all things digital with its EV-DO technology. Short for Evolution Data Optimized, this technology will allow even more ways for users to access digital content from the Internet and other networks whether that data is voice, videos, graphics, documents, text messaging, or photographs. It won't be long before the same connectivity people enjoy in their homes and offices will be available anywhere, anytime, in any form.

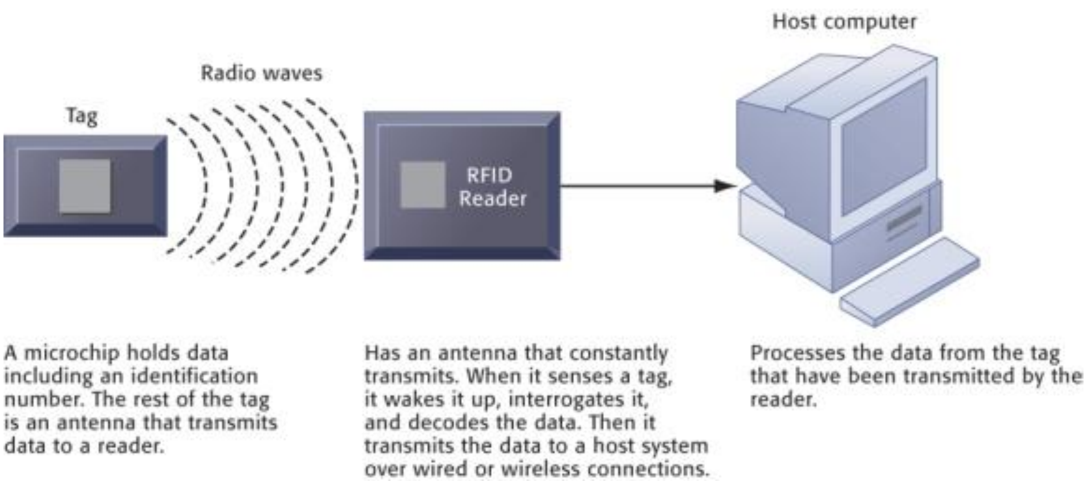
RFID and Wireless Sensor Networks

Radio Frequency Identification (RFID) systems are an excellent example of how wireless technology is totally remaking supply chain management systems. RFID tags are small microchips that contain information about the product. This technology holds a distinct advantage over the old bar codes because it doesn't require line-of-sight readers. Instead the tags transmit data via radio frequencies to computing devices that track the product. The tags can be either active or passive. Let's compare the characteristics of each:

- Active RFID tags: battery powered; data can be rewritten; have a longer read range, shorter operational life
- Passive RFID tags: no power source, smaller, lighter, and less expensive; unlimited operational lifetime; shorter read range

Figure 27 shows how the RFID technology works.

Figure 27: How RFID works.



Source: (Laudon and Laudon, 2010:310)

RFID tags offer more inventory management control over products than the current bar code technology for several reasons:

- More data can be written to RFID tags
- More real-time data can be provided by RFID tags
- RFID tags can trigger other processes within the computer system
- RFID tags do not require line-of-sight readers

Even though RFID tags are more expensive than bar-code technologies, the cost will drop as they become more prevalent and the system switch-over is completed. For example, in 2001 a single RFID tag cost approximately $2.00. An RFID tag in 2008 costs approximately 10 cents.

Wireless Sensor Networks

Businesses use **wireless sensor networks (WSNs)** to connect handheld devices with data storage devices and allow workers to roam untethered through warehouses and office buildings. In the long run, WSNs will be cheaper for businesses and homes since no structural changes will need to be made to the building's walls, ceilings, or floors. If you want to add equipment, you'll simply add another node to the network. You won't have to cut holes, run wires, or alter the physical structure at all.

CASE STUDY

Read the "Google versus Microsoft Case Study from Page 317 of the text book and answer the questions that follow

(*Answers at the end of this Section*)

SUGGESTED ANSWERS TO SELF-CHECK QUESTIONS

7.1 What is a telecommunications system?
What are the principal functions of all telecommunications systems?

A telecommunications system is a collection of compatible hardware and software arranged to communicate information, such as text, graphic images, voice, or video, from one location to another. The principal functions of all telecommunications systems include the transmission of information, establishing an interface between sender and receiver, routing messages along the most efficient path, performing elementary information processing to get the right message to the right receiver, checking and editing transmitted information for errors and formats, converting messages from the speeds of one device to those of another, controlling the flow of information, routing messages, and maintaining overall network structure.

7.2 What is the Internet? List and describe alternative ways of accessing the Internet.

The Internet is an international network of networks connecting hundreds of millions of people. The Internet is the primary infrastructure for e-commerce, e-business, and the digital firm. Individuals access the Internet through Internet Service Providers, popular online services, or through their company's network. An individual cannot access the Internet directly. Instead individuals with a computer equipped with a modem pay a small fee to an Internet Service Provider to access the Internet. People can also subscribe to popular online services, such as America Online and Microsoft Network. Alternatively, people who are part of an organization with its own network that is connected to the Internet can access the Internet through the organization's network.

7.3 Describe the capabilities of next-generation networks, including Internet2? How do they differ from those of the existing public Internet? What benefits can they provide?

Next Generation Internet (along with Internet2) is NRN consortia representing 180 universities, private businesses, and government agencies that are working on a new robust high-bandwidth version of the Internet. Internet2 is a research network with new protocols and transmission speeds that provides an infrastructure for supporting high-bandwidth Internet applications. Internet2 makes it easier to deliver high-bandwidth applications, such as videoconferencing, video on demand, and multimedia. As the textbook mentions, the Internet was not designed to handle the huge quantities of data that are flowing through its interconnected networks. Experimental national research networks attempt to address this problem by providing test beds for leading-edge technology for research institutions, universities, and corporations. The technologies enable companies to distribute video, audio, three-dimensional simulations, and life-size video teleconferencing without performance degradation

7.4 Name and describe the technologies used for wireless transmission

Common technologies for wireless transmission include microwave transmission, communication satellites, pagers, cellular telephones, personal communication services, personal digital assistants, smart phones, and mobile data networks. A microwave system is a high-volume, long-distance, point-to-point transmission in which high-frequency radio signals are transmitted through the atmosphere from one terrestrial transmission station to another. A communication satellite system transmits data using orbiting satellites that serve as relay stations for transmitting microwave signals over very long distances. A paging system is a wireless transmission technology in which the pager beeps when the user receives a message and is used to transmit short alphanumeric messages. Cellular phones are devices that transmit voice or data using radio waves to communicate with the radio antennas placed within adjacent geographic areas called cells. Personal communication services are a wireless cellular technology that uses lower power, higher frequency radio waves than does cellular technology and can be used with smaller size telephones. Personal digital assistants are small, pen-based, handheld computers with built-in wireless telecommunications capable of entirely digital communications transmission. A smart phone is a wireless phone with voice, text, and Internet capabilities. Mobile data networks are wireless networks that enable two-way transmission of data files cheaply and efficiently.

ANSWERS - CASE STUDY

1. **Define and compare the business strategies and business models of Google and Microsoft.**

   Google: Its business model has always focused on the Internet and the Web. It began as one of many search engines. It quickly ran away from the pack with its copyrighted PageRank search algorithm which returns superior search results for Web users. It also has developed extensive online advertising services for businesses of all sizes. It's ability to attract the best and brightest minds in the industry helps make it one of the most successful Web-based businesses ever. Google provides value to the user by using an inexpensive, flexible infrastructure to speed up Web searches and provide its users with a vast array of Web-based services and software tools.

   Microsoft: Its business model originally focused on the desktop computer running the Windows operating system and Office desktop productivity applications. The company and its products are staples for businesses and consumers looking to improve their productivity with computer-based tasks. While it is trying to expand its presence on the Internet, it still must try to keep customers bound to the desktop computer.

2. **Has the Internet taken over the PC desktop as the center of the action? Why or why not?**

   The technology and computing world seems to be approaching the point where the Internet has taken over the PC desktop as the center of action thanks to Google and software-as-a-service companies. The Internet continues to develop and the availability of broadband Internet connections provide more bandwidth for users. Google's introduction of the concept of cloud computing allows more and more computing tasks to be performed via the Web, on computers sitting in data centers. Google is banking that Internet-based computing will supplant desktop computing as the way most people work with their computers. Using cloud computing, users are not tied to a particular machine to access information or do work. Google remains responsible for data center maintenance thereby relieving companies, small and large, from the chore. Google is also relying on the increasing ubiquity of the Internet and availability of broadband and Wi-Fi connections to offset security concerns and the potential lack of Internet connections to applications.

   On the other hand, Microsoft has a well-established and popular set of applications that many consumers and businesses feel comfortable using. The installed base of Microsoft products provides it shelter, at least temporarily, from the onslaught of Internet-based products and services. Users are familiar and comfortable with Microsoft products and companies aren't about to throw all of their software out the window. The migration to the Internet away from PC desktops will be a gradual process.

3. Why did Microsoft attempt to acquire Yahoo!? How did it affect its business model? Do you believe this was a good move?

Microsoft realized it needed to bolster its Internet presence. Purchasing Yahoo! would give the company more Internet search market share – 20 percent more on top of its own 10 percent. The merger would increase the possibility of dethroning Google. With or without Yahoo!, Microsoft needs to improve its Internet presence a great deal. It's online services division's performance has worsened while Google's has improve.

Microsoft wants to "innovate and disrupt in search, win in display ads, and reinvent portal and social media experiences." Its pursuit of Yahoo! suggests skepticism even on Microsoft's own part that the company can do all of this on its own. It is far easier to simply buy a company that already does all these things rather than try to develop the services and products in-house.

Even though Microsoft's initial attempts to purchase Yahoo! were unsuccessful, it probably did the right thing. Even if it eventually succeeds and purchases the company, it will be very difficult to integrate Yahoo!'s culture and organization into Microsoft's. That will deal a setback to both companies.

4. What is the significance of Google Apps to Google's future success?

The Google Apps suite include a series of Web-based applications that include Gmail, instant messaging, calendar, word processing, presentation, and spreadsheet applications. It also includes tools for creating collaborative Web sites. The applications are smaller, more simpler versions of Microsoft's Office applications and exclude many advanced features that Google insists most users don't need. Basic versions are free while 'Premier' editions sell for about $50 per year per person. Microsoft Office costs about $500 per year per person. That appeals to small businesses who prefer cheaper, simpler versions of the application. Google has partnered with Salesforce.com to integrate their CRM applications with Google Apps. That created a new sales channel market Google Apps to businesses that have already adopted Salesforce CRM software and its business model of software-as-a-service.

Both Google and Microsoft have opened their software platforms to developers in an attempt to increase the number of applications available for each company.

5. Would you use Google Apps instead of Microsoft Office applications for computing tasks? Why or why not?

Answers will vary but some components that students should include in their answers are:

- Price: Google Apps are free for the slimmed down version or $50 per year per use. Microsoft Office is a flat rate of $500 per year per user.
- Access: Google Apps are available from any computer. Microsoft Office limits its availability to a particular desktop.
- Security: Google Apps may have security risks based on Internet vunerabilities. Microsoft Office has little or no security risks as long as data remains on a secured desktop.
- Compliance with federal laws: Because Google Apps are maintained on central servers owned and maintained by Google, companies may find themselves out of compliance with laws like Sarbanes-Oxley which requires that companies maintain and report their data to the government upon request. No such situation exists with Microsoft Office applications.
- Existing platforms: Many companies have built their computing platforms around Microsoft operating systems and Office applications. They are reluctant to give that up and move to a new platform like Google Apps.

6. Which company and business model do you believe will prevail in this epic struggle? Justify your answer.

Students should consider these principles in their answers:

- Developing scale internally is far more difficult than simply buying it outright. In attempting to grow into new areas, Microsoft faces considerable challenges. The industry changes too quickly for one company to be dominant for very long. Microsoft has had difficulty sustaining its growth rates since the Internet's inception. Even well-managed companies encounter difficulties when faced with disruptive new technologies and Microsoft may be no exception.
- The size, complexity, and bureaucracy of organizations affect the ability of any company to continue to innovate, grow, and expand its reach. (see Chapter 3) As both Google and Microsoft continue to grow, their ability to "turn on a dime" in the face of other competitors may be in serious jeopardy.
- Google currently has the major share of the Web-based advertising market, however Microsoft and other market entrants will be a major threat to them. The Microsoft corporation have very "deep pockets" and will stop at nothing to overturn and destroy Google's competitive advantage. Legal and regulatory compliance will be a major issue as this market grows and more concerns are expressed from the external environments.
- History, however, is not on Google's side. Every major company that's been a force in technology in one era has lost its lead in the next era. For example, IBM was king in the 1940s and 1950s. DEC was king in the mini-computer era during the 1970s. Microsoft was king in the 1980s and 1990s during the reign of desktop computers. Google reigns in the 2000s with its Web-based services. Will it remain on top as technology continues to evolve?

Chapter 8

Securing Information Systems

After completing this chapter, students should be able to answer the following questions:

- Why are information systems vulnerable to destruction, error, and abuse?
- What is the business value of security and control?
- What are the components of an organizational framework for security and control?
- What are the most important tools and technologies for safeguarding information resources?

Introduction

As our society and the world itself come to depend on computers and information systems more and more, firms must put forth a better effort in making their systems less vulnerable and 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.

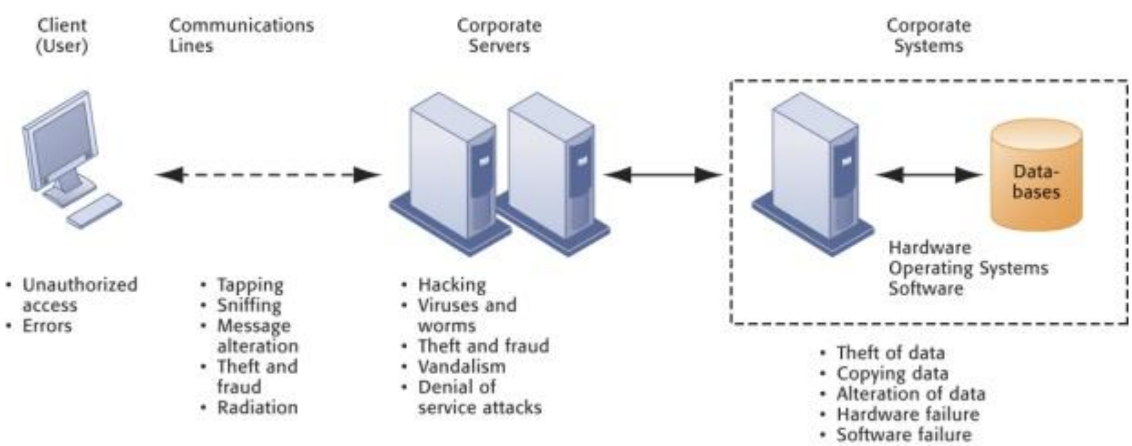
8.1 System Vulnerability and Abuse

As firms become more technologically oriented, they must become more aware of **security** and **control** issues surrounding their information systems and protect the resources more stringently than ever before. It’s that simple.

Why Systems Are Vulnerable

Information systems are vulnerable to technical, organizational, and environmental threats from internal and external sources. The weakest link in the chain is poor system management. If managers at all levels don’t make security and reliability their number one priority, then the threats to an information system can easily become real. Figure 28 below gives you an idea of some of the threats to each component of a typical network.

Figure 28: Contemporary Security Challenges and Vulnerabilities.



Source: (Laudon and Laudon, 2010:323)

Businesses that partner with outside companies are more vulnerable because at least some data may be less controlled. Partnering companies may not protect information as stringently. Hardware and software safeguards may not be as important to outsiders. Employees of the partnering firm may not view security as diligently as the primary business.

In today's business environment, it's not enough to protect hardware and software physically located within an organization. Mobile computing devices like smartphones, cell phones, netbooks, and laptops, add to the vulnerability of information systems

Internet Vulnerabilities

> "If electronic business is to prosper and truly move into the mainstream of commerce, everyone involved–merchants, financial institutions, software vendors, and security suppliers such as VeriSign–has to make security a top priority, starting right now. Security is very hard to get right under the best of circumstances and just about impossible when it isn't the focus of attention. If the industry doesn't get this right–and fast–it's setting the stage for a catastrophic loss of confidence." (Business Week, March 26, 2001)
>
> "In a survey my company carried out last year, security professionals were asked to identify the most common sources of automated worm attacks. Not surprisingly, three of the top four causes pointed directly at dirty PCs. Forty-three percent said employee laptops were the primary source of worm attacks, 34 percent fingered contractor laptops, and 27 percent claimed that home PCs connected to virtual private networks (VPNs) were the guilty parties." (Jon Oltsik, Time to send a consistent message on security, CNet News.com Feb 23, 2006)

These two articles show how long the problem with poor security has existed and how vulnerable computing systems are. Every point of entry into the Internet network is a point of vulnerability.

If you connect to the Internet with a cable modem or DSL you are much more vulnerable to hackers on your home PC than if you connect with a dial-up modem. That's because you are always connected, with a permanent IP address, which makes it easier for hackers to find you. The only smart thing to do is keep your software up-to-date and include firewall protection.

Because distributed computing is used extensively in network systems, you have more points of entry, which can make attacking the system easier. The more people you have using the system, the more potential for fraud and abuse of the information maintained in that system. 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 let down the necessary safeguards in order for one other person to disable a system or destroy data.

Wireless Security Challenges

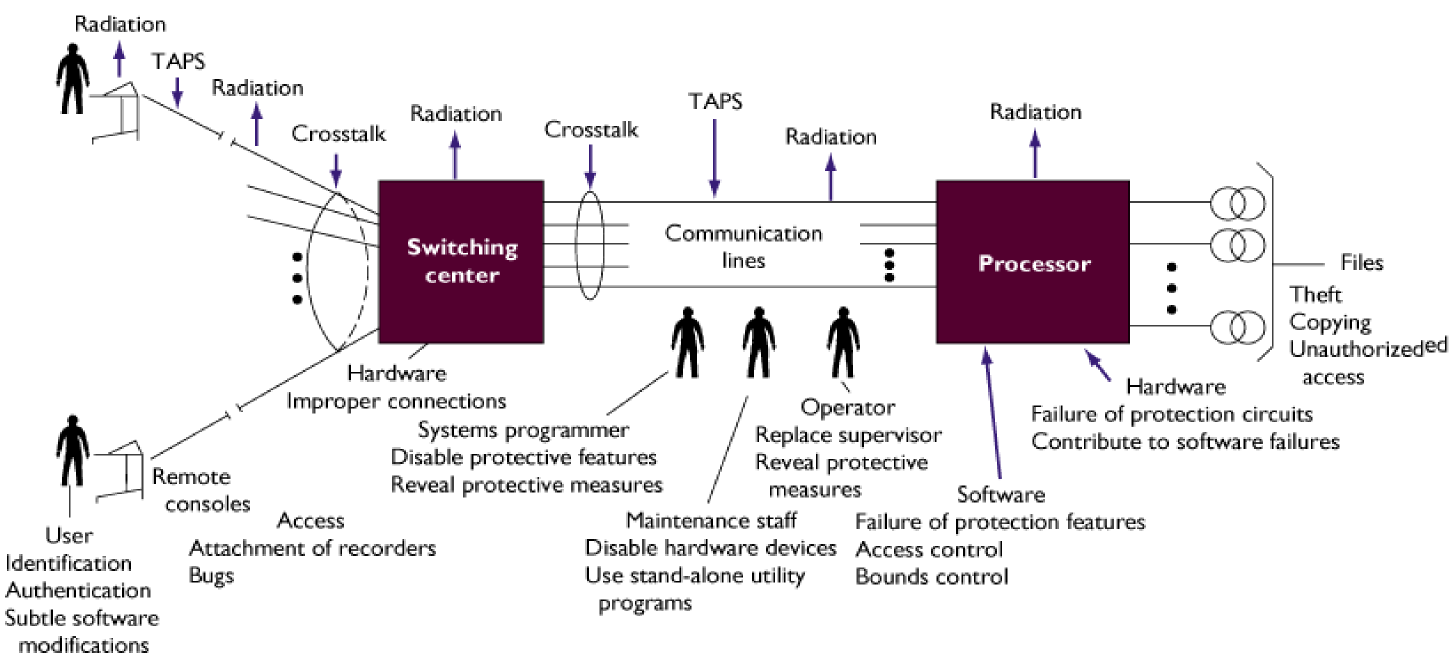
It's a difficult balancing act when it comes to making wireless systems easy to access and yet difficult to penetrate. Internet cafes, airports, hotels, and other hotspot access points need to make it easy for users to use the network systems with the 802.11 standard. Yet, because it is so easy, hackers and crackers can easily access unsuspecting users' systems and steal data or use the entry point as a way to spread malicious programs. The hackers can use **war driving** techniques to gain access to wireless networks not only in hotels and airports, but private businesses and government centers.

Wireless networks are vulnerable in the following ways:

- Radio frequency bands are easy to scan
- Signals are spread over a wide range of frequencies
- Service set identifiers (SSID) are broadcast multiple times and are easily picked up
- Rogue access points can be established on different radio channels and divert signals from authentic points
- Wired equivalent privacy (WEP) isn't very effective because it relies on user input

Network vulnerabilities is shown in Figure 29 below.

Figure 29: Network Vulnerabilities



Source : (Laudon and Laudon, 2002:436)

Malicious Software: Viruses, Worms, Trojan Horses, and Spyware

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.

Web-enabled and e-mail-enabled cell phones are now being targeted as a way to spread viruses.

> Just when you were getting the hang of protecting your computer from viruses, they must have sneezed and found your cell phone. One in every 10 phones is now a smart phone—capable of handling data and messaging. That means it's become easy and lucrative for hackers to attack your cell phone. And the dangers are just as real. From 2004 to 2006, the number of phone viruses doubled every month.
>
> According to Symantec, viruses spread on cell phones in a variety of ways: Internet downloads, MMS (multimedia messaging service) attachments, and Bluetooth transfers to name a few. They'll often show up as game downloads, updates to your phone's system, ringtones, or alerts. McAfee Avert Labs has identified about 450 different variants of mobile threats, and that's not including phishing attacks and spam. According to McAfee research, 83 percent of worldwide carriers have had security incidents in 2007. (www.yahoo.com/blog, Robin Raskin, Oct 31, 2007)

A different type of **malware** called **worms** can also destroy data on computers or clog network systems with software-generated electronic transmissions. Worms are similar to viruses in that they can create additional file copies on a computer and generate emails to other computers with the infected file attached. Worms differ from viruses because they don't need human intervention to spread from one computer to another.

Trojan horses cause problems because they force a computer system to perform unexpected operations, often to the detriment of the system and the user. This type of malware is usually masked in email messages although it can be stored on Web sites.

This table gives you examples of malicious code that are spread through vulnerable Internet-connected systems.

SELF CHECK QUESTION 8.1

Why are computer systems more vulnerable than manual systems to destruction, fraud, error, and misuse? Name some of the key areas where systems are most vulnerable

(Answers at the end of this Section)

Table: 5 Examples of Malicious Code

NAME	TYPE	DESCRIPTION
Storm	Worm/ Trojan horse	First identified in January 2007. Spreads via e-mail spam with a fake attachment. Infected up to 10 million computers, causing them to join its zombie network of computers engaged in criminal activity.
Sasser.ftp	Worm	First appeared in May 2004. Spread over the Internet by attacking random IP addresses. Causes computers to continually crash and reboot, and infected computers to search for more victims. Affected millions of computers worldwide, disrupting British Airways flight check-ins, operations of British coast guard stations, Hong Kong hospitals, Taiwan post office branches, and Australia's Westpac Bank. Sasser and its variants caused an estimated $14.8 billion to $18.6 billion in damages worldwide.
MyDoom.A	Worm	First appeared on January 26, 2004. Spreads as an e-mail attachment. Sends e-mail to addresses harvested from infected machines, forging the sender's address. At its peak this worm lowered global Internet performance by 10 percent and Web page loading times by as much as 50 percent. Was programmed to stop spreading after February 12, 2004.
Sobig.F	Worm	First detected on August 19, 2003. Spreads via e-mail attachments and sends massive amounts of mail with forged sender information. Deactivated itself on September 10, 2003, after infecting more than 1 million PCs and doing $5 to $10 billion in damage.
ILOVEYOU	Virus	First detected on May 3, 2000. Script virus written in Visual Basic script and transmitted as an attachment to e-mail with the subject line ILOVEYOU. Overwrites music, image, and other files with a copy of itself and did an estimated $10 billion to $15 billion in damage.
Melissa	Macro virus/ worm	First appeared in March 1999. Word macro script mailing infected Word file to first 50 entries in user's Microsoft Outlook address book. Infected 15 to 29 percent of all business PCs, causing $300 million to $600 million in damage.

Source: (Laudon and Laudon, 2010:329)

Not all **spyware** is damaging to a computer system. It is a popular method for some Web sites to monitor how users navigate through a site, providing critical information that the Web designers and developers can use to improve the site. Unfortunately, some spyware is becoming a preferred method for hackers to install malicious code on computers and allow them to infiltrate an unsuspecting computer. **Key loggers** are an example of how spyware programs are used to capture personal or business information from unsuspecting users.

Hackers and Computer Crime

Hackers and **crackers**, 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 it hard to gather real statistics about the extent of hacking attempts and successes. Unauthorized access 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, where they can 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 through **cybervandalism**. Other hackers attack systems because they don't like the company.

> Even after last week's unveiling of privacy upgrades, a security lapse on the Facebook Inc. social network early this week still exposed restricted photos to anyone using the site, according to an Associated Press report later confirmed by the company to Computerworld.
>
> A spokeswoman said that after learning of the problem, Facebook engineers on Monday "tested the scenario, found that it was a bug and fixed it immediately." In a statement, the company added that "We take security very seriously." (Computerworld, March 26, 2008)

Spoofing and Sniffing

These are two other methods hackers and criminals use to gain improper or illegal access to computer systems. **Spoofing** is becoming a common way to steal financial information through fake Web sites. The spoofed site is almost a mirror image of the real site and unless the unsuspecting user examines the spoof closely, he/she may inadvertently give out important personal and financial information.

Using a **sniffer** program is a popular way to "grab" information as it passes over transmission lines regardless of whether they are hard-wired or wireless. It is almost impossible to detect and encryption is about the only way to safeguard against it.

Denial of Service Attacks

As companies and organizations expand their business to Web sites, they are opening another point of vulnerability through **denial of service attacks.** Using **botnets** to launch **distributed denial of service attacks** is becoming all too common.

> "Hacker RSnake blogs about a newly discovered and deadly denial-of-service attack that could well be the next big threat to the Internet as a whole. It goes after a broadband Internet connection and KOs machines on the other end such that they stay offline even after the attack is over. It spans various systems, too: the pair of Swedish researchers who found it have already contacted firewall, operating system, and Web-enabled device vendors whose products are vulnerable to this attack.") (Slashdot.org, Nov 2008)

Computer Crime

Some of the crimes we have just described are the most popular. **Computer crime** is a growing national and international threat to the continued development of e-business and e-commerce. When the Internet was first created in the late 1960s, the designers intentionally built it to be open and easily accessible. Little did they know 40 years later, that structure would be the very cause of so much crime and vandalism. Table 6 lists the best known examples of computer crime.

Table: 6 Computer Crimes

COMPUTERS AS TARGETS OF CRIME
Breaching the confidentiality of protected computerized data
Accessing a computer system without authority
Knowingly accessing a protected computer to commit fraud
Intentionally accessing a protected computer and causing damage, negligently or deliberately
Knowingly transmitting a program, program code, or command that intentionally causes damage to a protected computer
Threatening to cause damage to a protected computer
COMPUTERS AS INSTRUMENTS OF CRIME
Theft of trade secrets
Unauthorized copying of software or copyrighted intellectual property, such as articles, books, music, and video
Schemes to defraud
Using e-mail for threats or harassment
Intentionally attempting to intercept electronic communication
Illegally accessing stored electronic communications, including e-mail and voice mail
Transmitting or possessing child pornography using a computer

It's very difficult for our society and our governments to keep up with the rapid changes in the types of computer crime being committed. Many laws have to be rewritten and many new laws must be implemented to accommodate the changes.

Identity Theft

The fastest growing crime off or on the Internet is identity theft. Even though identity theft is most likely to occur in an offline environment, once your personal information has been stolen its easy to use it in an online environment.

> "The biggest risk for identity fraud is from the old-fashioned theft of your wallet or paper records from your trash. And from people who know you. People who are close to you can set up known accounts and have the information sent to a new address. So the fraud goes on longer and is harder to discover," says James Van Dyke of Javelin Strategy in Pleasanton, California. (USAToday Online, Jan 26, 2005)

Several government Web sites provide extensive information about how to prevent identity theft. The Federal Trade Commission at www.ftc.gov gives you information about what to do if you think your identity has been stolen. Another government-sponsored site is OnGuardOnline.gov:

"OnGuardOnline.gov provides practical tips from the federal government and the technology industry to help you be on guard against Internet fraud, secure your computer, and protect your personal information."

There are many precautions people can take to help prevent identity theft. One way is to scrutinize emails or phone calls that ask for your personal information or financial account information. No legitimate financial institution will ever send an e-mail requesting you to supply your account information. That is the number one indicator that the e-mail is a **phishing** e-mail. You should ignore and delete the email immediately. You can also access www.annualcreditreport.com and receive free copies of your credit reports from the three major credit reporting bureaus to monitor the information about your credit card and financial activities.

Other ways your identity can be stolen is through **evil twins** based on wireless network intrusions and **pharming**, the use of bogus Web sites. All of these are classified as computer crimes for which our government is continually passing new laws.

Click Fraud

All those ads you see on Web sites cost the sponsor money. Every time someone clicks on an ad, the sponsor is charged a pay-per-click fee. The fee is based on the popularity of the search words that generated the ad. What if your company is paying for an ad with little or no resultant traffic to your Web site? That's what happens in the case of click fraud. A person or a software program continually hits on the ad, driving up the advertising fees, without any intention of actually visiting the site.

> "The growing ranks of businesspeople worried about click fraud typically have no complaint about versions of their ads that appear on actual Google or Yahoo Web pages, often next to search results. The trouble arises when the Internet giants boost their profits by recycling ads to millions of other sites, ranging from the familiar, such as cnn.com, to dummy Web addresses like insurance1472.com, which display lists of ads and little if anything else. When somebody clicks on these recycled ads, marketers such as MostChoice get billed, sometimes even if the clicks appear to come from Mongolia. Google or Yahoo then share the revenue with a daisy chain of Web site hosts and operators. A penny or so even trickles down to the lowly clickers.
> That means Google and Yahoo at times passively profit from click fraud and, in theory, have an incentive to tolerate it. So do smaller search engines and marketing networks that similarly recycle ads. (BusinessWeek, October 2, 2006)

Global Threats: Cyberterrorism and Cyberwarfare

As terrorism continues to increase the possibility of physical attacks anywhere in the world, computer systems can be targeted as often as buildings, cars, or trains. Governments realize this and are investigating ways of preventing system attacks or minimizing the damage caused to the vast number of networks that are vulnerable.

> "Just how real is the threat that cyberterrorism poses? Because most critical infrastructure in Western societies is networked through computers, the potential threat from cyberterrorism is, to be sure, very alarming. Hackers, although not motivated by the same goals that inspire terrorists, have demonstrated that individuals can gain access to sensitive information and to the operation of crucial services. Terrorists, at least in theory, could thus follow the hackers' lead and then, having broken into government and private computer systems, cripple or at least disable the military, financial, and service sectors of advanced economies. The growing dependence of our societies on information technology has created a new form of vulnerability, giving terrorists the chance to approach targets that would otherwise be utterly unassailable, such as national defense systems and air traffic control systems. The more technologically developed a country is, the more vulnerable it becomes to cyber attacks against its infrastructure." (United States Institute for Peace, Special Report #119, Dec 2004)

Internal Threats: Employees

It is surprising to learn that most computer crime against companies is committed by current or former employees. They know the system best, are entrusted with huge amounts of data, and have the easiest access. Managers and executives need to be aware of potential internal threats to their systems and put special measures in place to safeguard systems and data. They also need to impress upon all employees how important security is throughout the system right down to the last person.

> "Workers are more like to indulge in risky Internet behavior—surfing to unknown or even suspicious sites, for example—when they have an IT department behind them to clean up their mess, a recently released study claims.
>
> According to the July study—which was released Tuesday by Tokyo-based Trend Micro and based on polls of 1,200 users, 400 each in the United States, Germany, and Japan—39 percent of enterprise workers believed that their company's IT department would keep them safe from viruses, worms, spyware, spam, and phishing and pharming attacks.
>
> That confidence, whether on the mark or misplaced, leads workers to do risky, even stupid, things at work, such as opening questionable e-mail messages or clicking on unknown Web site links.
>
> Out of those who admitted to unsafe surfing, 63 percent acknowledged they took the risk because IT had installed security software on their computers, for

> instance. Meanwhile, 40 percent of risk-takers admitted they did so because IT was available to provide support if problems occurred, essentially providing a backstop.” (Gregg Keizer TechWeb News Sep 14, 2005)

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. The same password should not be used for more than one access point. Using multiple passwords limits the damage done if a hacker does manage to obtain a single password.

Safeguarding individual passwords from **social engineering** maliciousness is the responsibility of everyone in the organization. An effective way of limiting access to data is to establish computer-generated logs that show every employee who logged on, what they did, what part of the system they 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.

Software Vulnerability

You too can be a millionaire! On the ABC television show “Who Wants to be a Millionaire,” one contestant won the top prize of one million dollars by knowing which insect represented a computer “bug.” 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 computer 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 burnt it out. She coined the term “bug” to describe a problem with computers.

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, **patches,** 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 and corrected.

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. Many bugs originate in poorly defined and designed programs and keep infiltrating all parts of the program.

> "As governments, businesses, and other organizations become more reliant on technology, the consequences of software failures are rarely trivial. Entire businesses–and even lives–are at stake. Many experts believe the situation will only worsen as software automates new tasks and more systems interconnect with and rely on other computers. Technical challenges may be surmounted, but managing people never gets easier. "The limit we're hitting is the human limit, not the limit of software," says Joshua Greenbaum, principal analyst at Enterprise Applications Consulting in Berkeley."

8.2 Business Value of Security and Control

Transactions worth billions and trillions of dollars are carried out on networks every day. Think of the impact if the networks experience downtime for even a few minutes. And, the problem is far worse than companies may reveal:

> "Since the beginning of the year, there has been a string of high-profile identity thefts. Bank of America disclosed it lost computer tapes containing financial data of some of its customers. The personal information of 59,000 people affiliated with California State University—the group included prospective students, faculty and staff—was stolen last month by hackers. The ChoicePoint scam, which was reported in February, affected as many as 145,000 consumers. The most alarming part of this situation, perhaps, is that these are the known incidents. In the case of ChoicePoint, for example, the only reason the theft came to light was because California law required the company to tell affected consumers. "The fact is, consumer data is semiregularly hacked and never reported to authorities," Panda Software CTO Patrick Hinojosa said. (copied from ContactCenterToday.com, Mar 1, 2006)

In 2005 ChoicePoint, a data brokerage company, revealed that they had inadvertently sold personal and financial information to more than 50 companies that were fronts for identity thieves. This incident underscores the difficulties with protecting data and information on millions of unsuspecting consumers and legitimate businesses.
The cost of settling several lawsuits went far beyond the potential profits Choicepoint probably made. Indeed, the problem has been very damaging to Choicepoint's business reputation.

> "Consumer data broker ChoicePoint, Inc., which last year acknowledged that the personal financial records of more than 163,000 consumers in its database had been compromised, will pay $10 million in civil penalties and $5 million in consumer redress to settle Federal Trade Commission charges that its security and record-handling procedures violated consumers' privacy rights and federal laws. The settlement requires ChoicePoint to implement new procedures to ensure that it provides consumer reports only to legitimate businesses for lawful purposes, to establish and maintain a comprehensive information security program, and to

obtain audits by an independent third-party security professional every other year until 2026.

"The message to ChoicePoint and others should be clear: Consumers' private data must be protected from thieves," said Deborah Platt Majoras, Chairman of the FTC. "Data security is critical to consumers, and protecting it is a priority for the FTC, as it should be to every business in America." (FTC.gov, copied Nov 2008)

Legal and Regulatory Requirements for Electronic Records Management

Because so much of our personal and financial information is now maintained electronically, the U.S. government is beginning to pass laws mandating how the data will be protected from unauthorized or illegal misuse. Congress has passed several measures outlining the requirements for electronic records management:

- **HIPAA**: protects medical and health care data
- **Gramm-Leach-Bliley Act**: requires financial institutions to ensure the security and confidentiality of customer data
- **Sarbanes-Oxley Act**: requires companies and their management to safeguard the accuracy and integrity of financial information that is used internally and released externally

All of these laws are in response to computer crimes and abuses that businesses or individuals have committed or experienced. It's very difficult to pass the laws and costly for businesses who struggle to comply with them.

Electronic Evidence and Computer Forensics

Several things are happening in the corporate world that are changing the requirements for how companies handle their electronic documents: 1) Companies are communicating more and more with e-mail and other forms of electronic transmissions, and 2) Courts are allowing all forms of communication to be held as evidence. Therefore businesses must develop methods of capturing, storing, and presenting any and all electronic communications including e-mail, instant messaging, and e-commerce transactions.

Computer forensics is a growing field because of the increasing digitization of documents and communications. Many people believe that just because they delete a file from a computer file directory that it's no longer available or recoverable. That's a false belief. Ambient data remains on hard drives in magnetic form long after it's apparently been deleted. People trained in computer forensics are able to uncover ambient data and other forms of electronic evidence that can be used in courts of law. Businesses and employees must increase their awareness of the necessity for keeping good records.

8.3 Establishing a Framework for Security and Control

How do you help prevent some of the problems we've discussed? One of the best ways is to institute controls into your information system the same way you might in any other system; through methods, policies, and procedures.

Information Systems Controls

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. There are fences around the perimeter of the building that 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. It doesn't wait until everything is built. You should do the same thing with an information system. It's no different from any other system that requires planning and well-thought-out policies and procedures *before* construction begins.

The two types of information system controls are:

- **General controls:** software, physical hardware, computer operations, data security, implementation process, and administrative. Table 8-3 in the text describes each of these.
- **Application controls**: input, processing, and output

Risk Assessment

Companies and government systems constantly use **risk assessment** 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 set up cost comparisons for developing and maintaining security against the loss potential. It's done all the time in other systems, so use it for your information system as well.

Security Policy

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 for their information systems. Because of the increasing liability for security breaches, many companies are now establishing a chief security officer position to help ensure the firm maximizes the protection of information resources. Some tools available to the CSO are:

- **Security policy:** principle document that determines security goals and how they will be achieved
- **Acceptable use policy:** outlines acceptable and unacceptable uses of hardware and telecommunications equipment; specifies consequences for noncompliance
- **Authorization policy:** determines what access users may have to information resources
- **Authorization management systems:** manages access to each part of the information system

Disaster Recovery Planning and Business Continuity Planning

Floods, fires, hurricanes, even tsunamis, happen without a moment's notice. Perhaps the most important element of a successful system is a **disaster recovery plan.** Some firms, not just in New York City and Washington D.C. but around the world, discovered the necessity for a well-written and tested plan on September 11, 2001. Those firms that had completed **business continuity planning** were able to carry on business, while those that hadn't, spent days and weeks recovering from the terrorist attacks.

It's important that managers and employees work with information system technicians to develop these plans. Too much is at stake to leave the planning process to one group or the other.

The Role of Auditing

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 an important 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 is protected against theft, abuse, and misuse. In essence, an MIS audit checks all the controls we've discussed in this chapter.

SELF CHECK QUESTION 8.2

Describe the roles of firewalls, intrusion detection systems, and encryption systems in promoting security.

(Answers at the end of this Section)

8.4 Technologies and Tools for Protecting Information Resources

Let's look at some of the ways a firm can help protect itself.

Access Control

Continuous headlines telling of hackers' exploits in the past year should be enough to convince every company of the need to install firewalls, **access controls,** and other security measures. With the installation of cable modems or DSL lines, home users must follow the same guidelines. These new connections, which leave your personal computer "always on," are just as vulnerable to attacks as corporate systems.

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 it up, and properly protecting it against corruption. Do you even have a policy about whether employees can store data on their individual terminals?
In corporate systems, it's important to ensure **authentication** methods are in place so that unauthorized users can't gain access to the system and its data. Access can be granted in one of three ways: something you know – passwords; something you have – tokens or smart cards; something you are – biometric authentication.

Because most simple password systems are too weak and make the system too vulnerable, security experts are devising new methods to control access. **Tokens** and **smart cards** are small, physical devices individuals use to securely access information systems.

Biometric authentication is becoming more popular as a method of protecting systems and data as the technology is refined. While you may have seen the fingerprint or facial recognition techniques only on sci-fi movies, rest assured it may be the next wave of security that's installed in your organization.

Firewalls, Intrusion Detection Systems, and Antivirus Software

The four types of firewalls described in the text are:
1. *Packet filtering:* data packet header information is examined in isolation
2. *Stateful inspection:* the actual message comes through the firewall but must be identified by the user as passable
3. *Network address translation (NAT):* conceals IP addresses and makes it more difficult to penetrate systems
4. *Application proxy filter:* sort of like a fence through which a substitute message passes

Intrusion Detection Systems

Firewalls can deter, but not completely prevent, network penetration from outsiders and should be viewed as one element in an overall security plan. In addition to firewalls, digital firms relying on networks use **intrusion detection systems** to help them protect their systems.

In March 2002, Wright Patterson Air Force Base, Ohio, reported over 250,000 unauthorized attempted entries into its computer systems by hackers in a 24-hour period. The intrusion detection systems it had in place allowed authorities to track the hacker attempts and thwart damage to its critical data and systems.

Antivirus and Antispyware Software

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 at least once a week because new viruses are constantly being written and passed around. Some antivirus software companies now make it very easy to keep your antivirus software current through online updates.
McAfee.com will detect when you are online and notify you when new updates are available. With a few mouse clicks, you download the software to protect against the newest viruses.

Unified Threat Management Systems

It's a daunting task to individually manage all the security tools available to business. **Unified threat management** technologies help organizations by providing all of them in one comprehensive package. It's a great way for small- and medium-size organizations to ensure they cover all the security vulnerabilities in their systems.

Securing Wireless Networks

It's becoming more important for Wi-Fi users to protect their data and electronic transmissions as wireless networks and their access points proliferate around the country. Security is easily penetrated because of the very nature of the spectrum transmission used in Wi-Fi. Unless users take stringent precautions to protect their computers, it's relatively easy for hackers to obtain access to files. Stronger encryption and authentications systems for Wi-Fi than the original Wired Equivalent Privacy (WEP) is being installed in newer computer models. Wi-Fi Protected Access (WPA) improves security on wireless networks but individual users still carry the responsibility to make sure passwords are changed from the original and encryption systems are used to help protect data.

> "Before he ran for president Barack Obama quit smoking. Now that he's won the job, he may have to break another addiction: Checking his BlackBerry for e-mail.

The president's e-mail can be subpoenaed by Congress and courts and may be subject to public records laws, so if a president doesn't want his e-mail public, he shouldn't e-mail, experts said. And there may be security issues about carrying around trackable cell phones.

Obama transition officials haven't made a decision on what the new president will or will not carry, but those who have been there say it's unlikely he'll carry his BlackBerry and he may be in for some withdrawal pains.

"Definitely he's going to feel an electronic detoxing," said Reed Dickens, former assistant press secretary to President George W. Bush. Dickens jokes that he personally is so addicted to his BlackBerry that he checks his device before opening his right eye.” (CNN.com, Nov 17, 2008)

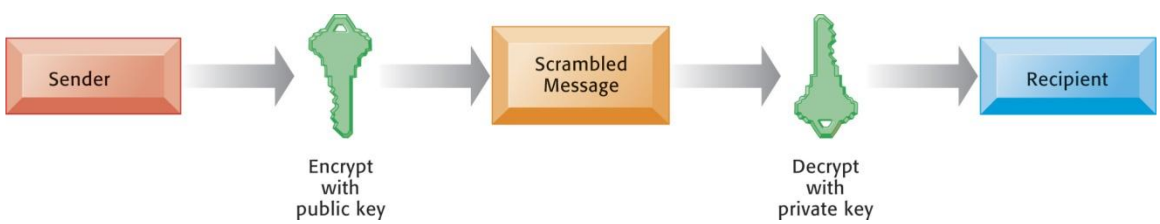
Encryption and Public Key Infrastructure

Most people are reluctant to buy and sell on the Internet because they’re afraid of theft, fraud, and interception of transactions. To help ease the mind and make transactions secure, many companies are using very sophisticated methods of protecting data as they travel across the various transmission mediums through the use of **encryption** (see Figure 30).

The standard methods of making online transactions more secure are **Secure Socket Layers, Transport Layer Security (TLS),** and **Secure Hypertext Transport Protocol.** The next time you’re on an e-commerce or e-business Web site, look in the address text box of your browser and notice if the address begins with https:. If so, the site incorporates one of these two security measures.

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. The sender and recipient have special software programs they can use to encode and decode the transaction on each end.

Figure 30: Public Key Encryption.



Source: (Laudon and Laudon, 2010: 348)

This figure shows you how **public key encryption** works using two keys: one public and one private. 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. Encryption software programs incorporate authentication and message integrity in its program to ensure senders and receivers are protected against many of the computer crimes committed on networks and the Internet.

Another way of providing authenticity to network transmissions is by using a **digital certificate.** Just as your personal signature is connected to you, a digital certificate provides a way of proving you are who you say you are. <A HREF="http://www.globalsign.com" target="new">GlobalSign.com has lots of information about its digital certificate product and other useful information about this technology. You can get a demo certificate, find someone's certificate, or get more information about how to use your own certificate.

Public key infrastructure (PKI) is another method for providing secure authentication of online identity and makes users more comfortable transacting business over networks.

Ensuring System Availability

Many companies create **fault-tolerant computer 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 system experiences a significant period of **downtime**. Add the cost of lost productivity by employees to 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.

Make sure you understand the difference between fault-tolerant computer systems and **high-availability computing:**

- Fault-tolerant computer systems promise continuous availability and eliminate recovery time altogether
- High-availability computer systems help firms recover quickly from a crash

High-availability computer systems use the following tools to ensure digital firms have continuous computing capacity available:

- load balancing
- redundant servers
- mirroring
- clustering
- storage area networks

As systems become more sophisticated and able to self-diagnose problems, **recovery-oriented computing** will go a long way towards helping businesses get back up and running more quickly and easily.

Controlling Network Traffic: Deep Packet Inspection

Network data traffic takes many different forms, from simple text file transfers to massive audio or video file transmission. Obviously the small text files take up less bandwidth and can be transmitted faster than the larger files. **Deep packet inspection** technologies help identify which types of files are being transferred and delay those that hog the network. It makes sense to a point except when the technology is misused or abused.

> The "Net neutrality" debate is gaining urgency, courtesy of Comcast. For years, the idea that an Internet service provider would give better delivery to some kinds of content over others was largely a fear shared by purist Net advocates. Now the cable giant (and its rival, Cox Communications) have admitted to slowing peer-to-peer traffic at times. One p-to-p company, Vuze, says it's time for big carriers to stop targeting this powerful technology, which distributes files over networks of thousands of PC users who download the software. Instead, Vuze says the carriers should embrace it to help meet consumers' insatiable appetite for bandwidth. (BusinessWeek, Dec 3, 2007)

CASE STUDY

Read the Rogue Trader Case Study from Page 359 of the text book and answer the questions that follow

(*Answers at the end of this Section*)

Security Outsourcing

If your company lacks the internal resources to adequately plan for disaster, you can use an outside source such as **managed security service providers.** They may be better at the necessary planning and offering appropriate hardware and software resources because they specialize in such things.

Ensuring Software Quality

There are two methods to help improve software programs and ensure better quality of them. The first one, software metrics, allows IS departments and users to measure a system's performance and identify problems as they occur. You could measure the number of transactions that are processed in a given amount of time or measure your company's online response time. As with any other type of metric, software metrics must be carefully designed, formal, objective, and used consistently. Testing software for bugs and the inevitable errors is so important and yet, so often overlooked. The two best methods of testing are walkthroughs and debugging. Walkthroughs are done before the software is written. Obviously, debugging is done after software is written when errors are found.

SUGGESTED ANSWERS TO SELF-CHECK QUESTIONS

8.1 Why are computer systems more vulnerable than manual systems to destruction, fraud, error, and misuse? Name some of the key areas where systems are most vulnerable.

Computer systems tend to be more vulnerable to destruction, error, and fraud than manual systems for the following reasons:

- Data is stored electronically, where it is not immediately visible or easily audited.
- Data is concentrated in electronic files. Effects of a disaster such as a hardware malfunction, power outage, or fire can be more extensive. An organization's entire record-keeping system could be destroyed.
- There may not be a visible trail to indicate what occurred for every computer process.
- Operation of automated systems requires specialized technical expertise. Unless the systems are properly protected, it may be easy for programmers and computer operators to make unauthorized changes.
- Data files can be accessed and manipulated directly in online systems.
- Data can be stolen, corrupted or destroyed by hackers and computer viruses.
- Errors in data can be entered.
- Errors can be accidentally inserted when desired updates are installed.
- Today many programs can be accessed through telecommunications, and telecommunications can produce errors in data transmission.
- Hardware and software can fail.
- Purposeful and accidental problems, such as programming and data errors, can occur by personnel.

8.2 Describe the roles of firewalls, intrusion detection systems, and encryption systems in promoting security.

Firewalls prevent unauthorized users from accessing internal networks. They protect internal systems by monitoring packets for the wrong source or destination, or by offering a proxy server with no access to the internal documents and systems, or by restricting the types of messages that get through, for example, e-mail. Further, many authentication controls have been added for Web pages as part of firewalls.

Intrusion detection systems monitor the most vulnerable points in a network to detect and deter unauthorized intruders. These systems often also monitor events, as they happen to look for security attacks in progress. Sometimes they even can be programmed to shut down a particularly sensitive part of a network if it receives unauthorized traffic.

Encryption offers protection by keeping messages or packets hidden from the view of unauthorized readers. Encryption is crucial for ensuring the success of electronic commerce between the organization and its customers, and between the organization and its vendors.

ANSWERS - CASE STUDY

1. What concepts in this chapter are illustrated in this case?

Chapter concepts illustrated in this case include:

- System vulnerabilities:
  - Computer crime: using computers as instruments of crime to defraud the bank, customers, and other financial institutions
  - Internal threats from employees: Kerviel has access to privileged information; he was able to run through the organization's system without leaving a trace
- Business value of security and control:
  - Organizations can be held liable for needless risk and harm created if the organization fails to take appropriate protective action to prevent loss of confidential information, data, corruption, or breach of privacy
  - Had Kerviel committed his actions in the U.S. he would have violated the Sarbanes-Oxley Act. Organizational executives could have been held criminally liable.
- Information system controls:
  - General controls: govern the design, security, and use of computer programs and the security of data files in general throughout the organization's information technology infrastructure
  - Application controls: automated and manual procedures that ensure that only authorized data are completely and accurately processed by that application
- Risk assessment: determines the level of risk to the firm if a specific activity or process is not properly controlled
- Security policy: drives policies determining acceptable use of the firm's information resources and which members of the company have access to its information assets
- The role of auditing: an MIS audit examines the firm's overall security environment as well as controls governing individual information systems

2. Describe the control weaknesses at SocGen. What management, organization, and technology factors contributed to those weaknesses?

One former SocGen risk auditor, Maxime Legrand, called the control procedures used to monitor the activity of its traders a sham and that the management "pretend(s) to have an inspection to please the banking commission."

Management: Kerviel's supervisors saw a balanced book when in fact he was exposing the bank to substantial risk because of the way he entered the transactions. Kerviel worked late into the night long after other traders had gone home and took only four vacation days over the course of 2007 to prevent his activities from being detected. Managers did not enforce vacation policies that would have allowed them to scrutinize his work while he was gone. Supposedly he used his manager's computer to execute several of his fraudulent trades while the manager watched him. Kerviel's defense lawyers argue that he acted with the tacit approval of his superiors during his more successful initial period of fraudulent activity.

Organization: Kerviel gained familiarity with many of the company's security procedures and back-office systems. He was then moved to another job in the company in which he could use that knowledge. He knew the schedule of SocGen's internal controls which allowed him to eliminate his fake trades from the system just minutes prior to the scheduled checks and re-enter them soon after. The temporary imbalance did not trigger an alert. The bank ignored many warning signs that Kerviel was capable of the level of fraud that he committed. The bank failed to follow up on 75 warnings on Kerviel's positions over the course of several years.

Technology: Kerviel was able to use other employees' access codes and user information to enter fake trades. The system failed to detect that Kerviel performed legitimate transaction in one direction, but falsified the hedges that were supposed to 'offset' the legitimate ones. He entered false transactions in a separate portfolio, distinct from the one containing his real trades. No system detection software was installed to detect these transactions. SocGen's controls were capable of detecting more complicated errors and fraudulent transaction than the simple ones that Kerviel allegedly committed.

3. **Who should be held responsible for Kerviel's trading losses? What role did SocGen's systems play? What role did management play?**

Most students will probably argue that managers and executives at SocGen should be held responsible for Kerviel's trading losses. They are the ones who should be setting policies and enforcing them to prevent these kinds of activities from taking place.

SocGen's systems were capable of detecting complicated errors and fraudulent transactions that were more sophisticated than those committed by Kerviel. Yet he was able to commit very simple fraudulent transactions that went undetected. System controls obviously were not as thorough or as strong as they should have been. There were several other system vulnerabilities that Kerviel was able to exploit to commit his crime.

Managers aided Kerviel's activities by deciding to unload his positions soon after discovering the fraud, despite the fact that the market conditions at the time were decidedly unfavorable. That led to even greater problems in the global financial world. The SEC launched an investigation into whether or not SocGen violated U.S. securities laws by unwinding Kerviel's positions covertly after the fraud was revealed as well as whether or not insider information played a role in the selling of SocGen stock prior to the announcement of the scandal.

4. What are some ways SocGen could have prevented Kerviel's fraud?

Some of the ways SocGen could have prevented Kerviel's fraud include:

- Instituting access controls to prevent improper access to systems by unauthorized insiders and outsiders. The bank could have used authentication technologies like tokens, smart cards, or biometric authorization instead of simple passwords. That would have prevented Kerviel from being able to use other employees' access codes to enter transactions.

- Intrusion detection systems could have been installed that would have detected much of Kerviel's activities. These systems generate alarms if they find a suspicious or anomalous event. They also check to see if important files have been modified. Monitoring software examines events as they are happening to discover security attacks in progress. Many of Kerviel's false 'offsetting' transactions could have been detected using one of these systems.

- Stronger auditing procedures should have been in place and enforced. Auditors can trace the flow of sample transactions through the system and perform tests, using automated audit software.

- Using computer forensic techniques and technologies would have helped. Electronic evidence resides on computer storage media in the form of computer files and as ambient data which are not visible to the average user. Data that Kerviel deleted on the bank's storage media could have been recovered through various techniques. The data could have been used as evidence at his trial and in follow-up investigations.

5. If you were responsible for redesigning SocGen's systems, what would you do to address their control problems?

Student answers will varying but should address these elements:

General controls: govern the design, security, and use of computer programs and the security of data files in general throughout the organization's information technology infrastructure. These controls address software controls, physical hardware controls, computer operations controls, data security controls, controls over implements of system processes, and administrative controls.

Application controls: specific controls unique to each computerized application. They include both automated and manual procedures that ensure that only authorized data are completely and accurately processed by applications. Application controls include input controls, processing controls, and output controls.

Acceptable use policy: SocGen should create an AUP to define acceptable uses of the firm's information resources and computing equipment, including desktop and laptop computers, wireless devices, telephones, and the Internet. A good AUP defines unacceptable and acceptable actions for every user and specifies consequences for noncompliance.

Authorization management system: establishes where and when a user is permitted to access certain parts of a Web site or a corporate database. Such systems allow each user access only to those portions of a system that person is permitted to enter, based on information established by a set of access rules.

Chapter 9

Achieving Operational Excellence and Customer Intimacy: Enterprise

After completing this chapter, students should be able to answer the following questions:

- How do enterprise systems help businesses achieve operational excellence?
- How do supply chain management systems coordinate planning, production, and logistics with suppliers?
- How do customer relationship management systems help firms achieve customer intimacy?
- What are the challenges posed by enterprise applications?
- How are enterprise applications used in platforms for new cross-functional services?

Introduction

Over the last decade businesses have come to realize how important it is to totally integrate business processes across the enterprise. We've spoken about "islands of information" many times. In today's fast-paced world, managing information assets is more important than ever before. In this chapter we'll look at how important it is for information to be available in every nook and cranny of an enterprise.

9.1 Enterprise Systems

We've look at enterprise resource planning systems in previous chapters and also discovered the importance of efficiently and effectively maintaining data that businesses can develop into useful information. As we've seen, it can be disastrous for an organization to have more than one set of data for customers, employees, and suppliers. The best idea is to have one database that supplies information where and when necessary across functional lines. Everyone from employees to managers, from customers to suppliers, would have the necessary tools to extract the data that they need and present it in the format that fits them best. That's where enterprise systems come in.

What are Enterprise Systems?

Enterprise systems aim to correct the problem of firms not having integrated information. Also known as enterprise resource planning (ERP) systems, their main goal is to bridge the communication gap among all departments and all users of information within a company. If production enters information about its processes, the data are available to accounting, sales, and human resources. If sales and marketing is planning a new advertising campaign, anyone anywhere within the organization will have access to that information. Enterprise systems truly allow a company to use information as a vital resource and enhance the bottom line.

Data integration throughout the firm is the key. Consolidated data from divisions and departments throughout the business, including key business processes, are immediately available to any authorized user. The greatest enticement of enterprise systems is the chance to cut costs firm-wide and enhance the ability to pass information throughout the organization.

"An October 2007 *CIO* magazine survey of nearly 400 IT executives who had an ERP system installed found that more than 85 percent of them agreed or strongly agreed that their ERP systems were essential to the core of their businesses, and that they "could not live without them." Though there has been recent IT scuttlebutt that ERP systems are now shrugged off as legacy inside 21st-century businesses, almost 80 percent of those surveyed disagreed or strongly disagreed with the statement, "My company views ERP systems as legacy systems and no longer invests in them." And when asked if their company would be able to live without its ERP systems within the next five years, more than 80 percent disagreed or strongly disagreed. For better or worse, ERP systems are here to stay." (Copied from cio.com, Nov 2008)

Enterprise Software

Many businesses assume that their operations are totally integrated across functional lines. After all, Manufacturing responds to an order from Sales and produces a product for which Accounting and Finance sends an invoice. A Production manager sends an email to the Human Resources Department requesting five new employees. When the Marketing department decides on a new advertising campaign, a copy of the brochure is included in all employees' pay envelope at the end of the month. Once a week all department managers meet with the executive staff and review statistics from last month's business.

What's the problem? Many times, departments fail to fully communicate with all the other departments about every process that is taking place in a company. They don't do it on purpose but forget how important total communication about every process and every piece of data is. Sales sends an order to Manufacturing with a shipment date that can't possibly be met. Accounting and Finance bills for supplies that Production never order. Human Resources holds a training class that interferes with a rush production job.

What's the solution? **Enterprise software** allows every functional area to share every process and every piece of data. A business can select specific processes in specific areas but eventually everything the company does will be shared across all lines. The software uses predefined processes and requires the company to adapt itself to the software. While many companies may balk at having to change, the software is designed around the best practices for that particular function. The company can benefit from using the most successful solutions in a particular industry to help achieve its objectives. The software helps the organization automate many of the steps taken from industry-wide best practices instead of having to do everything manually. And best of all, the software will help employees remember all of the necessary steps in a process and provide the data to all who need it.

While enterprise software can be somewhat modified, it is very expensive and very difficult to do so. Because the software is so complex, changing just one of the processes may disrupt some of the other interdependent modules. However, manufacturers of the enterprise software programs are modifying the software to envelop Internet services and make the data available to external sources such as suppliers, governmental agencies, and customers.

SELF CHECK QUESTION 9.1

Describe the relationship between TPS, MIS, DSS, and ESS

(*Answers at the end of this Section*)

Business Value of Enterprise Systems

Done correctly, enterprise systems can offer big rewards. Conversely, done incorrectly can cause a firm huge headaches, loss of business, employee turmoil, and wasted dollars.

The changes in the enterprise will be tremendous:

- **Management:** improved management decision making, with a comprehensive view of performance across all functional areas.
- **More efficient operations and customer-driven business processes:** all functional areas can focus more on the customer and respond to product demand more efficiently.
- **A more uniform organization:** a more disciplined approach to business throughout the entire firm, regardless of physical location and/or organizational structure.

Bottom Line: Enterprise systems force a company to fully integrate all business processes. These systems usually require massive changes in the structure and organization of a business and are difficult to implement. However, the changes can make a tremendous improvement in a firm by using the best practices of the industry and requiring all functional areas to focus more on the customer.

9.2 Supply Chain Management Systems

Oh, for the days when the old saying "the customer is king" was just a catch phrase. Now, it's an absolute reality and companies that don't live up to the phrase will get creamed in the marketplace. There are no more separate entities or distinct lines in the sand when it comes to integrating supply chains. It's more like shifting sand.

The Supply Chain

A **supply chain** is similar to a spider's web. It includes all of the internal functions of an organization, along with suppliers, distributors, retailers, and customers. They are all intertwined and rely on information from each other to effectively meet the business's objectives.

Exactly what are all the activities involved in getting a product from conception to delivery? There are probably many more than you can easily think of. And there are many more people involved than you might imagine. It may be helpful to break the supply chain into three distinct groups:

- Upstream: suppliers that deal directly with a manufacturer and their suppliers
- Downstream: distributors and those that deliver products to customers
- Internally: the employees that transform materials, components, and services into the actual products

Think of a mountain stream that starts very small, flows downhill, gathers more water as it combines with other streams, feeds into a river that continues to flow and eventually meets up with other rivers, and on into the ocean. The mountain stream is analogous to suppliers, the river represents manufacturers, and the ocean can be compared to customers.

SELF CHECK QUESTION 9.2

What is customer relationship management? Why is it so important to businesses?

(*Answers at the end of this Section*)

Information Systems and Supply Chain Management

As with other functional areas, information is the glue that holds the supply chain together. Lack of or faulty information can wreak havoc on the entire chain from getting supplies into the manufacturing process and getting the final product to the customer.

In a perfect world, **just-in-time** strategies for ordering and delivering supplies would be an ordinary process. Unfortunately, we don't live in a perfect world. Natural disasters, dock worker strikes, and terrorist activities such as September 11, 2001, can disrupt even the most carefully planned supply chains in an instant. Businesses have to plan as best they can around these kinds of events but they can't foresee every problem.

The **bull-whip effect** on the supply chain is more natural than you might think and happens in virtually every industry.

> "PC makers insist their inventories are in good shape. But there are signs of trouble further down the supply chain. Analysts were taken aback to learn that the Taiwan companies that make the guts of notebooks for market leaders Hewlett-Packard Co. and Dell Inc. saw February sales plunge 10% to 15%.
>
> What's going on? PC makers, encouraged by robust 35% growth in third-quarter notebook unit sales and signs of even stronger holiday demand, ramped up their orders from Taiwan by a staggering 68%, according to the Taipei-based Market Intelligence Center. But while the sales surge kept going through the fourth quarter, analysts fear that the sudden drop in supplier orders means that the pace has slipped in the first quarter of this year. Analysts add that PC makers incorrectly assumed that laptops were so hot that they were immune from the post-Christmas sales slump that has traditionally afflicted desktops." (BusinessWeek, March 15, 2004)

In the example of the bull-whip effect explained above, if the PC makers had been able to pass timely and accurate information to their parts suppliers, perhaps the sudden swing in supplying computer parts could have been avoided. Many companies don't want to give up too much of their information because they fear that outsiders will compromise the information. Unfortunately this way of old-style thinking costs too much money in terms of lost opportunities, overstocked and underused parts, and overpriced products.

Supply Chain Management Software

Supply chain planning systems can provide information up and down the chain and help everyone involved do a better forecasting job. In the example above, the information could pass more easily between the PC retailers and the parts suppliers. While the retailers were still remiss in accurately forecasting PC sales for the first quarter, the parts suppliers could have altered their manufacturing schedules quicker and avoided the huge inventory build-up.

Supply chain planning systems enable firms to

- Generate demand forecasts
- Develop sourcing and manufacturing plans
- Share information about changes easier and faster so work can be better coordinated
- Develop better **demand planning** that matches production closer with customer demands
- Manage the flow of products through distribution centers and warehouses by using **supply chain execution systems**
- Coordinate activities with supply chain partners
- Handle complex interdependencies among various supply chain processes
- Allow users to balance the costs of transportation, delivery, and handling

Global Supply Chains and the Internet

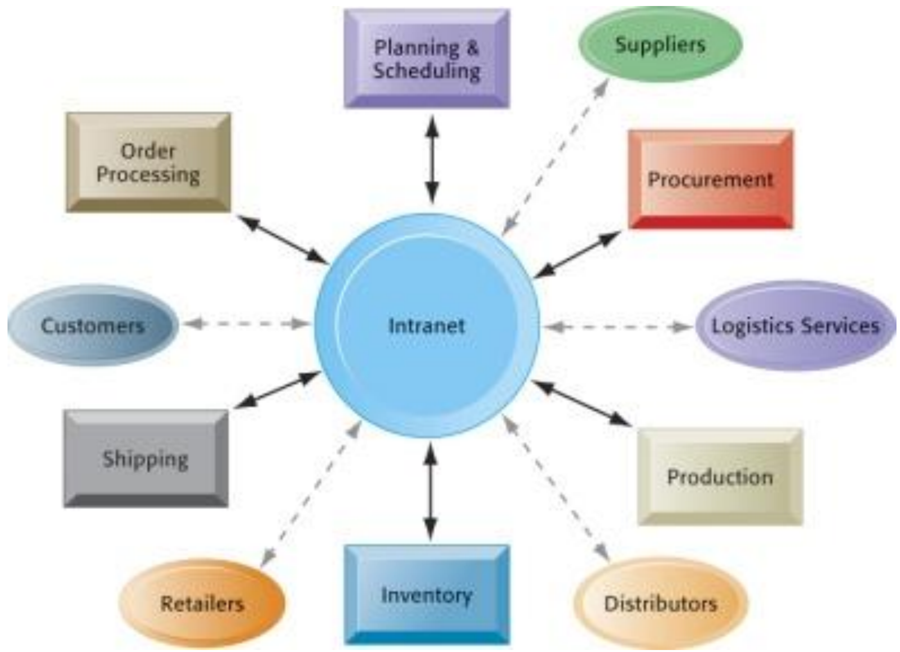
The islands of information that we've frequently mentioned don't exist just inside the corporation but also exist all up and down the supply chain. Adapting the supply chain software to the Internet and opening up information to suppliers, logistical experts, and distributors can greatly help a company reduce costs and ensure products are delivered when needed to the right location. It won't help a company's bottom line to have 1000 parkas delivered to Arizona in March when upstate New York is suffering through a difficult winter.

The same type of internal collaboration that organizations can generate through *intranets* can be extended to supply chain partners through *extranets*. Suppliers can log on to a company's extranet site and review next week's production schedule. The supplier can ensure enough production supplies are delivered to a manufacturer without over- or under-extending itself. Changes to the production schedule can be communicated easier to suppliers through Internet-enabled applications. Long-term forecasts can be posted to an extranet and schedules adjusted.

No expensive proprietary systems are necessary since all information is transmitted through ordinary Web-based applications. Internal and external users can use online applications to view delivery schedules or determine the optimal logistics for moving products.

Figure 31 demonstrates how intranets and extranet provide the necessary communication channels to improve supply chain management.

Figure 31: Intranets and Extranets for Supply Chain Management.



Source: (Laudon and Laudon, 2010:377)

Global Supply Chain Issues

Some of the issues businesses will face if they choose to use global supply chains are

- Greater geographic distances and time differences
- Additional costs for transportation, inventory, and local taxes and fees
- Varying performance standards
- Foreign government regulations
- Cultural differences

The Internet helps suppliers, manufacturers, and partners communicate easier through email, intranets, and extranets. And it gives them a way to make supply chain systems more easily available through Web-based browsers and portals.

While the Internet helps mitigate some of these issues, it's not a panacea for all of them. Companies must still deal with foreign governments and cultural differences for which there are no easy answers or Internet applications.

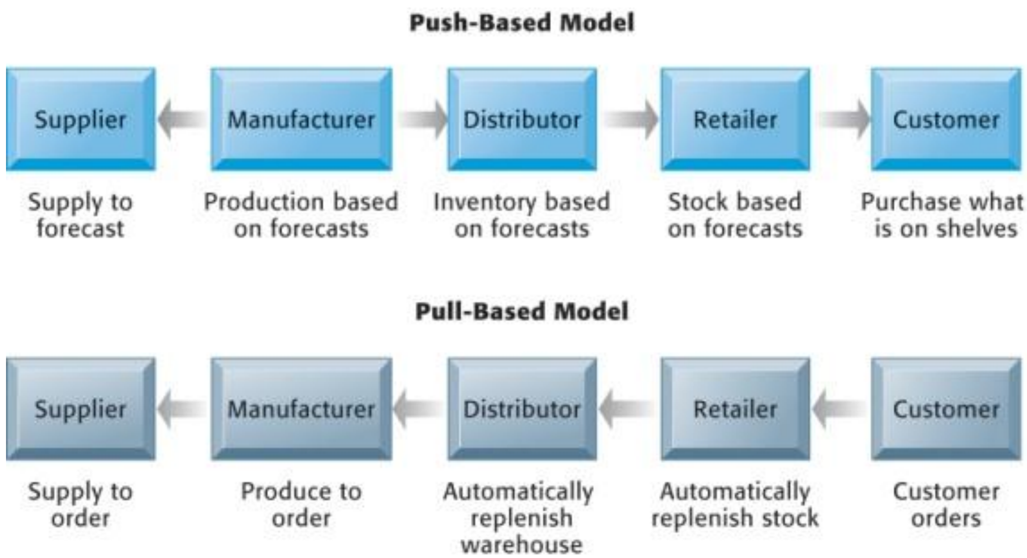
Demand-Driven Supply Chains

Traditionally, customers purchase whatever products are available. While colors, sizes, and prices may vary somewhat, generally a manufacturer decides what to produce by forecasting what the potential demand might be through a **push-based model.** That is quickly changing to a **pull-based model** in which the customer tells the manufacturer ahead of time what he/she wants to buy. One of the best examples of this new pull-based model is Dell Computer's build-to-order business model. Dell doesn't build a computer until it receives a customer order. Then it builds the computer to the customer's specifications.

Granted, the customer must choose from a pre-determined list of options, but Dell doesn't have a huge stock of unsold inventory that no one wants based on faulty demand forecasting.

Figure 32 below shows the differences between the push-based and pull-based supply chain models.

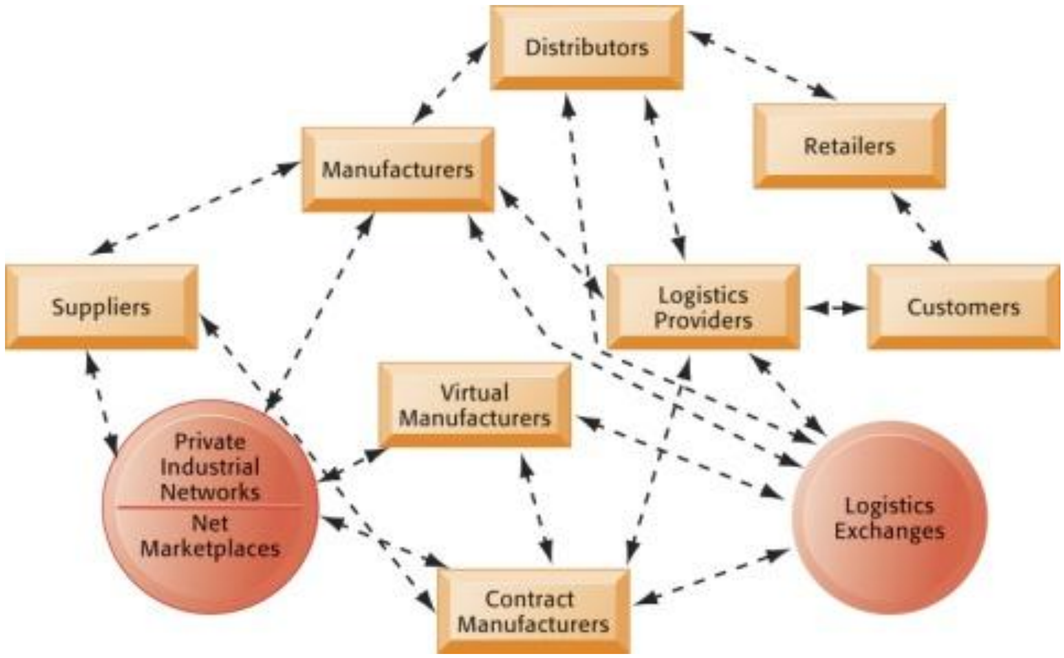
Figure 32: Push- Versus Pull-based Supply Chain Models



Source: (Laudon and Laudon, 2010: 379)

Automobile manufacturers are also adopting pull-based modeling for their customers. A customer in Des Moines can log onto a Web site and select the color, engine, options and kind of tires for his/her new car. The order is sent to the factory in Detroit and the manufacturer's suppliers simultaneously. While the customer must wait for delivery, at least he/she will get exactly the car they wanted. Figure 33 diagrams an Internet-driven supply chain.

Figure 33: The Future Internet Driven Supply Chain.



Source: (Laudon and Laudon, 2010: 380)

Business Value of Supply Chain Management Systems

The benefits of implementing an integrated, networked supply chain management system include:

- Match supply to demand
- Reduce inventory levels
- Improve delivery service
- Speed product time to market
- Use assets more effectively

In turn a company can

- Improve customer service and responsiveness
- Reduce costs
- Utilize cash better

These last three benefits of implementing a supply chain management system point directly to improving the bottom line for the company. By making the supply chain more efficient a company can save millions of dollars, improve its relationships with its customers, and sell more products.

Bottom Line: Supply chain management systems integrate all of the processes by supplying information to all entities involved in the chain. More precise, current information allows organizations to improve demand forecasting and better measure the performance effectiveness of a supply chain. Better information also allows a firm to move from push-based to pull-based modeling.

9.3 Customer Relationship Management Systems

> "You've gone to great lengths to identify and nurture the most valuable segments of your customer base. You've closely monitored them through surveys and focus groups, and you know they consistently indicate they are "highly satisfied" with your company and its products. But... are they loyal?
>
> If you're like most companies, you don't really know—at least, not for sure. And that's a problem. The notion that loyalty is all about improving customer "satisfaction" is perhaps the most common mistake. The frustrating truth is that what customers say about being satisfied turns out to be a poor indicator of loyalty. In fact, a consistent finding from customer research is that 60 percent to 80 percent of lost customers across all industry segments reported on surveys just prior to defecting that they were "very satisfied" or "satisfied." (Copied from www.accenture.com, Nov 2008, *Think Your Customers Are Loyal? Think Again*, By Woodruff W. Driggs, Steven S. Ramsey and Paul F. Nunes, *Outlook* Journal, September 2006)

While many companies strive to be "customer-centric" very few have been able to completely focus every functional area on the customer. Largely due to new avenues of information customers have through the Internet, organizations must fight harder to keep the customers they work so hard to get in the first place.

What Is Customer Relationship Management?

The goals of customer relationship management systems are to optimize

- revenue
- profitability
- customer satisfaction
- customer retention

Many companies are overloaded with data about customers. Unfortunately, too many companies don't have any useful information that can help them increase customer satisfaction and retention, thereby increasing revenues and profitability. The ability to turn raw data into useful information is where CRM systems shine. CRM systems gather customer information from all corners of a business, consolidate the information and then provide it to the organization's customer **touch points.** By offering a consolidated viewpoint of the customer to these touch points, a company can cater to the customer that offers the most profitability.

Financial institutions are a prime example of how effective CRM systems can be to help identify the customers that offer the most "bang for the buck." Most of the larger banks offer more than just checking and savings accounts. They provide investment services, insurance policies, and loans. It's much cheaper for Wells Fargo bank for instance, to provide its current customers with all of these financial products, rather than trying to attract new customers for each of the product lines. Information gleaned from a CRM system provides Wells Fargo with information about which customers are more likely to purchase these products and its sales force targets that market better.

CRM Software

CRM application software ranges in size and complexity making it possible for an organization to select the type of software it needs the most. Modules focusing on partner relationship management or employee relationship management can be integrated into the customer relationship management software at a later date.

Partner relationship management systems are a reflection of internal customer relationship management systems but extend past the immediate borders of a firm to its selling partners. For instance, Levi Jeans doesn't sell directly to its customers but rather through other retail outlets. How Levi's partners cater to the customer directly affects its profitability. Therefore, Levi is very interested in sharing information about its customers with its partners to increase sales of its products. Using partner relationship management systems not only helps Levi but also its retailers.

Employee relationship management modules associated with CRM focus more on how employees perform and interact with customers. These modules help a company manage

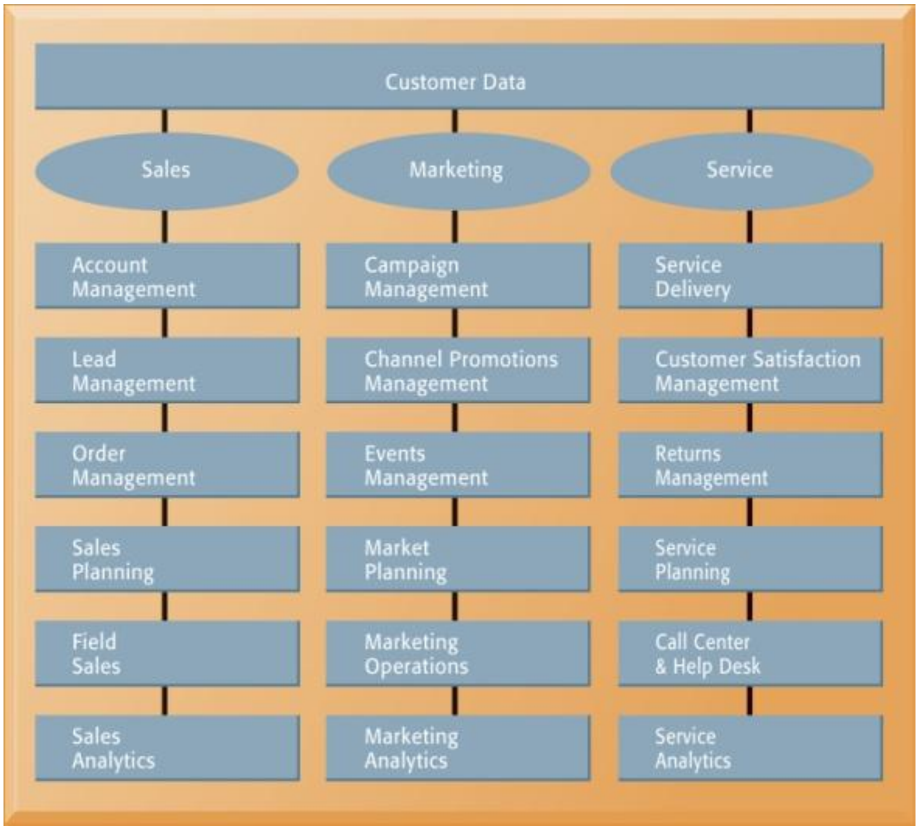
- Employee objectives
- Employee performance
- Performance-based compensation
- Employee training

Some of the more common capabilities of CRM software are:

- **Sales force automation:** allows the sales force to focus on the most profitable customer. It also reduces the cost per sale for acquiring new customers and retaining old ones.
- **Customer service:** gathers information from a variety of sources and makes it available across organizational functions so that data is input only once.
- **Marketing:** Allows companies to engage in **cross-selling, up-selling,** and **bundling** through better analysis of customer data.

Figure 34 shows how customer data feeds into these three functions.

Figure 34 : CRM Software Capabilities.



Source: (Laudon and Laudon, 2010: 386)

Operational and Analytical CRM

It's important to understand the difference between the operational and analytical aspects of CRM systems. **Operational CRM** includes everything a company should provide those employees who interface directly or indirectly with the customer: the sales force, call centers, and support activities. Managers and decision makers use the **analytical CRM** to help them improve business performance. The analytical CRM uses data from the operational CRM and provides managers with the opportunity to target smaller, specific customer groups or market segmentation. Rather than trying to blanket a huge group of potential customers, many of whom are not interested, managers use the analytical CRM to focus their efforts on those customers who can offer the most profit at the least cost.

One of the most important benefits of analytical CRM is the ability to determine the **customer lifetime value** (CLTV). The text mentions that it costs six times more to gain a new customer than to keep an old one. By measuring the CLTV of customers, organizations can calculate customer profitability and determine which customers they should cater to.

Business Value of Customer Relationship Management Systems

As the old saying goes, "We're wasting half of our advertising budget; we just don't know which half." CRM software will help managers better understand their customers thereby helping them make better decisions about product lines and marketing campaigns. CRM systems can also help reduce the customer **churn rate** and identify which customers are most profitable. Hopefully CRM will help them discover which half of the ad budget is wasted.

Once again, the benefits of using CRM systems are worth the challenges you'll face.

Benefits:

- Increased customer satisfaction
- Reduced marketing costs
- More effective marketing
- Lower costs for customer acquisition and retention
- Increased sales revenue
- Better response to customer needs

Bottom Line: Customer relationship management systems allow a firm to focus all of their energy and attention to developing profitable customers and foregoing unprofitable ones. Useful information produced by CRM systems allow firms to improve business performance while reducing costs associated with gaining and retaining customers. Information can be shared internally and externally.

9.4 Enterprise Applications: New Opportunities and Challenges

Before implementing enterprise application systems, organizations need a very clear picture of where they are now and where they want to go. Organizations must decide which processes provide the most value and which processes need the most improvement. And, the firm must allocate the organization resources where they are most needed.

Enterprise Application Challenges

The return on investment to companies that implement enterprise systems can be enormous in terms of enhanced information between suppliers, employees, customers, and business partners. The better the information is, the better the decisions. The better the information is, the better the products and services are for the customer. More customers lead to higher profits for the company (hopefully).

Hang on for a rough ride:

- **Daunting Implementation:** technological and fundamental changes will pervade every corner of the organization. The organizational structure and culture will change. The most daunting task will be retraining thousands of workers and convincing them the change is good. It will be easier to fail than to succeed.

- **High Up-Front Costs and Future Benefits:** There is no such thing as an overnight success when implementing an enterprise system. On average, it takes three to five years to fully implement an enterprise system. Keeping the firm on track and focused on the end result is more difficult than most firms anticipate.

- **Data Management:** It's more important than ever before. Now that one database serves the entire organization, if data are mismanaged, it will affect the every business function and process

- **Inflexibility:** Making changes in one area of the business is much more difficult after implementing an enterprise system. The software is just too complex to easily change.

- **Realizing Strategic Value:** Businesses that rely on unique or cutting-edge processes to gain a competitive advantage may lose that edge with enterprise system software.

Next-Generation Enterprise Applications

As companies get more comfortable with supply chain management and customer relationship management programs they realize the importance of branching out to enterprise solutions, enterprise suites, or e-business suites. Software manufacturers are creating these programs and ensuring firms can integrate data and information more easily with customers, suppliers, and business partners.

We discussed open source and on-demand software in earlier chapters. Even though they are still in the early stages of development, it shouldn't surprise you to learn that they are being developed for enterprise applications.
Small- and medium-size businesses are the ones most likely to follow this path because it's much cheaper. Web 2.0 services that we described before are also becoming integral parts of enterprise software.

Service Platforms

We've been saying that total integration of information from multiple functional areas is necessary. Businesses are finding **service platforms** help provide the integration. Service platforms bring all the applications used in all the business functions, units, or partners together and give customers, employees, managers, and external partners a consolidated view of the firm. Rather than implementing all new software applications, some businesses choose to use middleware, XML, and Web services to tie systems together. Put a portal front on the systems and just about everyone can access the information cheaper, faster, and easier.

CASE STUDY

Read the Symantec Case Study from Page 397 of the text book and answer the questions that follow

(*Answers at the end of this Section*)

SUGGESTED ANSWERS TO SELF-CHECK QUESTIONS

9.1 Describe the relationship between TPS, MIS, DSS, and ESS

The various types of systems in the organization exchange data with one another. TPS are a major source of data for other systems, especially MIS and DSS. TPS are operational-level systems that collect transaction data. Examples of these are payroll or order processing that track the flow of the daily routine transactions that are necessary to conduct business. TPS provide data that are required by MIS and DSS, although these systems may also use other data. DSS not only use data from TPS but also from MIS. MIS rely heavily on data from TPS. ESS obtains most of their internal data from MIS and DSS.

9.2 What is customer relationship management? Why is it so important to businesses?

Customer relationship management is a business and technology discipline to coordinate all of the business processes for dealing with existing and potential customers. With the growth of the Web, potential customers can easily comparison shop for retail and wholesale goods and even raw materials, so better treatment of customers has become very important. Good CRM systems consolidate customer data from multiple sources and provide analytical tools for answering questions such as: What is the value of a particular customer to the firm over his/her lifetime? CRM tools integrate the firm's customer-related processes and consolidate customer information from multiple communication channels, so that the firm can put one coherent face to the customer.

ANSWERS - CASE STUDY

1. What concepts in this chapter are illustrated in this case?

Symantec Corporation started out with good intentions. Shortly after acquiring Veritas it began an ERP rollout that was designed to standardize and unify the Symantec and Veritas information systems. The goal was to create a single ERP system, within which all of the company's extensive network of resellers, integrators, distributors, and customers could place orders for over 250,000 different products Symantec offered in the same way. That follows the basic concept of enterprise systems which are based on a suite of integrated software modules and a common central database. When new information is entered by one process, the information is made immediately available to other business processes.

Although companies can rewrite some of the software in ERP systems, the software is unusually complex and extensive customization may degrade system performance, compromising the information and process integration. If companies want to reap the maximum benefits from enterprise software, they must change the way they work to conform to the business processes in the software. Although Symantec and Veritas had each used Oracle E-Business Suite 11d prior to the merger, both used highly customized versions of the systems that made integration a daunting task.

An overhaul of the combined company's enterprise systems was needed to join together Symantec and Veritas's data from key business processes. Enterprise systems help large companies enforce standard practices and data so that everyone does business the same way worldwide. Enterprise systems help firms respond rapidly to customer requests for information or products. Unfortunately, the two companies bungled the implementation of the enterprise system almost from the beginning.

2. What management, organization, and technology factors were responsible for Symantec's difficulties in overhauling its ERP systems?

Management: Most of the issues were due to the company's shortsightedness in implementing Project Oasis. The initial reaction to the launch of the new system was decidedly negative. Once customers reached a Symantec employee, they could spend up to 20 more minutes troubleshooting problems, and were often told that there was nothing that could be done. There was simply too much change occurring all at once for typical customers to handle. Partners were unhappy with Symantec's slow response to many of the problems.

Organization: The company was unprepared to meet the increased demand for customer support after the rollout. Symantec neglected to coordinate the development of its new ERP system with the launch of other products from different divisions within the company. The changes to the licensing system were not coordinated with the rest of the project. Customers were unhappy with changes to the stock-keeping unit product system (SKU system). Symantec had overlooked the needs of many customers while designing a technically sound but user-unfriendly ERP system.

Technology: Both companies used highly customized versions of Oracle's E-Business Suite 11d prior to the merger. Users struggled to process the large amount of information provided to them and were overwhelmed by the increased number of steps, all of them new, required to place orders. Some smaller distributors and partners didn't update their systems to handle the new SKUs and were unable to submit purchase orders electronically. After the rollout, licensing became much more difficult for Symantec's customers and partners, forcing them to wait multiple weeks before receiving their licenses.

3. Was Symantec's response to the problem adequate? Explain your reasoning.

The company initiated a follow-up project named Project Nero. The goal of the project was to recapture the loyalty of customers who were disenchanted by the changes brought about by Oasis. The project reached out to customers and fixed the problems with the information systems to improve response times and streamline operations.

The company began by adding over 150 new customer representatives to handle the increased volume of calls, reducing wait times and increasing customer satisfaction. Executives traveled the country to improve relations with angered customers and partners. The company introduced a master list of product releases readily available and standardized its communication methods between departments regarding new projects and change management.

Symantec used Net Promoter methodology to measure and increase customer loyalty. The results identified specific criticisms and customer problems and dramatically aided Symantec in correcting those problems. Project Nero helped the company weather the worst of the crisis. However, the company does not release the results of its Net Promoter surveys to the public so the extent to which it has repaired its reputation is unclear.

4. What would you have done differently to prevent the implementation problems that arose at Symantec?

Student answers will vary but some of the principles that should be included in their answers are:

Even the most careful planning and well-designed systems can quickly go awry if customers are unable to make use of the new system. Enterprise applications involve complex pieces of software that are very expensive to purchase and implement. The total implementation cost of a large system, including software, database tools, consulting fees, personnel costs,

training, and perhaps hardware costs, might amount to four to five times the initial purchase price for the software.
Enterprise applications require not only deep-seated technological changes but also fundamental changes in the way a business operates. Business processes must be changed to work with the software. Employees must accept new job functions and responsibilities. Most implementation projects fail or experience enormous problems because executives, managers, and employees did not understand how much organizational change was required.

Specific Symantec problems that perhaps could have been avoided:
- Communicate with employees better to counteract the negative attitude towards the project.
- Communicate with customers and distributors better about the upcoming changes.
- Make sure all of the systems that were changing were coordinated throughout the organization.
- Not change as many systems all at the same time. Even though stretching the implementation out over a longer period may have cost more money, perhaps it would have prevented some of the massive problems overall.

5. **If you were a partner or customer of Symantec, would you have switched vendors in response to the ERP overhaul issues? Why or why not?**

Student answers will vary. Some principles to keep in mind are:

Enterprise applications introduce switching costs that make it very costly to switch vendors. Companies become dependent on the vendor to upgrade its product and maintain the installation. Many of Symantec's partners and smaller distributors were reliant on Symantec and perhaps could not afford to switch vendors. That would mean they would have to switch all of their internal systems at great cost.

Customers are often reluctant to switch vendors based on historical relationships. If the problems seem temporary, the customers will hang on. If the problems seem insurmountable, some customers will desert the sinking ship.

Chapter 10

E-Commerce: Digital Markets, Digital Goods

After completing this chapter, students should be able to answer the following questions:

- What are the unique features of e-commerce, digital markets, and digital goods?
- How has Internet technology changed business models?
- What are the various types of e-commerce and how has e-commerce changed consumer retailing and business-to-business transactions?
- What is the role of m-commerce in business and what are the most important
- m-commerce applications?
- What are the principal payment systems for electronic commerce?

Introduction

Twenty-four/seven–the mantra of the Internet. Whether it's buying, selling, gathering information, managing, or communicating, the driving force behind the evolutionary and revolutionary business is the Internet and its technological advances.

10.1 Electronic Commerce and the Internet

Take a moment and reflect back on your shopping experiences over the last year. Did any of them not involve using the Internet in one way or another? Perhaps you simply used the Internet to research the cost of products without actually purchasing a product or service online. Perhaps you emailed a company to get an answer to a question you had about a product after you purchased it at a regular brick-and-mortar store. If you did any of these you are among the growing legions that rely on the Internet as a new way of conducting business and commerce. Or, maybe you compared prices between two businesses to get the best deal.

SELF CHECK QUESTION 10.1

What are the advantages of using the Internet as the infrastructure for electronic commerce and electronic business?

(Answers at the end of this Section)

E-Commerce Today

The text provides useful statistics to demonstrate the solid growth in e-commerce. Many companies that failed during the "dot.com" bust did so because they didn't have solid business plans, not because e-commerce as a whole wasn't a good idea.

The Internet has proved to be the perfect vehicle for e-commerce because of its open standards and structure. No other methodology or technology has proven to work as well as the Internet for distributing information and bringing people together. It's cheap and relatively easy to use it as a conduit for connecting customers, suppliers, and employees of a firm. No other mechanism has been created that allow organizations to reach out to anyone and everyone like the Internet.

The Internet allows big businesses to act like small ones and small businesses to act big. The challenge to businesses is to make transactions not just cheaper and easier for themselves but also easier and more convenient for customers and suppliers. It's more than just posting a nice looking Web site with lots of cute animations and expecting customers and suppliers to figure it out from there. Web-based solutions must be easier to use and more convenient than traditional methods, not to mention competitors, if a company hopes to attract and keep customers.

Customers and suppliers are learning how to use the new technologies to gather information about the firm's products or services and compare them to the competition. It's easier and faster than ever before. Therefore, any business wishing to stay ahead of the game needs to appreciate that fact and change their processes and methodologies. If they don't, they may not be in business much longer.

Why E-commerce is Different

Most of us have become so used to the Internet that we take it for granted. Let's look at the factors that make e-commerce so different from anything we've seen before.

Ubiquity: 24/7 365 days a year, anytime, anywhere. New **marketspaces** change the balance of power from being business-centric to customer-centric. Transactions costs for both businesses and customers are reduced.

Global Reach: The Internet opens markets to new customers. If you live in New York City and yearn for fresh Montana-grown beef, you can order it from a Web site and receive it the next day. You benefit from new markets previously not available, and the Montana rancher benefits from new customers previously too expensive to reach.

Universal standards: One of the primary reasons e-commerce has grown so quickly and has become so wide-spread is due to the universal standards upon which the technology is built. Businesses don't have to build proprietary hardware, software, or networks in order to reach customers thereby keeping **market entry costs** to a minimum. Customers can use the universally accepted Internet tools to find new products and services quickly and easily thereby keeping **search costs** to a minimum. It truly is a win-win situation for both sides.

Richness: The **richness** of information available to customers, coupled with information that merchants are able to collect about them, is opening up new opportunities for both businesses and consumers. Consumers can access more information than was previously available and businesses collect more information than they were previously able to. Now, instead of trying to gather information about businesses or consumers from multiple sources, both parties can use the Internet to cobble together more information than ever. And do it much easier and faster than ever before.

Interactivity: E-commerce originally presented simple, static Web sites to customers with limited possibilities of interactivity between the two. Now, most major retailers and even small shops, use a variety of ways to communicate with customers and create new relationships around the globe.

Information Density: While many people complain about having too much information pouring from the Internet, it provides **information density** like no other medium. Consumers enjoy

price transparency allowing them to comparison shop quickly and easily. **Cost transparency** is another benefit consumers enjoy that they've never had available as readily as what they can find on the Internet. On the other hand merchants gather much more information about customers and use it for **price discrimination.**

Personalization/Customization: The neighborhood merchant probably knows most customers by name and remembers their personal preferences. That same cozy relationship can now be extended to the Internet through a variety of **personalization** and **customization** technologies. Interactivity, richness, information density, and universal standards help make it possible.
Social Technology: User Content Generation and Social Networking: Social networks are no longer limited to those people living in your immediate, physical neighborhood or even the same town or city. Your social network can now extend to all four corners of the world. More and more content is being generated by users like video, audio, graphics, and pictures.

Key Concepts in E-commerce: Digital Markets and Digital Goods in a Global Marketplace

Let's say you're getting ready to buy a new car. You've already checked out the prices and information on the various Web sites and have managed to get a pretty good deal because of the information you gathered. But now you need a loan and insurance for the new car. Your bank will give you a loan with a 7.5 percent interest rate. You think that's a little high. You call your insurance agent and she tells you the going rate is $1,500 a year. You get a sinking feeling that the excellent discount you were able to wrangle on the car itself will be quickly eaten up by the insurance and loan fees. But wait. You check out the Web sites offering loans and find out you can get 5 percent. You then discover you can get insurance for only $1,200 a year. Even if you don't use the Web sites to procure the loan or insurance, you can still take the information to your bank and insurance agent and perhaps get them to renegotiate. Because you were able to gather information from the Internet rather than physically traveling from bank to bank, or insurance company to insurance company, your search costs were much lower.

Because of the information you've gathered from the Web, the bank and insurance company no longer have the advantage of **information asymmetry.** That is, the bank and insurance company thought they had more information about the transaction than you did, therefore they had the upper-hand. But once you gained more information about the transaction than you previously had, you were able to get better rates. The demise of information asymmetry is a phenomenon that is occurring in many consumer and business transactions and is directly attributable to the Internet.

On the other hand, the Internet allows insurance companies and banks to quickly and easily adjust the information provided to you thus lowering their **menu costs.** They can just as easily engage in **dynamic pricing** based on information they gather from and about you.

Disintermediation, removing the middleman, has allowed many companies to improve their profits while reducing prices. In our example, insurance companies are using disintermediation to remove the local agent from the transaction between itself and the customer. Airlines have steadily removed the travel agent from transactions with customers thereby reducing their costs. Other industries are following in their footsteps slowly but surely.

Digital Goods

If products can be digitized, they can be sold and distributed on the Internet. Music and books have been the forerunner. Now we're seeing movies and television shows taking the same path. **Digital goods** are much cheaper to produce in the long run with little or no distribution costs compared to traditional channels. Digital goods marketspaces also provide relatively cheap and efficient channels for merchants who otherwise could not afford to reach customers on a global scale. Independent musicians and moviemakers are finding tremendous opportunities for reaching new audiences through the Internet that they couldn't reach before.

Advertising dollars are moving from traditional outlets to Internet-based outlets at alarming rates. That puts tremendous pressure on traditional mediums such as television channels and newspapers to get in on the paradigm shift. Businesses must now find new ways to chase the consumer instead of the consumer chasing the business.

Table 7 shows how the Internet changes the costs of digital goods versus traditional goods.

Table 7: How the Internet changes the markets for digital goods

	DIGITAL GOODS	TRADITIONAL GOODS
Marginal cost/unit	Zero	Greater than zero , high
Cost of production	High (most of the cost)	Variable
Copying cost	Approximately 0	Greater than zero, high
Distributed delivery cost	Low	High
Inventory cost	Low	High
Marketing cost	Variable	Variable
Pricing	More variable (bundling, random pricing games)	Fixed, based on unit costs

Source: (Laudon and Laudon, 2010: 412)

Internet Business Models

Table 10-5 in the text shows some of the new business models the Internet has enabled digital firms to undertake. Many of these businesses simply would not be possible without the technologies offered by the Internet.

Communication and Social Networking

The Internet has also allowed businesses and consumers to establish new types of relationships not previously possible. FTD.com, the flower Web site, offers you the opportunity to store birthdays, anniversaries, and other special occasions on their computer. A few days before the event, FTD.com will send you an e-mail reminder to order flowers.

You simply click on the Web site URL in the e-mail, select the flowers you want sent, and enter your credit card information. The whole transaction takes less than ten minutes and the recipient will love you for being so thoughtful. That's richness and reach that neither the consumer nor the business was ever able to establish before the Internet.

Just as magazines and newspapers can't exist without advertising, so too with many Web sites. But unlike traditional print media, **banner ads** allow more targeted advertising. However, many companies are realizing that banner ads are not as effective as they once were because most Web users have learned to ignore them. **Pop-up ads** are now being used, although they too are often ignored by consumers. Pop-up ads are displayed over a Web page as you're perusing the site; pop-under ads are displayed in a separate browser window beneath your main browser window and remain there until you close them. What we're seeing now is a whole new line of consumer software products that help prevent this type of advertising from reaching your computer screen.

People are very social beings so it's not surprising to find they are using the Internet to fulfill their need to connect with other people socially and professionally. **Social networking sites** such as MySpace.com and Facebook.com let people make new friends, find new jobs, and exchange information easily and quickly with a larger circle of people than through any other medium. Other sites allow users to engage in **social shopping** – a twist on traditional trips to the mall with friends. While some of these sites pose slight personal danger if misused, they fulfill the basic need people have to communicate with others.

Just as important, businesses are finding new ways to incorporate aspects of social networking into their work processes.

> Corporations increasingly are "exploring and experimenting" in the use of social networks to improve business operations, says Gina Bianchini, CEO of Ning, a social-networking site for businesses and consumers. It makes revenue from Google AdSense and premium services.
>
> "There's been a definite shift the last two months," she says. "There is a genuine interest now rather than a casual curiosity before."
>
> "The spread of the workforce has put a premium on tech tools that let people collaborate, learn and share info from different parts of the world," says Ross

Mayfield, co-founder of business-software maker Socialtext. He cites studies that show 85% of all employees work on projects with colleagues in other offices.

The employee-only sites are an excellent format for large, geographically dispersed organizations to communicate internally and elicit ideas from workers, says Tom Beauchamp, chief information officer at Hot Topic, a retail chain of 690 stores for teens in all 50 states. (USAToday.com, *Social Networking Sites Help Companies Boost Productivity*, Jon Swartz, Oct 8, 2008)

Digital Content, Entertainment, and Services

We mentioned before if it can be digitized, it can be bought, sold, and distributed through the Internet. Many television-based and radio newscasts have companion Web sites. It's not unusual for a broadcaster to give the audience a brief synopsis of a news article with the reminder to "visit our Web site for more information." That way, they can reach a larger audience through several different outlets instead of just one.

Podcasts are becoming a popular way for content providers to reach new audiences. You are no longer tethered to a computer if you want to hear an audio broadcast of music, commentary, how-to instructions, or just about anything else you can imagine. Many universities now offer podcasts of professors' lectures so students can download the content and take it with them on their portable audio devices. Many textbook publishers, including the one for this text, offer companion podcasts of individual chapters to provide students more ways to engage the course content.

If you use a *portal* Web site such as Yahoo.com as the first site up on your browser, it tracks your preferences through software and determines that you much prefer music sites instead of gardening sites. Therefore, ads appearing on the pages will usually direct you to the latest offerings of music and not maple trees. Some sites gather information from various sources and offer it to you in a consolidated format. These **online syndicators** relieve you from having to access many different sites to get the information you want.

E-Bay is called the "biggest garage sale in the world." It would be impossible for this type of dynamic pricing business to exist without the Internet. Interesting to note is the fact that e-Bay is one of a handful of **pure-play** Internet companies to consistently show a profit. As we found out through the dot.com bust, profits *are* still an important part of a business's success. The Internet allows pure-play or **clicks-and-mortar** business models to offer richness and reach in ways never before possible. It's up to the business to adapt to the new technologies and methodologies offered to remain competitive and profitable.

SELF CHECK QUESTION 10.2

How can the Internet facilitate sales and marketing to individual customers? Describe the role played by Web personalization

(Answers at the end of this Section)

10.2 Electronic 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 e-commerce is the fastest growing area of e-commerce and outpaces consumer retailing by millions of dollars.

The fact of the matter is e-commerce is growing by leaps and bounds because of the new opportunities offered by Internet-based applications that simply weren't possible 10 or 15 years ago.

Types of Electronic Commerce

E-commerce is divided into three major categories to make it easier to distinguish between the types of transactions that take place.

- **Business-to-consumer** (B2C): Most visible
- **Business-to-business** (B2B): Greatest dollar amount of transactions
- **Consumer-to-consumer (**C2C): Greater geographic reach

As you know, there are many products and services offered through traditional Web sites. But as we continue to expand the reach of the Internet to wireless devices, businesses are figuring out how to offer more products and services through new channels dubbed **mobile commerce** or **m-commerce.** Not only can you purchase your airline ticket through a traditional Web site but you can instantly find out about flight delays or cancellations through your cell phone or hand-held computer as you travel to the airport. Using your hand-held computer you can purchase and download an electronic book to read while you wait for the airplane to take off. Retailers are continually finding ways to expand m-commerce and find new ways to attract customers.

> "Amazon.com has launched on the Apple App Store an iPhone application that makes it possible to take a picture of a product and then send it to the online retailer, which will try to match it with products in its inventory. The software is meant to simplify shopping on the iPhone and the iPod Touch, which can access the Web through a Wi-Fi hot spot. The experimental feature called Amazon Remembers helps users keep track of items they see while away from home. The feature tries to match photos of products taken with the iPhone with what's in Amazon's inventory. When users receive the results, they can purchase items immediately or store them for later in their Amazon accounts." (InformationWeek.com, *Amazon Launches Experimental Mobile Shopping Feature*, Antone Gonsalves, Dec 3, 2008)

Achieving Customer Intimacy: Interactive Marketing, Personalization, and Self-Service

Throughout this chapter we've discussed all the new opportunities and channels available to customers and merchants. We tend to think of a great deal of disassociation between buyers and sellers when we think of doing business in cyberspace though. Actually the opposite is true. Let's look at how the Internet closes the gap between customers and businesses.

Interactive Marketing and Personalization

E-tailing (electronic retailing) Web sites must offer more than just 24/7 shopping if they want to be leaders.
Companies are finding that the Web offers excellent customer service tools, which save them money in personnel costs and gives customers what they want, when they want it. UPS offers online package status checking by updating its computers within minutes every time a package passes each checkpoint. The sender and recipient can track the package through the Web and know its whereabouts instantaneously. Now that's fast, customer-oriented, information service.

Kodak has remade its business model over the years in response to changing markets. Now it offers personalization and customization of products through its KodakGallery Web site. Upload your own photos and have them placed on individual products like coffee cups, t-shirts, blankets, you name it.

Web personalization allows companies to create one-to-one relationships with customers and suppliers that simply aren't possible outside Internet-enabled transactions. The cost of gathering marketing information in traditional channels is extremely high and the data gathered may not yield as much information as a company would hope. But with the Internet, companies can gather information that gives them a truer picture of what the customer is actually purchasing or looking for by using **clickstream tracking tools.** The information is more comprehensive, coherent, and current than data gathered in traditional methods.

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 that are then gift-wrapped and sent out for them. Amazon.com is moving into other markets like online auctions and offers many different services, such as travel through a partnership with Expedia.com™ and a baby registry through Babies-R-Us™. This is just one example of how the Internet allows companies to use **collaborative filtering** software to offer customer personalization that simply isn't available through any other channel.

Blogs and Wikis

Blogs, short for Weblog, have burst onto the scene during the last two presidential elections in 2004 and 2008. While you may have become familiar with this feature through the controversies created by them, blogs are far more than political tools. Businesses use them to communicate with customers and suppliers to announce new products or services and to garner feedback about company services. An excellent example of effective business uses of blogs is the one by Sun Microsystems, Inc. President and Chief Operating Officer Jonathan Schwartz [http://blogs.sun.com/roller/page/jonathan] who uses his blog to communicate with employees, vendors, outside software developers, and others interested in the company. He discusses policies and procedures with customers and users of the company's products and services. More valuable than that, he receives feedback from those outside the company and can use the information to help improve how the company meets its customer demands.

Companies use the **blogosphere** to mine data about consumer trends making it easier than ever to shape advertising and marketing campaigns. Mining all of the available data is unobtrusive and gives businesses a clearer picture of what people want.

Blogs help companies build customer loyalty and intimacy never before possible. Moblogs (mobile phone-based blogs) and vblogs (video-based blogs) are important outlets for advertising and product placement. Companies can pitch their products through blogs and make marketing less intrusive or banal for customers.

A useful feature that has been coupled with blogs is that of Real Simple Syndication or RSS for short. The process allows you to place a small program on your computing device that alerts you to new information posted to Web sites you've marked. When a blogger posts a new entry to your favorite site, you receive an alert and can immediately click on the RSS feed to review the posting. RSS can also be used on a variety of news-related Web sites to help you keep current on breaking headlines.

Customer Self-Service

If you're having trouble using a new software program, your first thought may be to call the company that produced the program. You first have to find the number, and then are put on hold for a long time. When you finally get through to a customer service technician, he directs you to the company's Web site containing FAQs (Frequently Asked Questions) about the software. You find the answer to your question plus more information about other features you didn't even know about. You could have saved yourself a lot of time and effort by first accessing the company's Web site.

The Lands' End Web site is an excellent example of how businesses are adapting their **call centers** with Internet technologies. If you can't find what you want on the site, you can call Lands' End and a customer service technician will help guide you through the site. She will even post pictures right on your computer of products you may be interested in.

Southwest Airlines allows you to obtain boarding passes from its Web site prior to your flight so you can bypass long lines at the airport. It also allows you to add email addresses to its site so those interested in your travel plans are instantly notified of your flight situation.

Many companies now provide self-service Web sites in order to save money for them and time for the customer. So before you pick up the phone next time, log on to the Web and see what's available. You may be pleasantly surprised.

Business-to-Business Electronic Commerce: New Efficiencies and Relationships

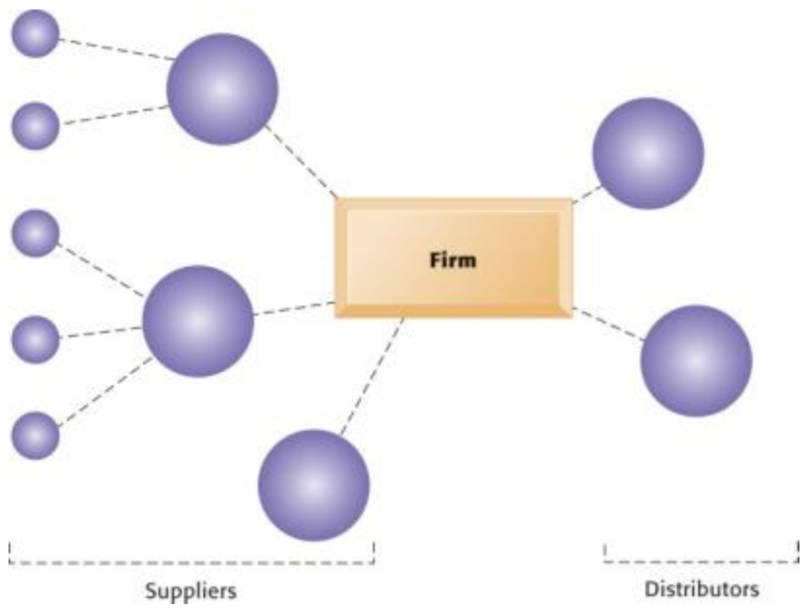
Before the Internet, transactions between businesses were based on long-term relationships and geographic restrictions. It wasn't practical or cost efficient to search out buyers or suppliers nationwide. That's all changed thanks to new technologies made available through **electronic data interchanges** (EDI) and the Internet. EDI processes allow companies to connect their information systems to each other and make transactions flow seamlessly between the systems. It's faster, cheaper, and less error-prone.

The Internet is slowly replacing EDI as the preferred method of **procurement** between businesses. EDI systems usually required proprietary systems while the Internet provides an open standard, universally accepted method of exchanging data for processes such as procurement and B2C commerce.

It's also cheaper and easier through online **private industrial networks,** also known as **private exchanges** for the buyer to find the cheapest prices and the seller to find new customers. Neither buyers nor sellers are restricted to doing business with one or two partners in a particular geographic area.

Figure 35 shows the relationships between buyers and sellers in online exchanges.

Figure 35: A Private Industrial Network.



Source: (Laudon and Laudon, 2010:423)

Businesses and both buyers and sellers are enjoying tremendous cost savings by using **net marketplaces** or e-hubs**.** B2B e-commerce is reducing the buyers' costs by allowing them to shop around for the lowest prices.
B2B e-commerce reduces sellers' costs by allowing them to automate purchasing transactions and reach a greater number of potential buyers of direct goods used in production processes and indirect goods like office supplies.

The types of **net marketplaces** available for B2B e-commerce include the following:

- **Vertical:** Specific industries
- **Horizontal:** Various functions across all industries
- **Branded:** Private exchanges across a broad range of industries

Exchanges also allow businesses to offer a broader range of services to other businesses. Staples, the office supply store, was restricted to offering in-store purchases of paper, pencils, and other supplies to other businesses. The buyer had to physically go to the store and wander through the aisles. Price comparison was limited to guessing whether Staples had the lowest price. Staples now offers an online exchange from which other businesses can not only order office supplies but also use business services such as payroll pricing, human resources management, legal and insurance services, and many others that weren't profitable or possible in the past. Staples.com is able to provide these online services by partnering with others to create new efficiencies and relationships through the Internet.

While the burst in the dot-com bubble has caused some companies to slow their e-commerce efforts, hardly any of them are totally abandoning Internet integration altogether. The benefit from the dot-com fiasco is that companies are planning their e-commerce efforts better and making their systems more stable and secure.

? **THINK POINT**

What are the benefits of e-commerce to your organisation?

10.3 M-Commerce

Cell phones aren't just for making phone calls anymore. Now they take photographs, send text messages, used as tracking devices, and for purchasing goods and services. What was once a very simple device has now turned in to a personal, portable computing device that's changing the very nature of commerce worldwide.

M-Commerce Services and Applications

M-Commerce extends the ubiquitous Internet and computing to new heights. No longer does a business have to wait for customers to find it. It can go out and find new customers quickly and easily. As you wander through downtown shops or the mall, a business will know you're near and send a message to your mobile computing device detailing lunch specials. While many of the services are currently not available in the United States, foreign countries are embracing the technology to provide the following benefits:

- Location-based services
- Banking and financial services
- Wireless advertising
- Games and entertainment including **ringtones** for cell phones
- Mobile bill payment
- User-generated content

Accessing Information from the Wireless Web

Even though wireless connectivity is more common in major metropolitan areas, it continues to spread as the available of wireless hotspots increases. The wireless devices are also improving that amount of data that can be transmitted and stored. **Wireless portals** proliferate and are offering more information and services.

10.4 Electronic Commerce Payment Systems

Various forms of electronic payment systems are taking shape to make Internet-based purchases easier and more secure.

Types of Electronic Payment Systems

Many of us don’t want to use credit cards on Internet sites because we don’t trust the technology. Or, we simply can’t bring ourselves to give someone our credit card information sight unseen. Many banks, credit card companies, and merchants are working very hard to devise new technologies to make it safer and more secure to shop on the Internet. **Digital wallets** offer convenience to buyers and sellers by storing information accessible only to those authorized.

Sometimes it costs more to process a transaction than the monetary value of the transaction. That’s one of the big issues facing some online merchants. For instance, if you want to purchase just one song from your favorite CD, you may be willing to spend only 75¢ for the song. The credit card transaction may cost the merchant $1. It stands to reason that not many merchants are going to look favorably on that deal. Using **micropayment systems** makes it more palatable to the merchant. Not many online sites are currently using this form of payment, but it holds much promise for smaller transactions on the Internet.

When the credit card was introduced years ago, many people simply refused to believe that products and services could be purchased without cold hard cash. Now they are as ubiquitous as the greenback. In our new electronic world, various online payment systems such as **electronic cash** (**e-cash**), **accumulated balance digital payment systems,** and **online stored value payment systems** are just a few more ways the technology industry and merchants worldwide will continue to make it easier and safer to make purchases online.

As customer-to-customer (C2C) e-commerce continues to grow, a secure, trustworthy, payment system is required. That’s where peer-to-peer payment systems such as <A HREF=http://www.paypal.com=”new”>PayPal come in. Their Web site explains, “PayPal is the preferred payment service for online auctions, and for online community and group Web sites. PayPal’s service, free to consumers, can be used from PCs or Web-enabled mobile phones.”

A couple more fast-growing payment services offered on the Internet are **digital checking** and **electronic bill presentment and payment systems.** The latter is gaining popularity as people become more used to our wired world. Even though most bill payment systems cost extra money, users find it worth it because they don’t have to worry about overdue bills and charges. Not only do most major banks offer this service but so does the U.S. Postal Service.

Table 8 is a synopsis of the various electronic payment systems available on the Internet. Time savings, convenience, and cost containment are behind the growing popularity of these systems.

CASE STUDY

Read the Facebook Case Study from Page 434 of the text book and answer the questions that follow

(*Answers at the end of this Section*)

Table 8: Electronic Payment Systems for E-Commerce

PAYMENT SYSTEM	DESCRIPTION	COMMERCIAL EXAMPLE SYSTEM
Credit card payment systems	Protect information transmitted among users, merchant sites, and processing banks	Visa MasterCard American Express
Digital wallet	Software that stores credit card and other information to facilitate form completion and payment for goods on the Web	Google Checkout
Accumulated balance digital payment systems	Accumulates micropayment purchases as a debit balance that must be paid periodically on credit card or telephone bills	Valista PaymentsPlus Clickshare
Stored value payment systems	Enable consumers to make instant payments to merchants or individuals based on value stored in a digital account	PayPal, Valista
Digital checking	Provides electronic checks with a secure digital signature	PayByCheck
Electronic billing presentment and payment systems	Support electronic payments for online and physical store purchases of goods or services after the purchase have taken place	Yahoo! Bill Pay, CheckFree

Source: (Laudon and Laudon, 2010: 428)

Digital Payment Systems for M-Commerce

One of the drawbacks to all these various forms of payment systems is the lack of standardization. As with any emerging technology or service, each company is vying to be the industry leader. But having so many different systems and methodologies leads to confusion by the consumer and extra expense by the merchant. Another problem with micropayment systems is that the average consumer is reluctant to go through the hassle required to make purchases for miniscule amounts of money. The music industry has tried to set up a system buyers can use to purchase just one song from an album instead of the whole album. So far, most potential customers aren't inclined to make purchases for just 99¢. The industry promises a shake-out in the next few years and eventually we will have fewer, thus more efficient, payment systems.

SUGGESTED ANSWERS TO SELF-CHECK QUESTIONS

10.1 What are the advantages of using the Internet as the infrastructure for electronic commerce and electronic business?

The Internet is an international network of networks connecting many millions of people from well over 100 countries. It is the largest information superhighway in the world. The Internet provides a universal and easy-to-use set of technologies and standards that can be adopted by all organizations, no matter what computer system or information technology platform they are using; provides a much lower cost and easier-to-use alternative for coordination activities than proprietary networks; reduces organizational transaction and agency costs; increases communication, including electronic mail, online forums, and chatting; provides access to increased information and information retrieval from many thousands of online databases around the world; and increases market potential with online offerings of information and products through the easy-to-use World Wide Web.

10.2 How can the Internet facilitate sales and marketing to individual customers? Describe the role played by Web personalization.

The Internet enables a company to create closer, cost-effective relationships with its customers. The company can use the Internet to provide information, service, support, and in many instances, the product over the Web. The Internet facilitates direct sales over the Web, interactive marketing and personalization, and customer self-service.

The Internet digitally enables the firm. The firm can link to customers and suppliers so that electronic commerce, automating business-to-business transactions such as invoices, purchase orders, and sometimes payments (digital cash and electronic funds transfer) are economically and technically feasible.

In many instances, the customer can purchase a product or service from a company's Web site. A

Web site also allows potential customers to obtain information about the products, distributors, and service centers. The information about distributors allows a company to use the Web site to market, while avoiding channel conflict. A FAQ (frequently asked questions) list can allow support for the product without tying up phone lines with common, easily answered questions. Such FAQ's can raise customer comfort with the product and the company.

ANSWERS - CASE STUDY

1. What concepts in this chapter are illustrated in this case?

Eight unique features of e-commerce technology are obviously illustrated in this case: ubiquity, global reach, universal standards, richness, interactivity, information density, personalization/customization, and social technology (Table 10-2 in the text) The following elements of Table 10-1 in the text, The Growth of E-commerce, also are illustrated: breadth of e-commerce offerings continue to grow; small businesses and entrepreneurs continue to flood the e-commerce marketplace; wireless Internet connections grow rapidly; powerful handheld mobile devices support a variety of Internet activities; the Internet broadband foundation becomes stronger; RSS grows; and more than half the Internet user population join an online social network.

2. What is the role of e-commerce and Web 2.0 technologies in Facebook's widespread popularity?

Businesses use social networking sites to harvest a vast amount of information about users and their preferences for many different products and services to create carefully targeted promotions. Businesses use the site to interact with potential customers. The sites are so "sticky" that they have become very powerful marketing tools. Users are reluctant to leave for fear of leaving the rest of their friends behind.

The Facebook Platform provides third-party developers a platform for applications like games, plug-in features for user profiles, and other programs which are fully integrated with the Facebook site.

Flixter, an online community for movie fans, has a Facebook application called Movies that allows people to tell their Facebook friends about the movies they've seen and share reviews.

3. Describe the weaknesses of Facebook's privacy policies and features. What management, organization, and technology factors have contributed to those weaknesses?

The company has encountered more than its fair share of controversy along its path to success, mostly concerning its handling and usage of the extensive information it collects from its users.

Management: Facebook assumed it had the consent of users to share information about them that it collected through the Beacon advertising service if they did not use the opt-out feature. Facebook changed Beacon to be an "opt-in" service and gave users the ability to disable it completely. The company utterly failed to grasp the extent to which the service violated its users' privacy as well as the uproar such a service was likely to cause. The same thing occurred when Facebook introduced its News Feed feature.
Organization: The personal information collected on the site represents a mother load to advertisers, but one that will remain largely untapped if Facebook users do not feel comfortable enough or have sufficient incentive to share it. Users that attempted to delete their accounts were met with resistance and often required outside assistance from watchdog groups.

Technology: privacy and user controls over the information granted to Facebook are the biggest concerns most users have with the site. Facebook grossly miscalculated user privacy demands when it launched the company's Beacon advertising service because it shared information about users that they had not explicitly intended or agreed to share. The service originally began as an "opt-out" feature. Even after users opted-out, the service continued to send information to Facebook regardless of whether or not the user was logged into Facebook at the time. The company's servers maintain copies of information indefinitely in accounts that have been deactivated.

4. Does Facebook have a viable business model? Explain your answer.

Student answers will vary but should include these elements:

Positive indicators:
- It's one of the largest social networking sites in the world and is growing
- Facebook's interface is simplistic and clean and tends to attract those looking for a crisp, more structured social networking environment
- It represents a unique opportunity for advertisers to reach highly targeted audiences based on their demographic information and narrowly specified criteria
- It represents a gold mine of opportunity because of the information the site has gathered and because of the richness of the social networking environment.
- Part of its status as a first-mover in the social networking marketplace helps attract more users

Negative indicators:
- It has created large numbers of hostile users because of its privacy violations

- Facebook's own popularity will injure its chances to attract advertisers to its site, claiming that the engaging and immersive environment that draws visitors to the site makes users less likely to click on ads
- Skeptics also believe that the current application system, where applications tend to support one another via advertising through other applications without the aid of extensive outside advertising, is an unsustainable model over the long term. So far, only 200 Facebook applications have attracted more than 10,000 users per day and 60 percent failed to attract even 100 daily users.
- It remains to be seen whether or not the company can turn its heavy site traffic and trove of personal information into new revenue streams.

5. If you were responsible for coordinating Facebook's advertising, how would you balance the desire to become increasingly profitable with the need to protect the privacy of your users?

Student answers will vary but should consider these statements:

- The toughest task for Facebook will be to continue to preserve the privacy of its members while monetizing the user data it has collected.
- Many users may not even be aware or care about the dissemination of their personal information. The benefits of being part of Facebook may outweigh the reservations its users have regarding their privacy.
- Facebook now provides privacy controls that allow users to sort friends into groups and grant access to parts of their profiles.
- Some advertisers have pulled out of Facebook's advertising programs when they learned about the privacy concerns raised by users.

Chapter 11

Managing Knowledge and Collaboration

After completing this chapter, students should be able to answer the following questions:

- What is the role of knowledge management and knowledge management programs in business?
- What types of systems are used for enterprise-wide knowledge management and how do they provide value for businesses?
- What are the major types of knowledge work systems and how do they provide value for firms?
- What are the business benefits of using intelligent techniques for knowledge management?

Introduction

"When people leave organizations today, they are potentially taking with them knowledge that's critical to the future of the business," says David DeLong, a business consultant and author of *Lost Knowledge: Confronting the Threat of an Aging Workforce*. Whether it's a key client relationship, mastery of an outdated computer language, or simply knowledge about where certain files are saved on a company server, every business has stored up bits of information and knowhow that isn't written in a manual or recorded in a training video." (BusinessWeek.com, *The Knowledge Handoff*, Douglas McMillian, Aug 26, 2008)

As we've mentioned in other chapters, information, therefore knowledge, is becoming an important corporate resource that must be captured, protected, preserved, and grown. How you do that is the focus of this chapter.

SELF CHECK QUESTION 11.1

What is knowledge management? How does it promote organizational learning? Why is it of great interest to business?

11.1 Knowledge Management Landscape

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 assets wisely will help companies do that. They must harness as much knowledge as they can and make it easy to share with others.

Important Dimensions of Knowledge

We discussed the difference between **data** and information in previous chapters. The next step up from information literacy is **knowledge**. An organization must transform the information it gathers and put it into meaningful concepts that give it insight into ways of improving the environment for its employees, suppliers, and customers. **Wisdom** then is using information to solve problems and knowing when, where, and how to apply knowledge.

You may have experienced the long-time employee that seems to know how to fix the intricate piece of machinery in his sleep. He's been doing it for years, he would tell you. All of the knowledge he retains in his mind is **tacit knowledge**. On the other hand, you may have dealt with an employee who seems to grab the operating manual every time he turns around. The manual is an example of **explicit knowledge** – that which is documented.

Table 9 below contains an excellent synopsis of organizational knowledge. Every organization has all four of these dimensions of knowledge:

- Knowledge is a firm asset
- Knowledge has different forms
- Knowledge has a location
- Knowledge is situational

How it handles them is what can make the organization a successful one that seems to outrun the competition, or one that seems to muddle through the best it can. Examine your organization and determine how well it values knowledge as an asset.

Table 9: Important Dimensions of Knowledge

KNOWLEDGE IS A FIRM ASSET
Knowledge is an intangible asset.
The transformation of data into useful information and knowledge requires organizational resources.
Knowledge is not subject to the law of diminishing returns as are physical assets, but instead experiences network effects as its value increases as more people share it.
KNOWLEDGE HAS DIFFERENT FORMS
Knowledge can be either tacit or explicit (codified).
Knowledge involves know-how, craft, and skill.
Knowledge involves knowing how to follow procedures.
Knowledge involves knowing why, not simply when, things happen (causality).
KNOWLEDGE HAS A LOCATION
Knowledge is a cognitive event involving mental models and maps of individuals.
There is both a social and an individual basis of knowledge.
Knowledge is "sticky" (hard to move), situated (enmeshed in a firm's culture), and contextual (works only in certain situations).
KNOWLEDGE IS SITUATIONAL
Knowledge is conditional: Knowing when to apply a procedure is just as important as knowing the procedure (conditional).
Knowledge is related to context: You must know how to use a certain tool and under what circumstances.

Source: (Laudon and Laudon, 2010:443)

Organizational Learning and Knowledge Management

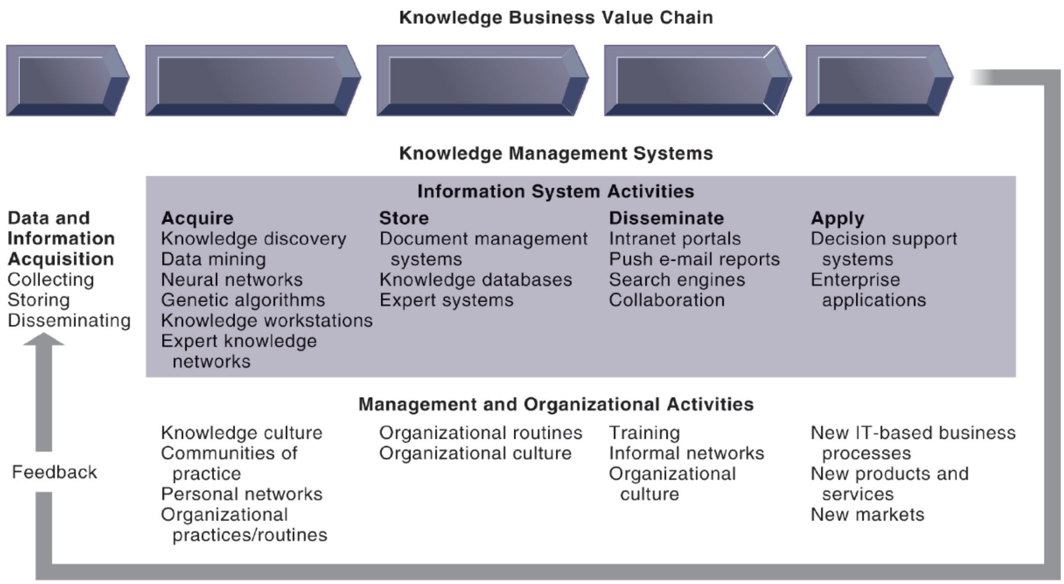
In the last few years, companies have downsized and flattened their organizations. Many employees who were laid off had been with these companies for years. When they walked out the door, they took experience, education, contacts, and information with them. Companies are finding out how important human resources are to their success and are establishing **organizational learning** mechanisms to capture and use the corporate knowledge.

Since the world doesn't exist in a vacuum, companies that want to flourish must continually adapt and change to meet the growing demands of doing business in tomorrow's environment. Employees must adjust to new challenges and new technologies. How well they do so is a reflection of the organization's ability to acquire and apply knowledge to changing situations through its organizational learning mechanisms.

Knowledge Management Value Chain

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.

Figure 36: The knowledge management value chain



Source: (Laudon and Laudon, 2010: 444)

SELF CHECK QUESTION 11.2

What management issues are raised by knowledge management systems? How can businesses obtain value from their knowledge management investments?

Figure 36 shows you the activities that go into successfully managing knowledge from acquiring it to applying it throughout the firm. It's not just technology related to the activities that's important to recognize. In fact, as the text points out, technology applications of managing knowledge account for only about 20 percent. The other 80 percent deals with organizing and managing the knowledge assets.

Knowledge Acquisition

Knowledge comes from a variety of sources. Early attempts of gathering knowledge were a hodgepodge of documents, reports, and employee input. Now companies are using more sophisticated technologies to gather information and knowledge from emails, transaction-processing systems, and outside sources such as news reports and government statistical data. It's important to remember that a great deal of knowledge should come from external sources since no organization exists in a vacuum.

Knowledge Storage

Remember, knowledge management is a continual process, not an event. As you gather knowledge you must store it efficiently and effectively. Document management systems are an easy way to digitize, index, and tag documents so that employees can retrieve them without much difficulty. Probably the most important element of any knowledge system is the people that feed the machine. One of the biggest reasons knowledge systems have failed in the past is because the employees and management either didn't place enough importance on the system or felt threatened by it. All the people in the digital firm need to realize how important a resource knowledge is and help take care of the system.

Knowledge Dissemination

Once you've built the system, acquired and stored the knowledge, you need to make it easy and efficient for employees to access the knowledge. Portals, wikis, social networks, IM, and email are just some of the tools you can use to disseminate information easily and cheaply. Everyone complains nowadays of having too much information. The organization needs to make knowledge dissemination unobtrusive and easy to master or the employees and managers will ignore it or underutilize it.

Knowledge Application

You can have all the information and knowledge you need to master any task, but if you don't build knowledge application into every functional area and every system used throughout the organization you are doing a disservice to both the knowledge and the company. As old systems are revamped and revised or new ones built, pay attention to how you can draw knowledge into them. The digital firm also needs to explore how it can use the knowledge system to build new processes for its suppliers and employees or new products for its customers. Once it masters that, it can outrun the competition and build a stronger organization.

Building Organization and Management Capital

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. One way companies are responding to the challenge is by appointing a chief knowledge officer. His/her responsibilities involve designing new programs, systems, and methods for capturing and managing knowledge. In some cases, the hardest part of the CKO's job may be convincing the organization that it needs to capture, organize, and use its corporate knowledge to remain competitive.

> "Basically, the CKO concept is rooted in the realization that companies can no longer expect that the products and services that made them successful in the past will keep them viable in the future. Instead, companies will differentiate themselves on the basis of what they know and their ability to know how to do new things well and quickly." (Copied from Business.com Web site, Nov 2008)

No one person has all the knowledge a digital firm needs. For that you must rely on many different people from many different locations. **Communities of practice** (COP) are built on the idea of combining ideas and knowledge from various sources and making it available to people inside and outside the organization. Professional conferences, newsletters, journals, and online newsgroups are excellent sources of information that center on the communities of practice concept.

Four areas where COP can make a difference are:

- Reuse knowledge
- Facilitate gathering new information
- Reduce learning curves
- Act as a spawning ground for new knowledge

CASE STUDY

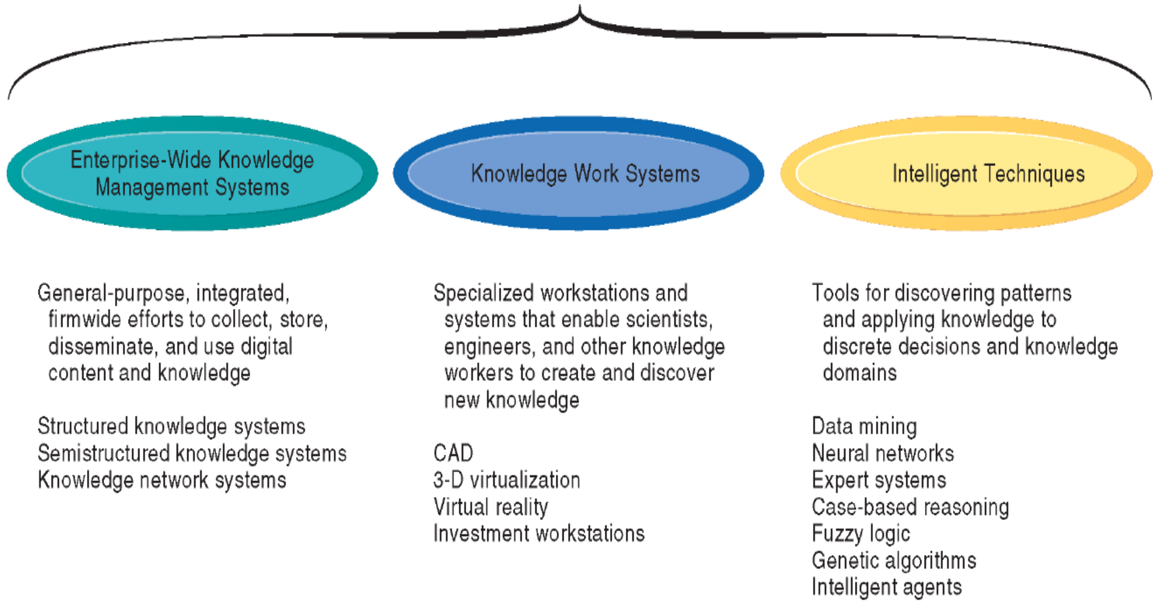
Read the Managing with Web 2.0 Case Study from Page 451 of the text book and answer the questions that follow

(*Answers at the end of this Section*)

Types of Knowledge Management Systems

Let's look at three major types of knowledge management systems as shown in Figure 37.

Figure 37 : Major types of Knowledge systems



Source: (Laudon and Laudon, 2010:446)

Enterprise-wide knowledge management systems are spread across the organization and offer a way to systematically complete the information system activities we just reviewed: acquiring, storing, disseminating, and applying knowledge.

Knowledge work systems use powerful workstations that can process the huge graphics files some professionals need or to 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 so the workers can "get right to it."

Intelligent techniques, which we'll look at more closely at the end of this chapter, include expert systems, neural networks, and genetic algorithms, to name a few.

11.2 Enterprise-Wide Knowledge Management Systems

With so many sources of information and knowledge available, how does an organization go about collecting, storing, distributing, and applying all of it? That's what we'll investigate in this section.

Enterprise Content Management Systems

Traditionally, knowledge wasn't considered a corporate resource. Many systems were built without the necessary infrastructure for gathering, storing, and retrieving knowledge. That started changing in the 1990s when companies started realizing how much knowledge was lying dormant in text documents and reports. The **structured knowledge** systems were the first attempts at capturing this type of knowledge and making it easily available to a wider range of people inside the organization.

As people started using newer forms of communications such as emails, chat rooms, voice mail, and digital-based reports, graphics, and presentations, organizations had to adapt their systems to accommodate the **semistructured knowledge. Enterprise content management systems** are designed to piggyback on the more rigidly structured knowledge systems to incorporate a wider range of information. Centralized knowledge repositories include information from the structured and semistructured knowledge systems. The knowledge repository is then easily accessed by employees throughout the organization and can also be properly managed by the CKO.

Before you get all the data, information, and knowledge into your enterprise content management system, you need to create a **taxonomy** that will help organize the information into meaningful categories. That makes it easy to find things later on. For example, you have lots of digital renderings of your company logo. Set up a taxonomy called "Logo." Now, whenever you add another digital file of a logo, you tag it with the taxonomy.

For those firms whose knowledge is contained in objects other than simple documents, **digital asset managements systems** help them collect, store, and process knowledge contains in photographs, graphic images, videos, and audio files.

Knowledge Network Systems

Because it's simply too expensive and too time-consuming to continually reinvent the wheel, corporations are turning to **knowledge networks** in an attempt to link those who hold the knowledge with those that need the knowledge. Employees who have the tacit knowledge about a product or project in their head are easily connected with employees who need to know the information through these kinds of networks. Corporations save time and money by placing data pertaining to the subject matter experts in a directory that all employees can access. Users are easily connected to the experts through these networks and can communicate and collaborate on a variety of subjects.

Collaboration Tools and Learning Management Systems

Knowledge systems are often used by and support professional employees such as engineers, researchers, analysts, and highly skilled technical workers. Portals provide easy-to-use access to these systems and help provide internal and external information others have discovered to be successful solutions or best practices. The organizational memory we spoke of earlier is shared among other workers more efficiently with knowledge systems. No reinventing the wheel, thank you!

If you thought that blogs, wikis, and social networking sites were only for kids or twenty-somethings that want to gossip and share their innermost thoughts and feelings, you would be wrong. Companies are discovering the power of using these tools for collaboration among and between employees-especially teams, customers, suppliers, and business partners. They are easy to use and often don't require any help from the IT staff to set up or support. And they sure are easier to search and organize than thousands and thousands of emails.

As you surf through the Web and find news articles, videos, pictures, or soundtracks that you want to track or share with others, you can use **social bookmarking** techniques to tag the information with keywords. You store the shared bookmarks in **folksonomies** so that your friends or co-workers can easily find the bookmarks.

Because business processes and work methods are constantly and continually changing, organizations must devise ways to make learning less expensive and easier to deliver. By using a **learning management system** to provide the necessary tools for delivering, tracking, and assessing employee learning, companies can reduce costs and ensure employees receive the right training at the right time. A company can make these systems even more productive if they are used in conjunction Web-based multimedia systems. Regardless of where the employee and educator are located, they can collaborate together whenever necessary.

11.3 Knowledge Work Systems

Many of the systems we've discussed centered on how to collect, store, distribute, and apply knowledge. Let's talk about how to create knowledge in this section.

Knowledge Workers and Knowledge Work

Knowledge work systems support the creation and integration of new knowledge that is beneficial to the organization. KWS are often used by and support professional employees such as engineers, researchers, analysts, and highly skilled technical workers. They are connected to knowledge systems that provide information others have discovered to be successful solutions or best practices. The organizational memory we spoke of earlier is shared among other workers more efficiently with knowledge systems. No reinventing the wheel, thank you!

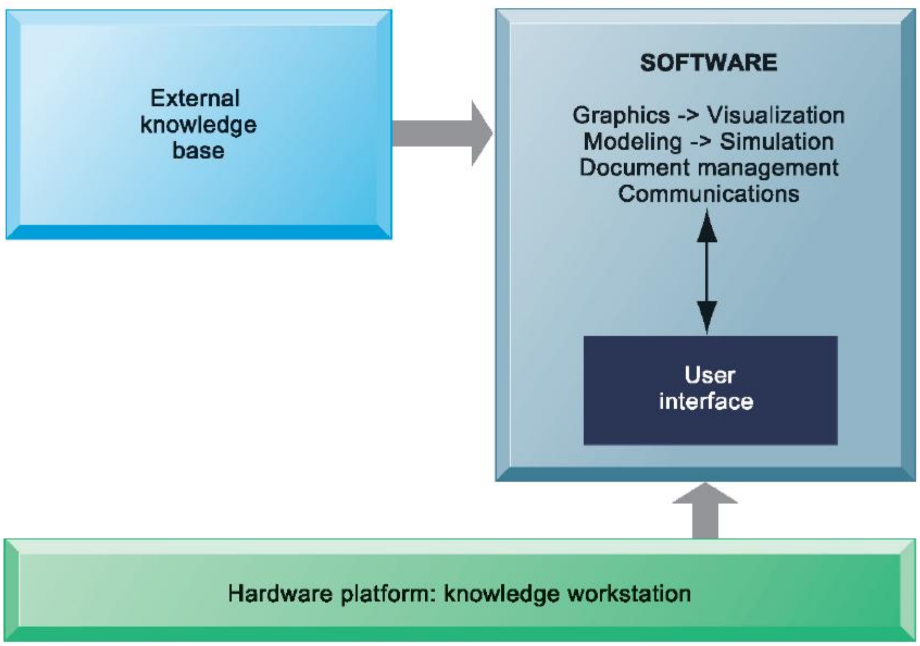
Requirements of Knowledge Work Systems

The first requirement of a KWS is that it provides knowledge workers with the following necessary tools:

- Graphics tools
- Analytical tools
- Communication tools
- Document management tools
- User friendly interface

Figure 38 shows the required elements of a KWS.

Figure 38: Requirements of knowledge work systems



Source: (Laudon and Laudon, 2010:453)

Examples of Knowledge Work Systems

Pick up any business or technology magazine or surf 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.

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 its 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. The amount of data is massive and must be processed quickly in order to keep up with the changing market conditions and the changing nature of the industries themselves.

11.4 Intelligent Techniques

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. Many of the systems under the AI umbrella are useful tools for capturing, storing, and disseminating human knowledge and intelligence. Other AI systems are used for **knowledge discovery**.

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 of a person.

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.

Yes, we used a very simplified example. Most expert systems require thousands of rules and frames in which to operate in a rule-based expert system. 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.

? THINK POINT

What in your opinion are the dangers of Artificial Intelligence?

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 prevent that.

You build an expert system in a similar fashion as other information systems in terms of hardware and software. However, it's even more important to continually maintain and update an expert system: You never want to make decisions based on outdated or incorrect information. You can build a transaction processing system and perhaps not update it for six months to a year. With an expert system, you have to update the data and the processing software almost immediately and continually so that it’s never out of date.

Examples of Successful Expert Systems

You measure the success of an expert system by the following:

- ❖ 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? Expert systems only do well in situations in which there are definitive outcomes. They aren't good at making decisions based on inferences. The expert system might *advise* to take the umbrella along or to leave it home based on the input. The human makes the final decision to take or leave the umbrella.

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. 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, and you're a *good* worker. What happens if your boss relies on an expert system that uses only facts? You submitted the last two projects late (because the boss made last minute changes), you took an extra week's vacation (when your child was in the hospital), and you were late to work three times in one month (because the subway broke down). You may or may not get the raise. Your boss still needs to use intuition, reasoning, and gut reaction to make the final decision.

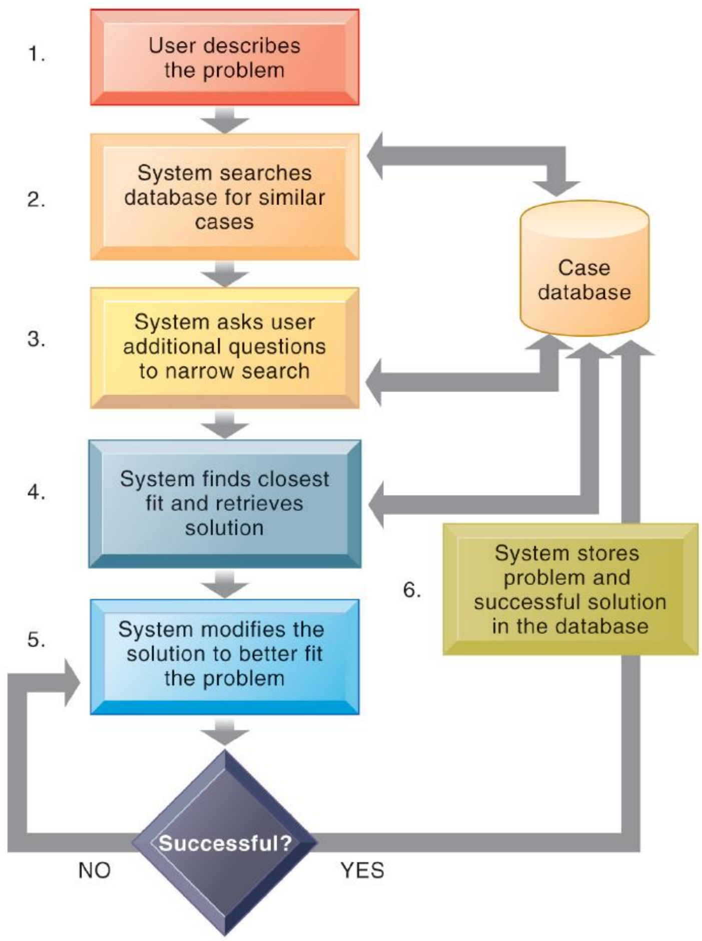
Organizational Intelligence: Case-Based Reasoning

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 continue 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.

Figure 39: How case-based reasoning works.



Source: (Laudon and Laudon, 2010:460)

Figure 39 gives you an excellent overview of how a case-based reasoning system works.

Fuzzy Logic Systems

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 *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.

Neural Networks

This type of knowledge system is as close to emulating the human ability to learn as we've been able to come. 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. That's basically how **neural networks** work.

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. The difference between expert systems and neural networks are as follows:

- 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 provide explanations for solutions.
- Neural networks cannot explain why they arrived at a particular solution.

- Expert systems require humans to update their database of information.
- Neural networks continue to expand their own base of information.

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 algorithms** 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 changed 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** do. 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 a problem. You can look forward to more of this hybridization as we continue to expand our knowledge of technology and of human behavior.

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. Figure 11-13 in the text demonstrates intelligent agent technology at 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 as a "shopping agent" that surfs the Web for you looking for specific items to purchase or the lowest prices on a particular item.

If you'd like to try a shopping bot yourself, try <A HREF="http://www.mysimon.com" target="new">MySimon. The Web site explains its service this way "Our secret is a team of helpers built with patent-pending software. The Virtual Learning Agent™ technology creates 'intelligent agents' trained by our own team of shopping experts to collect information from any online store." It's fun and fast.

Another way companies are using intelligent agent technology is by developing agents that mimic real entities – customers, supply chains, and stock markets. **Agent-based modeling** uses the agents to model behavior and help managers make decisions. For example, it seems reasonable to assume that it's better to wait until you have a full truckload of supplies before you dispatch the truck. But P&G discovered through agent-based modeling that the amount of lost sales because of out-of-stock conditions actually cost the company more than the transportation expenses associated with partial truckloads of supplies.

SUGGESTED ANSWERS TO SELF-CHECK QUESTIONS

11.1 What is knowledge management? How does it promote organizational learning? Why is it of great interest to business?

Knowledge management is the set of processes developed in an organization to create, gather, store, maintain, and disseminate the firm's knowledge. Knowledge management promotes organizational learning as it defines and codifies the organization's knowledge base. As the textbook points out, knowledge management enables the organization to learn from its environment and incorporate this new knowledge into its business processes. New SOPs can be created that reflect recent experiences within the organization. Knowledge management systems enable the creation and support of knowledge networks, knowledge repositories, and communities of practice. Knowledge networks enable people to be linked, so that experts in a given area can be easily identified and share tacit knowledge. Knowledge management streamlines the workflow and provides tools for creating a knowledge repository.

11.2 What management issues are raised by knowledge management systems? How can businesses obtain value from their knowledge management investments?

The difficulties of implementing knowledge management systems include: insufficient resources available to structure and update the content in repositories; poor quality and high variability of content quality because of insufficient validating mechanisms; content repositories lacks context, making documents difficult to understand; individual employees not rewarded for contributing content, and many fear sharing knowledge with others on the job; search engines return too much information, reflecting lack of knowledge structure or taxonomy.

For businesses to obtain value they should follow five important steps: 1) develop in stages; 2) choose a high-value business process; 3) choose the right audience; 4) measure ROI during initial implementation; 5) use the preliminary ROI to project enterprise-wide values.

ANSWERS - CASE STUDY

1. **How do Web 2.0 tools help companies manage knowledge, coordinate work, and enhance decision making?**

Blogs, wikis, and social networking are emerging as powerful tools to boost communication and productivity in the corporate workforce. Workers and managers are using wikis to store information and share memos. IBM created a wiki to help 50 of its experts collaborate on an intellectual property manifesto. Another IBM manager uses wikis to give him “a single view of the projects and their status” without sending numerous e-mails to each of his workers. IBM is also using social networking to help employees communicate better with each other. Dresdner Kleinwort investment bank uses corporate wikis for collaborating on materials related to meetings, supporting brainstorming sessions, and developing presentations.

2. **What business problems do blogs, wikis, and other social networking tools help solve?**

These tools reduce the need for e-mail and its inherent problems like storage, transmission bandwidth, and lack of searchability. Information is stored in one place with blogs and wikis. Employees and managers can communicate and collaborate with each other faster and easier. Decision-making is enhanced by the speed with which these tools allow managers to research and gather information. Because the tools are easier and cheaper to deploy, companies reduce the costs of knowledge management and decision-making.

3. **Describe how a company such as Wal-Mart or Proctor & Gamble would benefit from using Web 2.0 tools internally.**

Answers will vary but students should address the ease of use, lower deployment costs, and improved collaboration and communication that these tools provide.

4. **What challenges do companies face in spreading the use of Web 2.0? What issues should managers be concerned with?**

The biggest challenge to using these tools is convincing workers to use them and in regulating their use. Companies must enforce rules of privacy, respect, and confidentiality in its corporate code of conduct and not allow any anonymous online communication. Dresdner solved the problem of initial uncertainty about how to use a wiki by first deploying the tool in small groups of employees. Once the employees overcame their fear and uncertainty, the tools became very popular.

Chapter 12

Enhancing Decision Making

After completing this chapter, students should be able to answer the following questions:

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

Introduction

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

12.1 Decision Making and Information Systems

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

Business Value of Improved Decision Making

Table 10 provides a few examples of the dollar value that enhanced decision making would give to firms.

Table 10: Business Value of Enhanced Decision Making

EXAMPLE DECISION	DECISION MAKER	ANNUAL DECISIONS	IMPROVED DECISION	ANNUAL VAUE
Allocate support to most valuable customers	Accounts manager	12	$ 100,000	$1,200,000
Predict call center daily demand	Call center management	4	150,000	600,000
Decide parts inventory levels daily	Inventory manager	365	5,000	1,825,000
Identify competitive bids from major suppliers	Senior management	1	2,000,000	2,000,000
Schedule production to fill orders	Manufacturing manager	150	10,000	1,500,000
Allocate labor to complete a job	Production floor manager	100	4,000	400,000

Source: (Laudon and Laudon, 2010:477)

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

Types of Decisions

There are generally three classifications of decisions:

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

The different levels of management are involved in unique decision making as folows:

- **Senior Management:** makes decisions based on internal business information but also external industry and society changes; decisions affect long-term and strategic goals and the firm's objectives
- **Middle Management and project teams:** decisions affect resource allocation, short-range plans and performance of specific departments, task forces, teams, and special project groups
- **Operational management and project teams:** decisions affect subunits and individual employees regarding the resources, schedules and personnel decisions for specific projects
- **Individual employees:** decisions affect specific vendors, other employees and most importantly the customer

The Decision-Making Process

The text describes the four stages of decision making:

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

These four stages are not always consecutive and may well be concurrent or repetitive.

Managers and Decision Making in the Real World

While information systems have gone a long way towards improving the decision-making process, they are not the Holy Grail. They should be viewed as a way to assist managers in making decisions, but not as the final answer.

Managerial Roles

Let's compare the **classical model of management** with the behavioral model. The former describes the five classical functions of managers as

- Planning
- Organizing
- Coordinating
- Deciding
- Controlling

Behavioral models of managers dissect the many activities involved in the five functions of management. That is, managers

- Perform a great deal of work at an unrelenting pace
- Activities are fragmented
- Prefer current, specific, and ad hoc information
- Prefer oral communications rather than written documentation
- Maintain a diverse and complex web of contacts

Now, let's take all of these activities and categorize them into three **managerial roles**:

- **Interpersonal**: act as figureheads, leaders, and liaisons
- **Informational**: act as nerve centers, disseminators and spokespersons
- **Decisional**: act as entrepreneurs, handle disturbances, allocate resources, negotiate and mediate conflicts

Table 10 shows that support systems exist for only some of the managerial behaviors but not all of them.

SELF CHECK QUESTION 12.1

What is a decision support system? (DSS)

Answers at the end of this section

Table 11: Managerial Roles in supporting information systems

ROLE	BEHAVIOR	SUPPORT SYSTEMS
Interpersonal Roles		
Figurehead		None exist
Leader	Interpersonal	None exist
Liaison		Electronic communication systems
Informational Roles		
Nerve center		Management information systems, ESS
Disseminator	Information	Mail, office systems
Spokesperson	processing	Office and professional systems, workstations
Decisional Roles		
Entrepreneur	Decision	None exist
Disturbance handler	making	None exist
Resource allocator		DSS systems
Negotiator		None exist

Sources: Kenneth C. Laudon and Jane P. Laudon; and Mintzberg, 1971.

Real World Decision Making

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

- **Information Quality:** Was the information used to make the decision accurate, consistent, complete, valid, timely, accessible, and of high integrity? What if you were making a decision about purchasing a house and found out that there were errors in your credit record that prevented you from obtaining the necessary financing? Perhaps the data was out of date or contained mistakes.
- **Management Filters:** Everyone processes the best information through personal filters and biases. Managers are no different. For instance, you may suggest to your manager that the department purchase a piece of equipment from a certain manufacturer. Your manager disapproves the suggestion because he had a bad experience with that company ten years ago. The manager's bias negates the fact that the company has since improved and is the best and cheapest choice.
- **Organizational Inertia and Politics:** People hate change and will sometimes do whatever they can to keep the status quo. Decision-makers are no different especially if they stand to lose. What if your department will benefit from improving its business processes to the benefit of all concerned except that the manager will lose her job? It's likely the manager will not make decisions that will cause her to lose her job. Therefore, nothing gets done regarding improving the processes.

12.2 Systems for Decision Support

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 percent?"

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

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

Management Information System (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:

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

You can also understand the differences between these two types of systems by understanding the differences in the types of decisions made at the two levels of management. Are your decisions routine, or are your decisions nonroutine?

Decision-Support Systems (DSS)

Decision support systems help executives make better decisions by using historical and current data from internal information systems and external sources of data. 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.

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 are used primarily 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.

Interactive Session: Technology Business Intelligence Turns Dick’s Sporting Goods Into a Winner (see p. 461 in text) describes how a well-designed and well-structured information system can help improve the decision-making process. The organization’s new decision support system uses a relational database and a relational online analytical process to provide multi-dimensional information.

Components of DSS

A DSS has three main components, as shown in Figure 40: the database, software and the user interface. The **DSS database** is, of course, data collected from the organization's information systems. Another important source of information the organization may use is external data from governmental agencies or research data from universities. The data can be accessed from the warehouse or from a data mart (extraction of data from the warehouse). Many databases are now being maintained on desktop computers instead of mainframes.

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

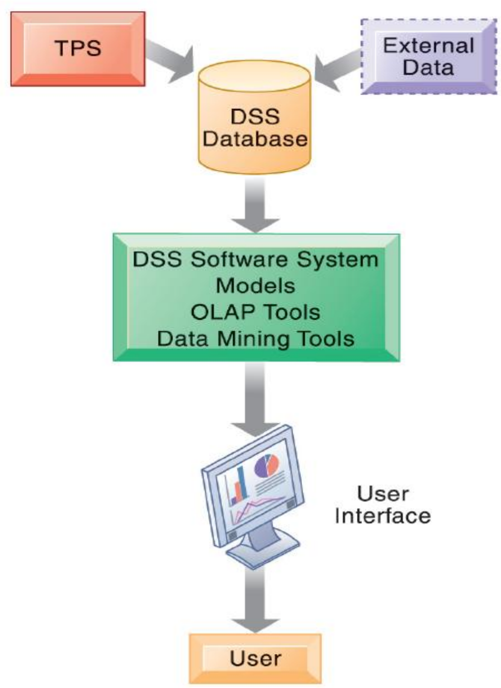
The what-if decisions most commonly made by executives use **sensitivity analysis models** to help them predict what effect the decisions will have on the organization. Executives don't make decisions based solely on intuition. The more information they have, the more they experiment with different outcomes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

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

Using Spreadsheet Pivot Tables to Support Decision Making

Common spreadsheet software like Microsoft's Excel helps managers review data in two dimensions rather than just one by using **pivot tables**. They can decipher patterns in information and help them allocate resources better. Managers using pivot tables can develop better strategies because they'll gain a better sense of correlating data points.

Figure 40: Overview of Decision Support System



Source: (Laudon and Laudon, 2010:486)

SELF CHECK QUESTION 12.2

What are the 3 basic components of a DSS? Briefly describe each.

Answers at the end of this section

Data Visualization and Geographic Information Systems (GIS)

Which would you rather decipher: a long list of seemingly endless list of numbers and complicated data, or a picture that truly can say it all in less than 1,000 words? Consider that almost our whole natural environment is one big graphic that we decipher through conceptualization. What if we combine thousands and thousands of words and numbers into a graphic that we can more naturally view and draw conclusions through concepts? That's the idea behind **data visualization**. If you want to see a sensible depiction of this emerging technology go to www.smartmoney.com < http://www.smartmoney.com > and, under Tools, click on the link labeled **Mutual Fund Map**. Rather than see traditional, out of context, lists of stock quotes, you can see a visualization of the data and put it into a more meaningful context. Click on one of the map sections and you can drill down through the data in a visual sense.

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

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

Web-Based Customer Decision-Support Systems

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

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

Realtor.com is an excellent example of a Web-based customer decision-support system. Besides the mortgage calculator described above, you can also use the customer DSS to help you determine how much home you can afford and another one to compare the cost of renting or buying a home. It also has information about moving tips, hiring a professional moving company versus doing-it-yourself, information about schools and crime rates, and a real estate glossary of terms. And by the way, they would appreciate you purchasing your new home through them!

Group Decision-Support Systems (GDSS)

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).**

You've been there: a meeting where nothing seems to get done, where some people dominate the agenda and others never say a word, and it dragged on for hours. When it was all over no one was sure what was accomplished, if anything. But the doughnuts 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.

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. More sophisticated GDSS require meeting facilitators and other staff that keep the hardware operating correctly. Many companies are bypassing specially equipped rooms in favor of having group participants "attend" the meeting through their individual desktop computers.

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.

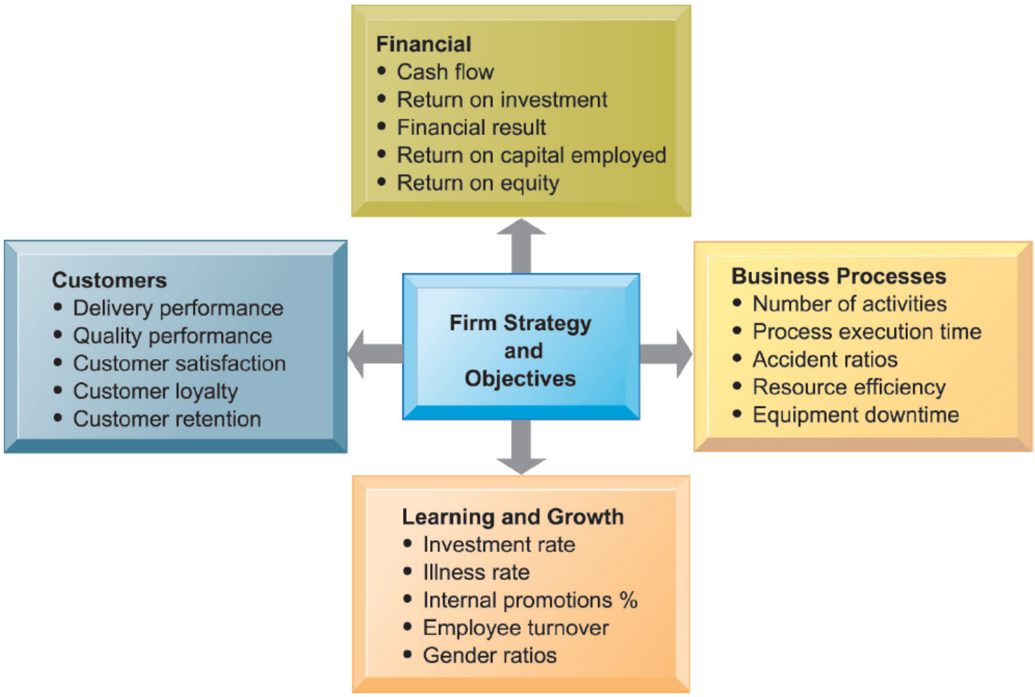
GDSS are best used for tasks involving:
- Idea generation
- Complex problems
- Large groups

12.3 Executive Support Systems (ESS) and the Balanced Scorecard Framework

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

Using a **balanced scorecard method**, many companies are combining their internal financial information with additional perspectives, such as customers, internal business processes, and learning and growth. By focusing on **key performance indicators (KPIs)** in each of these areas, executives gain a better understanding of how the organization is doing. After senior management establishes KPIs for each area, then and only then can the flow of information be established. Figure 41depicts the framework for a balanced scorecard.

Figure 41: The Balanced Scorecard Framework



Source: (Laudon and Laudon, 2010:495)

The Role of Executives Support Systems in the Firm

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

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

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

Business Value of Executive Support Systems

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

Because of the trend toward flatter organizations with fewer layers of management, companies are employing ESS at lower levels of the organization. Flatter organizations also require managers to access more information about a wider range of activities than in the past. This requirement can be accomplished with the aid of a good ESS. Executives can also monitor the performance of their own areas and of the company as a whole.

CASE STUDY

Read the Too many bumped fliers” Case Study from Page 485 of the text book and answer the questions that follow

(*Answers at the end of this Section*)

SUGGESTED ANSWERS TO SELF-CHECK QUESTIONS

12.1 What is a decision-support system (DSS)?

How does it differ from a management information system (MIS)?

A DSS assists management decision making by combining data, sophisticated analytical models, and user-friendly software into a single, powerful system that can support semi structured or unstructured decision making. These systems help end users utilize data and models to discuss and decide semi structured and unstructured problems, but they do not solve the problems for the user. Generally speaking, MIS provide routine, pre specified, and formatted reports based on data extracted and summarized from the firm's TPS. These reports provide information on the firm's performance and are used to help monitor and control the business. In contrast, DSS provide capabilities for addressing non routine decisions and user control. DSS emphasize change, flexibility, and rapid response and place a greater emphasis on models, assumptions, ad hoc queries, and display graphics. Additionally, MIS primarily address structured problems, whereas DSS focus more on supporting semi structured and unstructured problems

12.2 What are the three basic components of a DSS? Briefly describe each.

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

ANSWERS - CASE STUDY

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

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

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

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

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

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

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

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

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

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

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

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

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

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

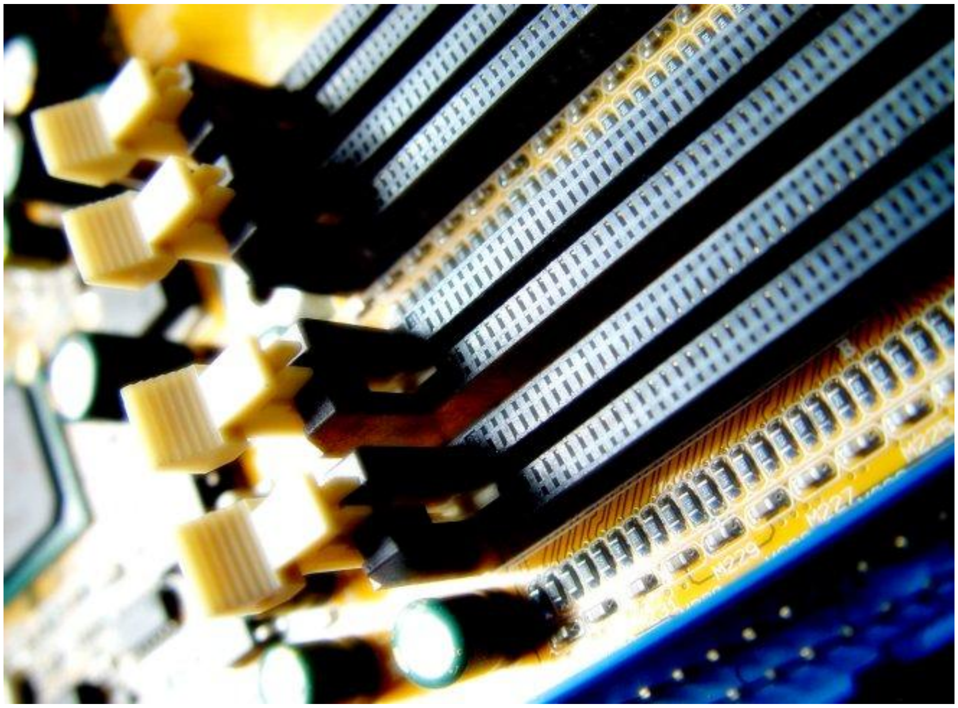
The answers to this question will vary but should address the key players: analysts, attendants, passengers, and decision-making processes by key executives.

Chapter 13

Building Information Systems

After completing this chapter, students should be able to answer the following questions:

- How does building new systems produce organizational change?
- What are the core activities in the systems development process?
- What are the principal methodologies for modeling and designing systems?
- What are the alternative methods for building information systems?
- What are new approaches for system-building in the digital firm era?



Introduction

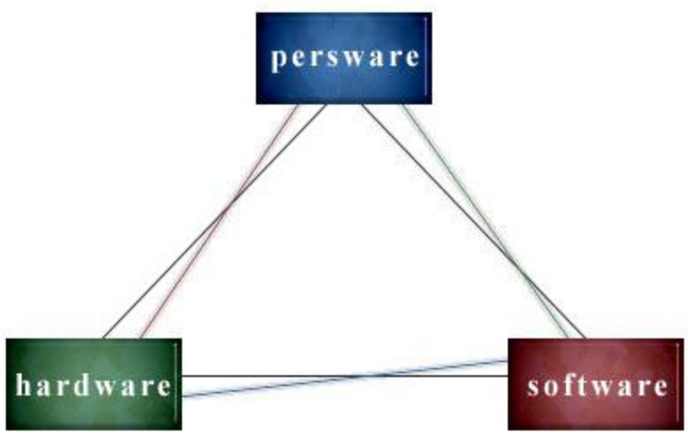
"What do you mean we have to change the way we make our candy bars? They are the number one selling product we have. Everyone loves them. Why can't we just keep doing things the way we've always done them? It's worked fine this long."

It's not unusual to hear this type of dialog in 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.

13.1 Systems as Planned Organizational Change

It would be nice if we could give you a precise checklist of how to smoothly introduce a new information system, 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 associated with new systems development.

The triangle that we've used before is back…

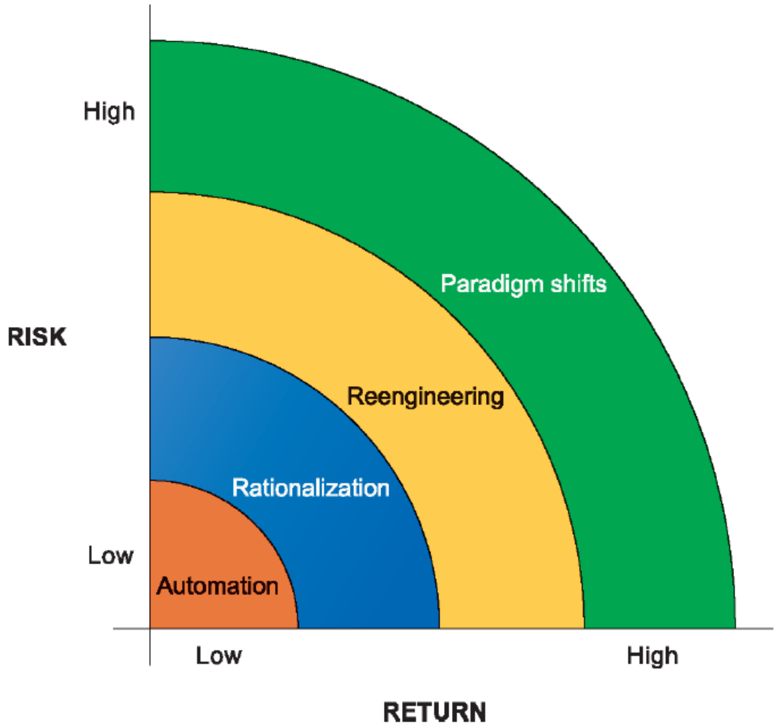


All three elements will pose their own unique challenges to managers, but you may be surprised to learn that the hardware and software will probably be the easiest of the three to manage. Successfully reorganizing the company relies on more than just bringing in new equipment and new programs. Understanding and incorporating changes in the social and political climate in any organization is one of the most important aspects.

Systems Development and Organizational Change

Change is disruptive. Change is dangerous. Change is good. Change is necessary. Change is constant.

Figure 42: Organizational change carries risks and rewards.



Source: (Laudon and Laudon, 2010:509)

This figure 42 shows the four degrees of organizational change. **Automation** is the easiest (except for those people losing their jobs), and the most common form of change. 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 relatively accepted by the people.

Business process 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 process 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 Internet is causing all kinds of industries and businesses to alter their products, their services, and their processes in radical ways. Entire organizations are being created to handle the paradigm shifts caused by the Web and other Internet applications. Look at the automobile industry as an example of this type of change: Traditional dealerships are being disrupted by automalls and online buying opportunities. How can a local dealer compete on price with these two environmental challenges? What is the dealers' 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 to do them? Because companies realize they have to take on the challenges in order to stay competitive. They have had to cut costs and streamline their operations because of global economic pressures, in addition to meeting the demands of their shareholders. And done well, the rewards can be tremendous.

SELF CHECK QUESTION 13.1

Why can an information system be considered planned organizational change?

(Answers at the end of this Section)

Business Process Reengineering

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 a 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 online package tracking systems. That simple process was never economically feasible before the Internet. They had to reengineer their business processes to incorporate this new business process.

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 toward paperwork. Instead of 10 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 total number of people who handle it. Or, you can migrate the application process to the Web and make it even more efficient and customer-friendly. Wells Fargo Bank allows customers to complete an online application and receive a preliminary approval or disapproval within minutes. Wells Fargo's computer system is connected to the credit reporting agencies' computers for quick access of customer credit data. If customers have questions about the application or the types of loans available, they can initiate an instant messaging session with a bank employee and get all their questions answered on the spot. Once the application has been submitted, the customer can check the progress of it online. Once the loan is approved, the money is allocated to the customer through an online account. Wells Fargo processes more bank loans faster and more efficiently. The customer is happier with less effort. And all of this can take place 24/7.

Steps in Effective Reengineering

BPR attempts fail 70 percent of the time. That's an astonishing figure when you think about it. What if your car failed to start 70 percent 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.

First, decide which business processes you need to focus on. Then decide how improvements to these processes will help the organization's overall business strategy.

What can organizations, their managers, and workers do to help make BPR a success? It may be helpful to make a diagram of how your processes work now and then envision how they will work after they are redesigned. Figure 13-2 in the text shows an example of how mortgage processing was redesigned using BPR techniques. Try just a few processes to get your feet wet and then expand it 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.

Process Improvement: Business Process Management, Total Quality Management (TQM) and Six Sigma

Who wants to eat a candy bar that tastes horrible, drips all over your hands and clothes, and costs way more than it should? WorldWide Candy Corporation from previous chapters avoids those pitfalls better than the competition because it has decided to use its information systems to enhance the quality of the company and the product. The customer knows that Cybernuts is far superior to any other candy bar in taste, and it's not that expensive. The customer doesn't really focus on the fact that chocolate isn't melting all over her hands. That's an intriguing aspect of keeping the customer happy, when you think about it. The customer doesn't consider the quality of a product until it isn't there. Then it may be too late for the producer to win back the customer.

Business Process Management

Take a seemingly simple task such as sending out customer invoices and really analyze how many steps are involved in the process. Even in a small business, you may be surprised how many steps there are. **Business process management (BPM)** is the art and science of analyzing every task in a business and helping firms continually optimize them. BPM includes work flow management, business process modeling, quality management, change management, and standardizing processes throughout the organization. Every business, from the smallest to the largest should continually analyze how they accomplish every task and look for ways to improve everything. The business doesn't have to accomplish this with the idea that every process should be automated even though many can. The business simply has to continually look for better methods of performing the work.

SELF CHECK QUESTION 13.2

Describe each of the four kinds of organizational change that can be promoted with information technology

(Answers at the end of this Section)

Total Quality Management and Six Sigma

Total quality management, making quality control everyone's responsibility, relies on an excellent information system that supplies workers and management with the data necessary to improve products and drive down costs. **Six Sigma** is another initiative companies use to spot problems and correct them before they are too deeply embedded in the company's processes. It just stands to reason that the longer a flaw is allowed to fester in the system, the more problems it may cause. And the more problems, the higher the costs. So if you can identify the defects early on and eliminate them, you can achieve more efficient production at lower costs. That's the premise behind Six Sigma.

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 the types of information systems we discussed can be fed into quality management and make it easier to develop and improve products that blow away the competition.

How Information Systems Support Quality Improvements

Here are some ways companies can use information systems to achieve total quality management:

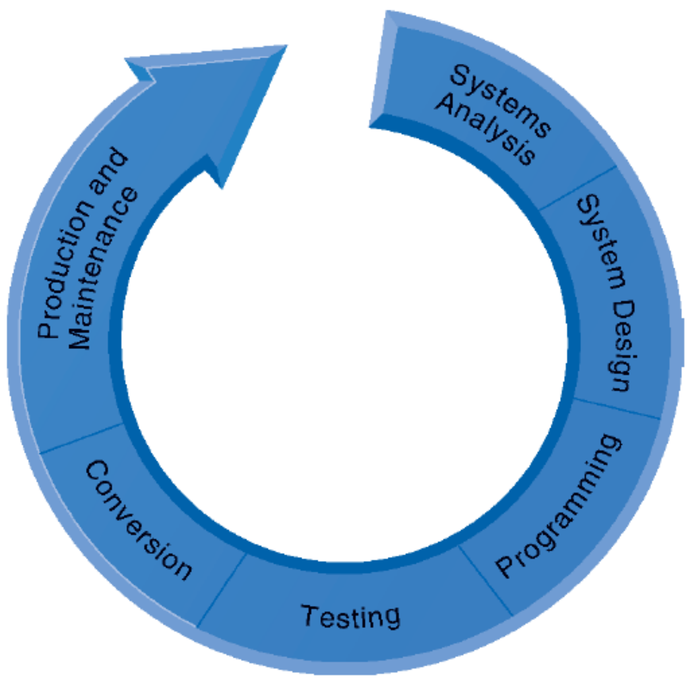
- ❖ Simplify processes by using information to determine what the processes are in the first place
- ❖ Identify **benchmark** targets
- ❖ Gather, process, and store customer feedback in information systems that are available company-wide
- ❖ Reduce cycle time by providing information earlier in the process

- Redesign the process or redesign the product by using information about the process
- Improve production processes by using available information from internal and external sources

13.2 Overview of Systems Development

Systems development includes every resource and every step that goes into producing an information system that solves a problem or helps the organization take advantage of new opportunities.

Figure 43: The systems development process



Source: (Laudon and Laudon, 2010:516).

Don't start by thinking, “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 within the entire organization to develop a usable system that will serve everyone.

The arrow in Figure 43 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. Make sure you're addressing the real problem and not just the symptoms. Effective **systems 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 rest of the current information systems and the business plan itself.

Is your idea even feasible? You might be surprised how often organizations fail to ask this question. A **feasibility study** helps you determine if your proposed solution is achievable *before* you spend thousands of dollars. The study will review the technical, financial, and organizational feasibility of hardware, software, and persware and help you decide whether your proposed answer is the right one.
Too often organizations underestimate the cost of a new system, especially in the persware area: training, downtime, lost productivity, and employee disruption.

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. That's why you must write down the problem and then keep referring to your notes 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. A significant cause of system failure in development projects is because organizations failed to properly analyze and understand their information requirements.

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 existing organizational processes?

Systems Design

Congratulations! If you get to the **systems design** 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.

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 the authors 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. Table 13-1 in the text categorizes all of the design specifications that you'll need to develop for a new system.

The Role of End Users

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 organization as the number one priority, and remembering that the best system is one that meets the user's needs.

Don't forget that 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. The number one reason so many system development projects fail is due to insufficient user involvement.

Completing the Systems Development Process

Now that you're through the analysis and design phases, 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. Either way, make sure 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 the **testing** phase of the development process can severely hamper the project's success.

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 people who were involved with the design and programming stages do all the testing. Get a fresh pair of eyes to look at the system according to the **test plan** that was developed by the programmers and the users.

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.

- 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.

- 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.

- If neither of the above describes 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.

- 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 **documentation** of 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 and it's in **production**, you want to go back one more time and make sure it's meeting your needs through a **postimplementation audit**. Eventually you're going to have to perform **maintenance** on the system no matter how well you designed and built it. And someday you'll have to make major changes or replace it altogether.

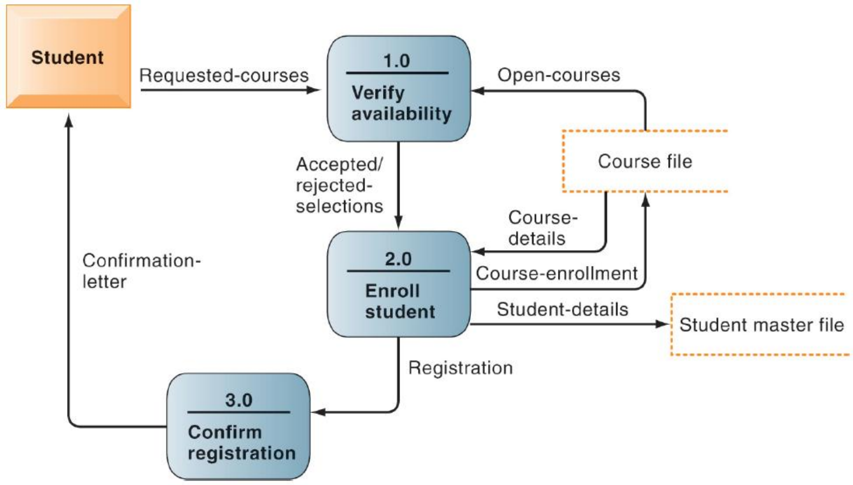
Modeling and Designing Systems: Structured and Object-Oriented Methodologies

There's always more than one way to accomplish a task. The trick is to use the one that works best for the job you're trying to accomplish.

Structured Methodologies

Traditionally, systems have been structured in a very orderly manner. The methods used to build the systems begin at the top and progress to the lowest detail always with an eye towards keeping the processes separated from the data. The designers sketch out how the data moves through the system by using data flow diagrams. That way the designers can easily track all the processes and their interrelationships. The DFDs can be used to help spot trouble areas before the system is actually built. Figure 44shows a typical data flow diagram.

Figure 44: Data flow diagram



Source: (Laudon and Laudon, 2010:523)

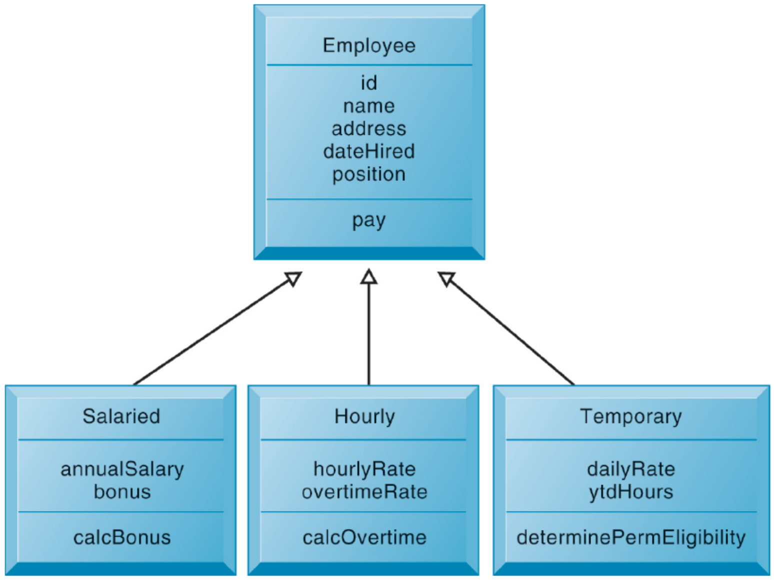
The advantage of using data flow diagrams is that they can be used to show a very general, high-level process or very minute detail using the same tools. Anyone can view the overall system and then easily drill down through the diagrams to lower levels of the system. Couple the DFDs with a data dictionary and you can develop **process specifications** that describe how the data is transformed into useable information. Hierarchical **structure charts** complete the structured methodology by providing top-down charts that show each level and how they interrelate.

Object-Oriented Development

The structured development method keeps data and processes separate. **Object-oriented development** combines the two and treats them as one **object**. More importantly, 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 once you have built up a library of them. It also makes it easier to create new software, because you aren't continually starting from scratch.

The terms used in this section, *class* and *inheritance*, describe how object-oriented modeling uses objects to develop a program. It may sound complicated, but it really isn't. Figure 45 shows you how classes inherit the common features of their superclass. Take a few minutes to study it.

Figure 45: Class and inheritance



Source: (Laudon and Laudon, 2010:526)

Object-oriented development is an iterative and incremental way of building programs.

The steps in the analysis phase are:

- Document functional requirements
- Specify the most important properties
- Decide what the proposed system must do
- Analyze interactions between the system and users to indentify objects

Steps in the design phase are:

- Describe how the objects will behave
- Describe how objects will interact with one another
- Group similar objects together to form a class
- Group classes into hierarchies

Computer-Aided Software Engineering

If we've automated just about everything else with software, it shouldn't be a surprise that we're also automating software design and development. Computer aided software engineering (CASE) provides developers with an easy to use method of developing software code that is well-documented, well-designed, and easily reused. Because software programs are becoming so complex it's not unusual to have teams of programmers develop the code. CASE tools provide an element of coordination and management for the programming teams. CASE tools also help keep programming elements such as data flow diagrams and data dictionaries synchronized. CASE tools bring discipline and structure to the program design and development process that may otherwise be lacking.

13.3 Alternative System-Building Approaches

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.

Traditional Systems Life Cycle

The **systems life cycle** is primarily used for large systems projects. It has existed for years and uses tried-and-true methods that help ensure the success of the system from its humble beginnings as an idea to an old relic that eventually needs replacing.

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.

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 correct. Are users adequately trained, or do you still have work to do 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.
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 10 years ago and now seems small and outdated. It's the nature of the beast.

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.

Prototyping

Fast, cheap, user-centered. **Prototyping** may be the best way to develop a new system if end users don't have a clue about what they really want the system to look like. Even if they have a few clues, **prototypes** works well because the user can guide the process based on what they see as the system is 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 **iterative** process used in building a prototype system.

Generally you 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.

Steps in Prototyping

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, use Step 4 frequently.

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 easy utilized in other areas?

The greatest advantage of the prototyping method of developing **end-user interfaces** 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?

End-User Development

Taking matters into their own hands. 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 previously reviewed. It's convenient for small applications, and the user can have complete ownership of the system.

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.

Managers should be aware of some inherent dangers with **end-user development** processes. Standardization can be a tough issue when you use it. You're almost begging for conflicts in data processing and storage, since each user will have his own method of creating, defining, and developing data using **query languages**.

The most frequent risks of end-user development methods are:
- Testing and documentation may be inadequate
- Control over data may be lost
- Costs may exceed benefits
- Hardware, software, and quality standards may be violated

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.

Application Software Packages and Outsourcing

We mentioned earlier that software programs are becoming extremely complex to design, develop, and build. Many companies either don't have the in-house staff to accomplish the task or they decide to focus on their core competencies and have someone else develop the software they need.

Application Software Packages

Fast, easy, convenient, user-driven. Many software packages are extremely convenient for non-techies to use to develop their information products. 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.
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.

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.

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. What are the training costs, implementation costs, and integration costs? They all add up.

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
- 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 fully evaluate the software package according to your needs. Remember, you give up a lot of control when you choose to go with a prewritten software package.

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, often at a lower cost than in-house staff. That's the primary reason companies choose **offshore outsourcing**. They can also offer smaller organizations economies of scale that make overall information processing cheaper.

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.

13.4 Application Development for the Digital Firm

Until a few years ago it was common for system development to take months if not years. That time frame has shortened to days or weeks. Pundits refer to "Internet time" as a reference for the much more rapid development of systems that some companies experience now. Unfortunately, some of the more important steps of development may be slighted or overlooked altogether in the rush to get a product out the door. Unfortunately, customers may be the ones to suffer the most from the mistakes.

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 gap – 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. There just isn't enough time.

Rapid Application Development (RAD) reduces the time it takes to build systems by using many of the tools that we've discussed. You can choose from prototyping or fourth-generation tools to develop systems much more quickly. End users and techies can work hand-in-hand with **joint application design** (JAD) tools to reduce the development time for new applications. Because of the collaborative environment so prevalent in today's business world, **agile development** is a popular way of developing systems. This method takes a large project and breaks it down into small sub-projects. Teams use iteration and continuous feedback to develop plans, establish requirements analysis, design the project, code it, test it, and document it.

Component-Based Development and Web Services

Component-based development is simply the practice of developing reusable components that are commonly found in many software programs. Create a “Save File” function for one application and use it in all applications. Not only does it save development time but creates functions that users have to learn only once and use multiple times. In short, why keep re-inventing the wheel when it works just fine across a multitude of vehicles.

Web Services and Service-Oriented Computing

Both of these system development methods rely on reusable components obtainable through the Internet. They are independent of operating systems, programming languages, or client devices. That makes them cheaper and easier to incorporate than proprietary software development.

> “Service-oriented computing (SOC) is a programming paradigm shift in the computer and information technology industry. Unlike object-oriented programming, SOC deals with modules or components that can be represented as reusable entities with service interfaces. Each entity may have a specific goal or objective. The entities can be composed and reused in various applications or solutions.” (BusinessWeek.com, Dec 2008)

CASE STUDY

Read the Chrysler Case Study from Page 534 of the text book and answer the questions that follow

(*Answers at the end of this Section*)

SUGGESTED ANSWERS TO SELF-CHECK QUESTIONS

13.1 Why can an information system be considered planned organizational change?

An information system is a socio-technical entity, an arrangement of both technical and social elements. Information systems change involves hardware and software, but in addition, it involves changes in jobs, skills, management, and organization. When we design a new information system, we are redesigning the organization, reordering its technical and social elements.

13.2 Describe each of the four kinds of organizational change that can be promoted with information technology.

Information technology enables automation, rationalization, reengineering, and paradigm shifts. Automation uses the computer to speed up the performance of existing tasks. This approach to organizational change affects the organization less than the other three. It may release staff to other jobs, reduce the number of employees needed, or enable the organization to process more transactions. Rationalization of procedures refers to the streamlining of standard operating procedures, eliminating obvious bottlenecks, so that automation makes operating procedures more efficient. By making such changes, it can eliminate some tasks and enable the organization to make more changes than automation, but the organization still has not made changes in the goals or strategy of the company. Business process reengineering refers to the radical redesign of business processes, combining steps to cut waste and eliminating repetitive, paper-intensive tasks in order to improve cost, quality, and services, and to maximize the benefits of information technology. This is a more powerful type of organizational change because an organization can use it to rethink and streamline its business processes, improve speed, service, and quality. A paradigm shift is a radical reconceptualisation of the nature of the business and the nature of the organization. The strategy of the business can be changed, and sometimes even the business the company is in.

ANSWERS - CASE STUDY

1. What management, organization, and technology issues should Chrysler have explored when deciding whether to outsource to TCS?

Management: Managers and executives must evaluate all the risks associated with offshore outsourcing and make sure outsourcing is the best answer. Managers must understand the additional costs for coping with cultural differences that drain productivity. They must deal with human resources issues – terminating or relocating domestic employees.

Organization: Does TCS possess skills, resources, and assets that Chrysler doesn't have on its staff? Personnel costs obviously drove much of Chrysler's decision to outsource its IT staff. Annual compensation for a cost estimator in the U.S. is around $70,000 to $80,000 per year versus a third to half of that for the same employee working in a foreign country.

Technology: Costs for transitioning to a new vendor and for improving internal software development methods to match those of outsourcing vendors are often underestimated. Chrysler's management determined that the company was spending too much of its IT budget on core maintenance of systems and not enough in reinvesting in the business.

2. What points should Chrysler have addressed in its outsourcing contract with TCS?

Chrysler must address the following points in its outsourcing contract:

- Who will be responsible for various components of the transition?
- How will the vendor be monitored to make sure they are fulfilling their contractual obligations?
- How will system requirements be documented and agreed upon by both sides?
- What are the time lines for fully transferring work to TCS from Chrysler's IT staff?
- Which Chrysler employees will be retained by TCS, how will they be compensated, and who will have supervisory responsibility for them?
- What exit strategy will Chrysler and TCS use if the contract is later terminated?

3. Was Tata Consultancy Services a good outsourcing choice for Chrysler? Why or why not? Explain your answer.

On the positive side, TCS will leverage its Global Network Delivery Model, a collaborative best-of-class framework of people, processes, and infrastructure that uses TCS's tools, methodologies, and products to help Chrysler reduce implementation time and realize business benefits. The Global Network Delivery Model is considered a benchmark of excellence in software development. Chrysler will also be able to shed about 20 percent of its full-time employees and save all of the associated costs of these employees. And, Jan Bertsch, Chrysler vice president and CIO asserts that the change will improve the company's IT operations. Management determined that the company was spending too much of its IT budget on core maintenance of systems and not enough in reinvesting in the business.

On the negative side, Tata Consultancy Services is owned by Tata Motors, a company that will compete in India – and potentially other parts of the world – with Chrysler. Tata will take over Chrysler's application maintenance and support services, particularly for Chrysler's sales, marketing, product development, shared services, and after sales functions. It's a very dicey move to hire your competition to manage many of your core activities.

Chapter 14

Managing Projects

After completing this chapter, students should be able to answer the following questions:

1. What are the objectives of project management and why is it so essential in developing information systems?

2. What methods can be used for selecting and evaluating information systems projects and aligning them with the firm's business goals?

3. How can firms assess the business value of information systems projects?

4. What are the principal risk factors in information systems projects?

5. What strategies are useful for managing project risk and system implementation?

Introduction

Previously, we discussed how to design and build information system projects. That may be the easy part. It's much more difficult to manage an entire information system project to make sure a company realizes the intended benefits from its investment and that the system solves problems for the organization rather than create more.

14.1 The Importance of Project Management

Why do so many information system projects fail to deliver on their promises? Is it because the hardware, software, and data are flawed? Is it because **user interfaces** don't allow people to perform their jobs correctly? Is it because the processes aren't designed correctly? Those are all possibilities.

Runaway Projects and System Failure

The statistics provided in the Laudon text are startling:

- One-half of private sector projects are underestimated in terms of budget and time required to deliver
- A large number of projects are delivered with missing functionalities
- Only 29 percent of all technology investments are completed on time, on budget, and with all the promises met
- Between 30 and 40 percent of software projects far exceed their original schedules and budget projections

What is the leading cause of these dismal statistics? In two words – project management.

Project Management Objectives

Information system **projects** range from very small, end-user development projects, to major implementations of enterprise systems. Regardless of size, they all have some common characteristics.

First, they require the effective use of **project management** tools and technologies that help keep the project on time, within budget, and meet objectives.

Every project includes the same five variables:

- **Scope**: what work is or is not included in a project.
- Time: establish timeframes for each component of a project.
- Cost: the amount of time multiplied by the cost of human resources required of a project.
- Quality: does the project improve organizational performance and decision making?
- Risk: potential problems that may threaten the project's success.

14.2 Selecting Projects

"Gee, we thought we did everything by the book. Why doesn't the system work the way we envisioned?" Perhaps it's not the system itself but the way changes in the organization were managed. This section will help you better prepare for the hardest part of building information systems—managing the development and implementation of the system and the people it will affect.

Management Structure for Information Systems Projects

To help ensure success, companies should have four levels of management control for system projects:

- Corporate strategic planning group: develops strategic plans
- Information systems steering committee: includes department heads from end-user and information systems; reviews and approves systems plans, coordinates and integrate systems, selects specific projects
- Project management: information systems managers and end-user managers; oversees specific information systems projects
- Project team: directly responsible for individual system projects; consists of systems analysts, end-user business specialists, application programmers, and database specialists.

As you review the list above, one thing you should notice in particular is that there are business specialists and end-user involvement in every level of management. Too many companies fail to include non-techies in systems planning and management, much to their dismay later on.

Linking Information Systems to the Business Plan

Companies buy the hardware they think 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 circle 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 all the hardware and software purchases fit in with their organizational **information systems plan** and their people know how to use them.

"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.

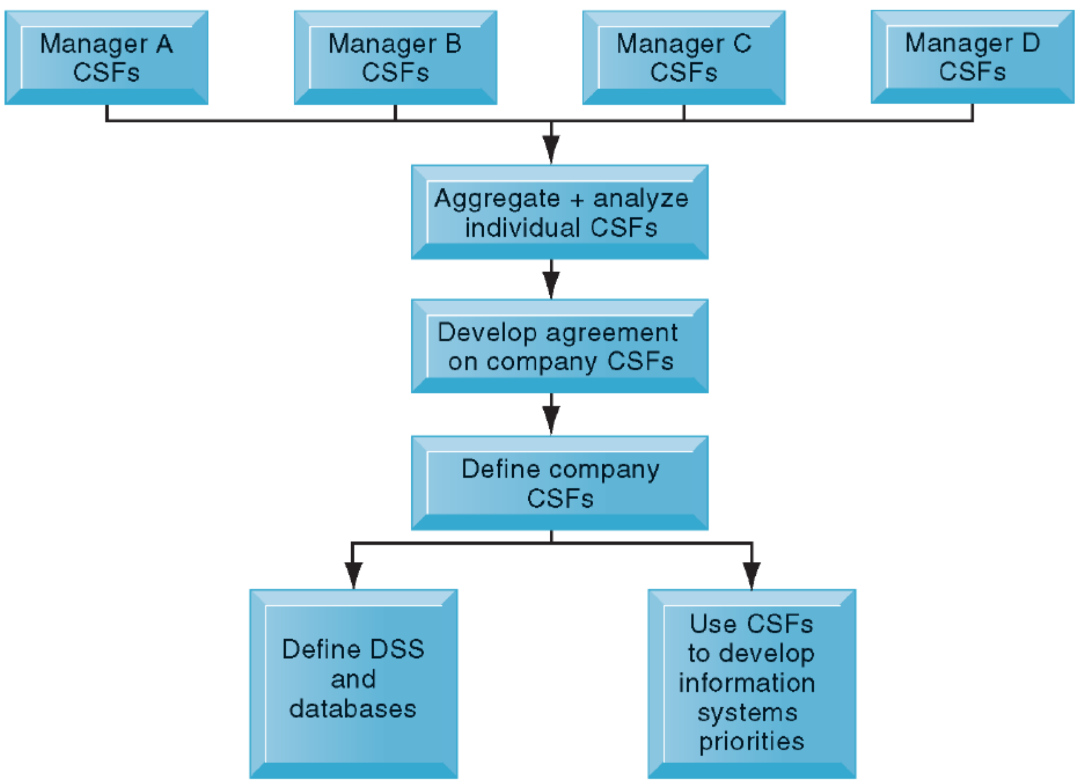
The problem is that too many companies don't have a plan for integrating new hardware and software purchases into their overall business plan, let alone meshing them with the persware side of the triangle.

Of course, the information plan should support the overall business plan and not conflict with it. The plan must include all levels of the organization, including the strategic and executive levels. These two levels include the people who often say they are exempt from having to determine information system needs.

Critical Success Factors

Critical success factors (CSFs) are simply the goals managers feel will make the organization a success. Using this method broadens 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 also called a "strategic analysis." Basically, you contact several top managers, ask them what they think will make the organization succeed, and then combine the results into a cohesive picture.

Figure 46: Using CSFs to Develop Systems



Source: (Laudon and Laudon, 2010:556)

SELF CHECK QUESTION 14.1

What are the objectives of project management and why is it so essential in developing information systems?

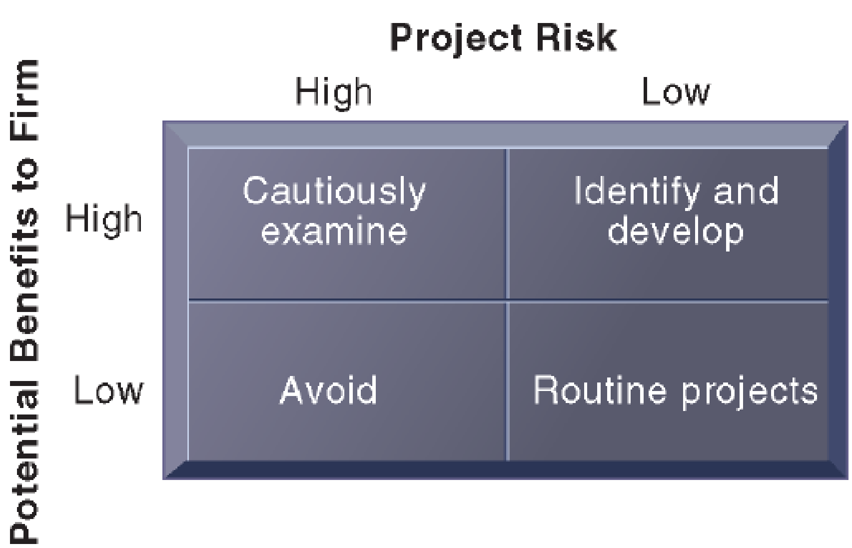
(Answers at the end of this Section)

Using the CSF method also takes into account how the external business 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 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 managers' goals represent the organization's goals? 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 only methodology used.

Figure 47: Portfolio Analysis



Source: (Laudon and Laudon, 2010:557)

The **portfolio analysis** shown in this figure 47 allows a company to objectively rate multiple alternative projects for their 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 ideal situation is to choose a system with the highest benefit and the lowest risk while ignoring systems with the lowest benefit and highest risk. That's reasonable. This method of rating projects helps companies align their IT assets with their business strategy and results in a better organization-wide coordination of IT investments.

Scoring Models

The **scoring model** is effective for comparing various alternatives in terms of their costs. This model can go a long way toward helping organizations determine the best course of action and quantify their decision making. And, if nothing else, it creates a dialog among the managers about strategic factors they should consider for the good of the firm. As the text states, "Scoring models are used most commonly to confirm, to rationalize, and to support decisions, rather than as the final arbiters of system selection."

SELF CHECK QUESTION 14.2

What methods can be used for selecting and evaluating information systems projects and aligning them with the firm's business goals?

(Answers at the end of this Section)

14.3 Establishing 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? What benefits will your customers gain from the new system?

However, you can't reduce everything to dollars and cents. Sometimes the benefits of the new system will be measured in other ways, but you can employ several different methods to evaluate a new information system, just as you would a new storage system.

Information System Costs and Benefits

One of the more difficult choices to make when evaluating new systems is to determine the **tangible benefits** versus **intangible benefits**. When a financial institution must decide whether to offer online banking, it may evaluate the system using one of the methods outlined in the text and determine that it will cost half a million dollars to implement. The immediate cost savings of not having employees interface directly with customers may be only $250,000.
On the surface you could say that the new system isn't worth the cost – the bank will lose $250,000. But the intangible benefits the bank customers may enjoy could potentially be worth a million dollars. In that case, the new system's intangible benefits will far exceed the tangible benefits. Table 14-3 in the text explains some of the tangible and intangible benefits of information systems.

Capital Budgeting for Information Systems

There are several methods for analyzing a new system in terms of dollars and cents using **capital budgeting** techniques. Each method measures the financial worth of the system by determining the difference between cash outflows and cash inflows. The Learning Tracks on the Web site for this chapter helps you see how each method analyzes a proposed new system from a different perspective. Why not just have one, you might ask. Because in this case, one size does *not* fit all.

Financial models used to evaluate new systems are:

- Payback Method: time required to pay back the initial investment
- Accounting Rate of ROI: approximation of the accounting income earned
- Net Present Value: amount of money an investment is worth, taking into account its cost, earnings, and the time value of money
- Cost-Benefit Ratio: ratio of benefits to costs Profitability Index: calculated by dividing the present value of the total cash inflow from an investment by the initial cost of the investment
- Internal Rate of Return: rate of return or profit that an investment is expected to earn

Real Options Pricing Models

The system investment that looks good to one company may be all wrong for another company based strictly on the numbers. That's because no two companies are *exactly* the same. And the uncertainty of most IT projects makes it even more difficult to evaluate a project based solely on numbers. **Real options pricing models** offers strategic planners the ability to bring other factors into the evaluation and place a value on them. It uses these factors:

- Value of the underlying IT asset
- Volatility of the value
- Cost of converting the option investment into the underlying asset
- The risk-free interest rate
- The options' time to maturity

Limitations of Financial Models

Keep in mind that there are limitations to each financial model used to evaluate new systems. Using the online banking example, you can assume the initial cost will not be recouped until months or years after implementation. As we've seen in the last few years, the hardware costs can change drastically within a short period of time. As soon as the system is installed, new technology can render it obsolete. How do you factor those realities into a financial evaluation model? Most of the time you can't.

On the other hand, you'll remember that the cost of adding new users to an existing network is marginal according to Metcalfe's Law and Network Economics. That must be factored into the financial models as well as elements of the TCO (Total Cost of Ownership). It is not unusual for the personnel costs in the TCO model to be underestimated or even totally overlooked.

14.4 Managing Project Risk

There's a risk to every project – large and small. Ignore those risks and you're simply asking for failure.

Dimensions of Project Risk

Here are three dimensions of risk associated with every project:

- *Project size:* as projects grow larger, the associated risk of failure increases. It's not just technical complexity that jeopardizes large projects. The number of units and groups that will use the new system and the potential influence the project has on business processes affect risk.
- *Project structure:* are requirements clear and straightforward or are they undefined, fluid, and constantly changing? Are users constantly changing their ideas about what the system should do? Do users even agree on what they want the new system to do?
- *Experience with technology:* Will the project team and information system staff have to learn new skills associated with the new system? If so, that will expose the project to technical problems and probably take more time to implement.

Change Management and the Concept of Implementation

Change is a given element in the business world. From mergers and acquisitions, to complete corporate purchases, to changing work processes and methodologies within the same company, change is hard on people and organizations. But **change management** is one of those necessary evils that keep companies in the lead or helps destroy them.

The Concept of Implementation

Implementation of a new system is *not* just about how to put the hardware and software into place. You have to address and manage people and processes to make sure they are in sync with the hardware and software. In essence you become a **change agent**. You have to convince users that the system is going to improve their world 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 those changes to them.

The Role of End Users

Make users feel they own the new system instead of it being an enemy or something they should fear. That's why we stress user involvement through the entire development process. The new system shouldn't be a surprise on Monday morning! Familiarity doesn't always breed contempt; it should breed acceptance when it comes to new information systems.

Table 10: The User-Designer Communication Gap

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 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 these data?
How will the operation of the system fit into my daily business schedule?	What database management system should we use?

Source: (Laudon and Laudon, 2010:563)

This table 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. Too little discussion and communication between the techies and the non-techies will be apparent through design flaws and a poorly implemented project. Understand where both sides are coming from, and you'll do a better job of getting them to work together. You can never have too *much* communication.

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 as anyone else.
Management support and commitment for new projects is required for these reasons:

- Creates a positive perception for both users and technical information services staff
- Ensures sufficient funding and resources are devoted to the project
- Implementing changes in work habits and procedures are easier
- Enforcing organizational realignments

Change Management Challenges for Business Process Reengineering, Enterprise Applications, and Mergers and Acquisitions

The text gives the startling fact that 70 percent of all business process reengineering projects fail to deliver promised benefits. It doesn't have to be that way. One abiding theme in most of the failures and successes is people. If the changes required by and in people are managed properly, then the success rate increases. Conversely, if people are poorly managed or, just as likely not managed at all, then the project stands a good change of failing. The leading threats of BPR projects are:

- dealing with fear and anxiety throughout the organization
- overcoming resistance by key managers
- changing job functions, career paths, and recruitment practices
- training

In spite of the size of the information system, some kind of organizational change must take place. Even if the project only involves two people, they will have to do things differently. As projects grow in size and scope, organizational change will grow accordingly.

Remember when you moved in with your college roommate? Or perhaps you got married. Or maybe you're sharing an apartment with someone. Maybe you had to move your favorite chair to another room to accommodate the other's large-size sofa. Or perhaps your microwave was different than your spouse's, therefore he had to learn a new way to operate yours. Regardless of the circumstances someone had to change the way they do things. The same thing happens in the business world when two companies merge.

The business world is fraught with examples of mergers and acquisitions that didn't work out or were not cost-effective. Many of the problems can be traced to employees that didn't adapt to the changes or to poorly integrated systems.

To ensure a successful merger managers must recognize:

- The realistic costs of integration
- The estimated benefits of economies in operation scope, knowledge, and time
- Any problematic systems that require major investments to integrate
- Any likely costs and organizational changes required to upgrade the IT infrastructure

Controlling Risk Factors

Identify the nature and level of risk associated with the project first. Then you can use the appropriate tools and risk-management approaches to reduce the risk of the project failing.

Managing Technical Complexity

You can use special tools to help you manage the implementation of a new information system (**internal integration tools**). It's important that the project leaders and team members have the appropriate level of expertise and experience in the project's technology. Otherwise, you should obtain it from outside sources.

Formal Planning and Control Tools

Automated management tools such as PERT or Gantt charts (**formal planning and control tools)** can also help you manage a complex project. They are extremely beneficial for scheduling events and tracking the hundreds of details involved.

Compare Figures 14-5, Gantt Chart, and 14-6, PERT Chart, in the text to understand the difference between the two types of planning tools. The **Gantt chart** depicts all of a project's activities, showing the start date and the anticipated completion date. It also lists the personnel resource requirements needed for each task. **PERT charts** on the other hand, show the interrelationship between tasks. It's a great way to show which tasks must be completed before other tasks can begin.

Increasing User Involvement and Overcoming User Resistance

We simply can't say it enough! Get users involved from the very beginning of a project and keep them involved. Use **external integration tools** to keep people involved and informed. Guard against destructive, although innocent, sabotage of the system (**counterimplementation**). Remember, people will weigh their own needs against those of the organization. You have to make sure the two agree as much as possible.

Some of the strategies you can use to overcome user resistance include:

- User participation
- User education and training
- Management edicts and policies
- Better incentives for users who cooperate
- Improve the end-user interface
- Solve organizational problems before introducing a new system

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 caught up in the hustle and bustle of the implementation process and they forget to address basic questions about the new system. An **organizational impact analysis** will help answer questions about organizational structure changes, attitudes, decision making, and operations. We urge you to write down what you want the end result to be in terms of the organization. If you do so, you can use these notes 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 efforts required for a successful 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 each other.

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.

Project Management Software Tools

Because project management is so difficult, there are some great software programs you can use to help you manage projects regardless of their size. The programs automate many of the mundane tasks like defining tasks, assigning resources, establishing start and end dates, tracking progress, and creating and maintaining PERT and Gantt charts. Best of all, when one element of a project changes, it’s easy to see how other elements are affected. That will help you make better decisions about the project and keep track of the myriad of details.

CASE STUDY

Read the Biosense Case Study from Page 569 of the text book and answer the questions that follow

(*Answers at the end of this Section*)

SUGGESTED ANSWERS TO SELF-CHECK QUESTIONS

14.1 What are the objectives of project management and why is it so essential in developing information systems?

Describe information system problems resulting from poor project management.

When an information system fails to work properly or costs too much to develop, companies may not realize any benefit from their information system investment, and the system may not be able to solve the problems for which it was intended. Good project management is essential for ensuring that systems are delivered on time, on budget, and provide genuine business benefits.

Project management refers to the application of knowledge, skills, tools, and techniques to achieve specific targets within specified budget and time constraints. Project management activities include planning the work, assessing the risk, estimating and acquiring resources required to accomplish the work, organizing the work, directing execution, and analyzing the results. Project management must deal with five major variables:

- Scope: defines what work is or is not included in a project
- Time: the amount of time required to complete the project
- Cost: based on the time to complete a project multiplied by the cost of the human resources required to complete the project.
- Quality: an indicator of how well the end result of a project satisfies the objectives specified by management
- Risk: refers to potential problems that would threaten the success of a project

14.2 What methods can be used for selecting and evaluating information systems projects and aligning them with the firm's business goals?

Large corporations will have a management structure to ensure the most important systems projects receive priority.

- **Corporate strategic planning group**: responsible for developing the firm's strategic plan, which may require the development of new systems.
- **Information systems steering committee**: the senior management group with responsibility for systems development and operations. It's composed of department heads from both end-user and information systems areas. The committee reviews and approves plans for systems in all divisions, seeks to coordinate and integrate systems, and occasionally selects specific information systems projects.
- **Project management group**: composed of information systems managers and end-user managers, this group is responsible for overseeing specific information systems projects.

- **Project team**: is directly responsible for individual systems projects. It consists of systems analysts, specialists from the relevant end-user business areas, application programmers, and database specialists.

An information systems plan helps executives, managers, and users identify information systems projects that will deliver the most business value. The information systems plan must support the overall business plan. It serves as a road map indicating the:

- purpose of the plan
- strategic business plan rationale
- current systems
- new developments
- management strategy
- implementation plan
- budget requirements

ANSWERS - CASE STUDY

1. Identify the risks in the BioSense project.

The BioSense program sits atop a hospital's existing information systems, continually gathering and analyzing data as they are generated. Custom software developed by the CDC monitors a facility's network traffic and captures relevant patient records, diagnoses, and prescription information. The system summarizes and presents analytical results by source, day, and syndrome for each ZIP code, state, and metropolitan area using maps, graphs, and tables.

Risks include:

Project size: *The larger the project, the greater the risk.* The sheer number of hospitals that the CDC wants to incorporate into the system is enormous. Approximately 700 Defense Department and 1110 VA facilities already report data to BioSense. It also receives data from Laboratory Corporation of America (LabCorp) orders for medical tests. LabCorp is one of the largest clinical lab service providers in the U.S. As of May, 2008, only 563 hospitals and state health organization were participating in BioSense – out of thousands.

Project structure: *Projects that are more highly structured than others stand a better chance of success.* It appears that the BioSense project still has relatively undefined, fluid, and constantly changing requirements and users who cannot agree on what they want. The BioSense project began in 2005. On May 3, 2006, the U.S. government issued an implementation plan for the project. It called for improved coordination among federal, state, and local authorities and the private sector for pandemics and other public health emergencies. However, it appears that the implementation plan was not coordinated with everyone who was supposed to participate. In 2007, the CDC decided to work with state and local public health care systems instead of competing with them. It has retreated to using BioSense in a limited form while simultaneously pursuing information-sharing measures with state health departments. The CDC will only encourage states to move their detailed data into a national repository instead of requiring it. The final design of the system is still unclear. The CDC is piloting different strategies to determine the best approach.

Experience with technology: *A project's risk rises if the project team and the information system staff lack the required technical expertise.* Each hospital must standardize patient and other medical data. CDC's contractors would have to work with each hospital to translate its data codes into the standards used by CDC's software. This is a massive task, given hospitals' limited IT staffs and resources.

2. What management, organization, and technology factors explain why this project has been difficult to implement?

Management: Apparently the intended users of the BioSense system – hospitals and state health organizations – were not part of the design and implementation planning activities. CDC management has since changed how it will encourage users to join the system. The final design of the system is still unclear. CDC management did not account for political changes the new system would cause.

Organization: Hospitals are reluctant to sign up for the new system because of concerns about maintaining privacy and security of patient information. The BioSense system would also let CDC "listen in" on patient treatments on a real-time basis. Physicians and health officials resent the system because it enables the federal government to encroach on what has traditionally been the domain of local health care providers and organizations.

Technology: Coding systems used by the BioSense project don't match coding systems used by hospitals and state health organizations. The data codes have to be translated into the standards used by the CDC's software.

3. Is the CDC's new approach to improving pandemic warnings a viable solution? Why or why not?

Student opinions will vary. However, they should include elements such as the opinion of Dr. John Rosenberg, director of the Infectious Disease Laboratory at the State of California's Department of Health Services in Richmond, CA – if an epidemic broke out, "You'd know it before the data rolled in. When your emergency rooms fill up you make a phone call; this is probably a better measure." On the other hand, the CDC is focusing on building an alert system to notify state and regional public health care officials electronically about pandemic outbreaks instead of relying on e-mail or the telephone.

Chapter 15

Managing Global Systems

After completing this chapter, students should be able to answer the following questions:

- What major factors are driving the internationalization of business?
- What are the alternative strategies for developing global businesses?
- How can information systems support different global business strategies?
- What are the challenges posed by global information systems and management solutions for these challenges?
- What are the issues and technical alternatives to be considered when developing international information systems?

Introduction

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 view.

15.1 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 might want to consider publishing it in four or five foreign languages. That's what it takes today to compete.

Developing an International Information Systems Architecture

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 your 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 using domestic stores as a model, that the company realized it was a much different world outside the U.S. Wal-Mart rearranged stores, stocked more items from within the countries, met local customers' needs, and dramatically increased sales.

So don't start creating all those juiced-up information systems as soon as you decide to pursue the foreign marketplace. Before you tackle the technology, you must:

1. Understand the global environment, including which **business driver** is most prominent
2. Determine the negative factors that create management challenges
3. Consider a corporate strategy
4. Consider the appropriate organizational structure
5. Know how you will implement your strategy
6. Consider the technology platform

Notice that the last issue you'll have to contend with is the technology. 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.

SELF CHECK QUESTION 15.1

List key technological considerations when deciding to go global?

(Answers at the end of this Section)

The Global Environment: Business Drivers and Challenges

Table 12 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 12: The Global Environment: Business Drivers and Challenges

GENERAL CULTURAL FACTORS	SPECIFIC BUSINESS FACTORS
Global communication and transportation technologies	Global markets
Development of global culture	Global production and operations
Emergence of global social norms	Global coordination
Political stability	Global workforce
Global knowledge base	Global economies of scale

Source: (Laudon and Laudon, 2010:583)

Perhaps the most important challenge facing corporations and companies wanting to open foreign markets is that of the **global culture**. We can more easily share cultures with other countries 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 is an important influence on how well the company does.

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. Toyota Motor Corporation has its domestic headquarters in Toyota City, Japan with manufacturing operations in 27 foreign countries and regions, including the U.S. Ask yourself this question: Who says all corporate offices must be located in the continental U.S.?

Countries that we traditionally have thought of as third world, or underdeveloped, are emerging as forces to be reckoned with. China, India, 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. Many companies are finding it more beneficial to locate manufacturing within the region where it sells its products. If the company experiences problems within a particular region, like floods or political strife, it can easily shift operations to another region.

Business Challenges

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 every country 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 without the person's prior consent. The individual must be notified first before the information can be collected and before the information can be given to another entity. If they do collect the information, there are very strict laws about how they must store it and who can access it.

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 merged information systems.

Globalism presents challenges and opportunities in areas of accounting systems, language, and currency usage. Some companies are deciding to adopt foreign systems than to continue using American systems.

> "In a regulatory sea change that could cost billions of dollars, thousands of U.S. companies — plus foreign corporations that do business here — will adopt global financial reporting rules within five years if regulators have their way. Whether U.S. companies like it or not, the new era of global accounting appears unstoppable, and businesses that ignore the International Financial Reporting Standards (IFRS) will fall behind.

SEC Chairman Christopher Cox has called the move "a revolutionary development" that will streamline global reporting standards and create "a true *lingua franca*" for accounting. Business leaders such as the U.S. Chamber of Commerce say it would help the USA compete in the world economy, leading to more cross-border commerce.

In an interview, Sir David Tweedie, chairman of the International Accounting Standards Board in London, says the growth of the global economy means "we must eventually end up with a common system of regulation, auditing and accounting."

Executives at Lenovo, the China-based technology giant that bought IBM's personal computer business in 2005, are big believers in IFRS.

Dennis Culin, Lenovo's director of business transformation, says there was healthy debate and "fear of the unknown" among some U.S.-based employees who favored U.S. accounting. But in the end, adopting IFRS was a no-brainer for a corporation doing business in 160 countries.

Now, Culin says, Lenovo is weaning itself from IBM's old "legacy" U.S. accounting system. So far, Lenovo has converted its operations in Asia and Canada to IFRS, and it's working now on Europe, then Latin America. If the USA moves to global rules, Lenovo will adapt quickly.

"We didn't want to declare ourselves a U.S. company or a Chinese company — we wanted to be a world company," Culin says. "So this version of accounting fits us." (UsaToday.com, *U.S. considers costly switch to international accounting rules*, Iwata, Edward, Jan 6, 2009)

State of the Art

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. Then think about how difficult it is to mesh a system built on 1990s technology with one that was built in the 1980s and one built in 2005.

So why do companies even attempt to build themselves into global merchants? Because the potential payoff is enormous!

? **THINK POINT**

What measures should be put in place should your organisation choose to pursue a global strategy.

15.2 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 13 shows the four main global strategies that can form the basis for a global organizational structure.

Table 13: Global Business Strategy

BUSINESS FUNCTION	DOMESTIC EXPORTER	MULTINATIONAL	FRANCHISER	TRANSNATIONAL
Production	Centralized	Dispersed	Coordinated	Coordinated
Finance/Accounting	Centralized	Centralized	Centralized	Coordinated
Sales/Marketing	Mixed	Dispersed	Coordinated	Coordinated
Human Resources	Centralized	Centralized	Coordinated	Coordinated
Strategic Management	Centralized	Centralized	Centralized	Coordinated

Source: (Laudon and Laudon, 2010:587)

Domestic exporter: Most operations are located in the domestic country and the company exports products to foreign companies. A company located in India that 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 are 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. Going back to our earlier example of Toyota, the company's headquarters may be in Japan but its operations are spread throughout the world. That's not just its manufacturing operations. Design facilities and research and development centers are located throughout the world. Because of advanced telecommunications, networks, and global information systems, transnational corporations can decentralize and disperse, or they can centralize and globally coordinate, whichever scenario best meets their needs.

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 48 : Global strategy and systems configurations.

SYSTEM CONFIGURATION	Strategy			
	Domestic Exporter	Multinational	Franchiser	Transnational
Centralized	X			
Duplicated			X	
Decentralized	x	X	x	
Networked		x		X

Source: (Laudon and Laudon, 2010:588)

Figure 48 gives you an idea of the type of information system that 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 branches.
- **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 and 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 coffee 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, a global chief information officer (CIO) position.* General Motors has one person who is responsible for an information system that spans the globe. While smaller units spread throughout the world actually carry out the operations, the CIO ensures total integration of all the local, regional, and global systems.

15.3 Managing Global Systems

Take all the problems and challenges you can think of when developing a single information system for a domestic operation (see the table) and then multiply it by tens or hundreds. Now you understand the problem of developing a system to support a global business operation.

Table 14: Management Challenges in Developing Global Systems

Agreeing on common user requirements
Introducing changes in business processes
Coordinating applications development
Coordinating software releases
Encouraging local users to support global systems.

Source: (Laudon and Laudon, 2010:588)

SELF CHECK QUESTION 15.2

Describe the challenges for management in a global company?

(Answers at the end of this Section)

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: 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.

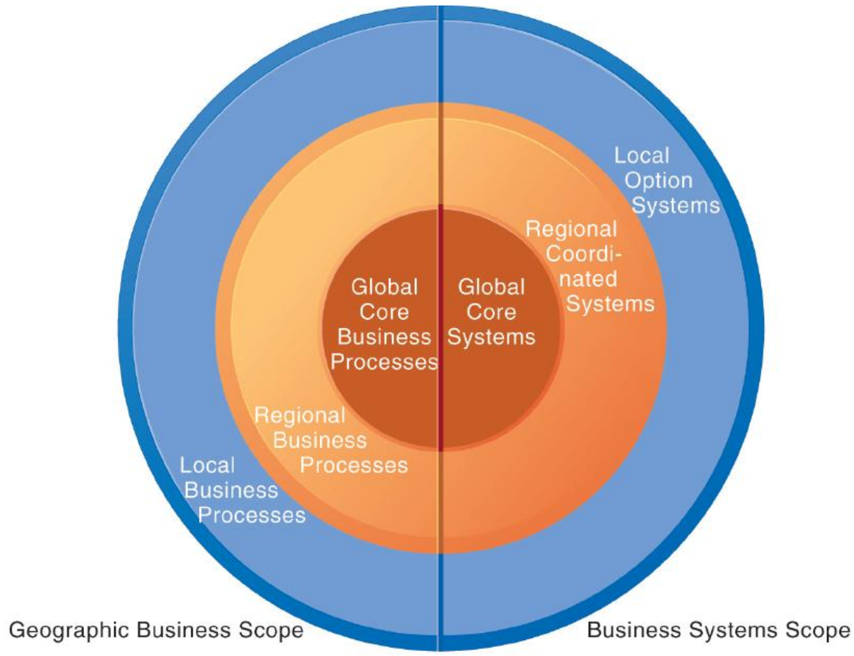
All 12 team members approach the project from different perspectives, different values, different needs, and different goals. Some like to start early and do a thorough job; others never start any assignment until the day it's due. Some team members have Apple computers, some have PCs; some have the most current software, others rely on programs created five years ago which are incompatible with today's software. All of you are very 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 for managers when they are organizing or reorganizing global commerce.

Global Systems Strategy

The figure 49 below 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.

Figure 49: The main dimensions of a solution to the coordination problem.



Source: (Laudon and Laudon, 2010:591)

Define the Core Business Processes

Decide how your business processes are divided among global, regional, and local units. Make sure you keep cultural and political biases out of the way when you're deciding which location is better. Carefully analyze each task and all available resources to support the process in each location. Decide which location best supports each process. You may be surprised to learn that it's cheaper and more efficient to store manufactured goods separately from where they are produced. Last, you should rank-order the processes and decide which will be managed centrally and which will be distributed to the regional and local level.

Identify the Core Systems to Coordinate Centrally

Once you've identified and analyzed each business process, you decide which systems will be centralized and which to keep decentralized. Obviously, the systems should match the business processes. 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.

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? What laws will affect your decision? 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 by 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.

This isn't the piecemeal approach to which the text refers. The piecemeal approach discussed in the text would be to move accounts receivable to the global system, then a year later move the accounts payable. Another example of an ill-advised piecemeal approach would be to leave the daily production planning processes on the old systems while transferring the production supply purchasing processes to a new system without proper coordination between the two.

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 South American 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 are tremendous. No longer does a company have to build individual production units in every country in which it wants to sell its products.

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 like they're getting blindsided. This is one area in which an intranet may prove to be an invaluable tool to help you get the word out.

Interactive Session: Management: Colgate-Palmolive Keeps the World Smiling (see p. 594 of the text) discusses how this global giant tackled the problem of managing IT projects spread throughout 200 countries. It developed a system that tracks who is working on what IT project and how much money is being spent. Most importantly, the new system enables the Colgate IT team to better align its priorities to business objectives.

- **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:** 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.

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.

15.4 Technology Issues and Opportunities for Global Value Chains

Advances in technology and the desire to seize new business opportunities presented by the advances are what induce organizations to undertake the changes we've been discussing. However, the same things that drive the desire can create the headaches.

Hardware, software and telecommunications are special problems in a global setting: you need to synchronize, harmonize, and integrate.

Computing Platforms 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 types 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 they 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 in Cincinnati, 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.

Table 15 shows some of the problems you’ll have to contend with when working in other countries.

Table 15: Management Challenges in Developing Global Systems

Quality of service
Security
Costs and tariffs
Network management
Installation delays
Poor quality of international service
Regulatory constraints
Network capacity

Source: (Laudon and Laudon, 2010:597)

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.

While the public Internet may not always be reliable and secure, the technologies upon which the Internet is built provide ways for corporations to build the networks they need. Intranets, extranets, and virtual private networks are two alternatives to using the wide-open Internet.

Many foreign countries are leap-frogging some of their past connectivity problems with brand-new technology such as Web-enabled cell phones. Instead of building expensive old-fashioned telecommunication systems with traditional phone lines, people are using wireless communication devices based on satellite and microwave technologies to communicate with each other. You may think of the United States as the “most wired” country in the world. You would be wrong! Finland has far greater penetration in this area per capita than any other country in the world, but it’s based on wireless technology not traditional telephone lines.
And Japan has a greater saturation of Web-enabled cell phones and associated applications than America.

Software Localization

We mentioned before that different foreign units probably have divergent standards for their information systems. Trying to merge different 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, that 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 levels 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? You may have to adopt **software localization** policies to convert your applications to a second language.

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 a new advertising campaign all day Tuesday. When she's done for the day, she may electronically send the project 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.

CASE STUDY

Read the Cell Phones Case Study on Page 599 of the text book and answer the questions that follow

(*Answers at the end of this Section*)

SUGGESTED ANSWERS TO SELF-CHECK QUESTIONS

15.1 List key technological considerations when deciding to go global?

- Understand the global environment, including which **business driver** is most prominent
- Determine the negative factors that create management challenges
- Consider a corporate strategy
- Consider the appropriate organizational structure
- Know how you will implement your strategy
- Consider the technology platform

15.2 Describe the challenges for management in a global company?

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 is easier to implement. Do not 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 are more likely to succeed. Give other people some ownership of the change process, and they will be more than happy to help you and the company succeed.
- **Coordinate applications development:** Communicate, communicate, communicate. Tell people what's going on; do not surprise them about anything. Change is difficult enough without people feeling like they are getting blindsided. This is one area in which an Intranet may prove to be an invaluable tool to help you get the word out.
- **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 is 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.

ANSWERS - CASE STUDY

1. What strategies are cell phone companies using to close the digital divide and market phones to the poorest segment of the world's population?

Cellular phone companies use 'human-behavior researchers' or 'user anthropologists' to gather information about consumer habits and the lives of potential cell phone buyers. Cell phone designers and technology architects use the information in a process called 'human-centered design.' Products that people find appealing and easy to use are built around these design principles. That increases the likelihood that people in poorer countries will buy the phones. Phone companies must overcome barriers such as the lack of electricity, low incomes, and lack of service in non-urban areas. Apparently the phone companies are succeeding in overcoming these problems based on these statistics: It took 20 years for the first billion phones to sell, four years for the second billion, and only two years for the third billion. Eighty percent of the world's population lives within range of a cellular network, double the level in 2000.

2. Why do economists predict that widespread cell phone usage in developing countries would have an unprecedented effect on the growth of those countries?

Cell phones are becoming useful business tools in poorer countries by allowing people to more easily identify and take advantage of business opportunities. Cell phones increase profits on an individual level. Every additional 10 cell phones per 100 people per country, adds 0.5 percent to that country's gross domestic product. Here are a few creative ways people are using cell phones to develop new business opportunities:

- Phone ladies in Bangladesh charge small commissions for fellow villagers to make and receive calls
- Ugandans use prepaid air time as an intermediary to transfer currency
- People in West African countries trade a variety of projects using cell phone text messaging to communicate
- Fishermen off the coast of Kerala use cell phones to contact prospective buyers

3. What are some examples of how cell phones might increase quality of life for residents of developing countries?

Even the poorest families dedicate a significant portion of their small budgets to communication technologies for these reasons:

- People remain reachable even though they are constantly on the move due to war, drought, natural disasters, or extreme poverty

- Patients can more easily reach doctors, and doctors can more easily acquire information pertaining to diseases and ailments they may need to treat
- Cell phones enable people to more easily identify and take advantage of business opportunities thereby increasing their standard of living

4. Do you believe that cell phones will proliferate widely through Africa and Asia? Why or why not?

Cell phone will probably continue to proliferate throughout Africa and Asia in spite of the lack of electricity, low incomes, and lack of service. Cell phone companies will continue to solve technologically-related problems while people will continue to find ways to afford cell phones. Cell phones combine features of watches, alarm clocks, cameras and video cameras, stereos, televisions, and wallets. They are growing in usefulness even as they decrease in price. They are cheaper and easier to use than computers when accessing the Internet. Access to the Internet via cell phones also promises to bring about societal and political change in developing countries in which repressive governments exert control over all forms of media.