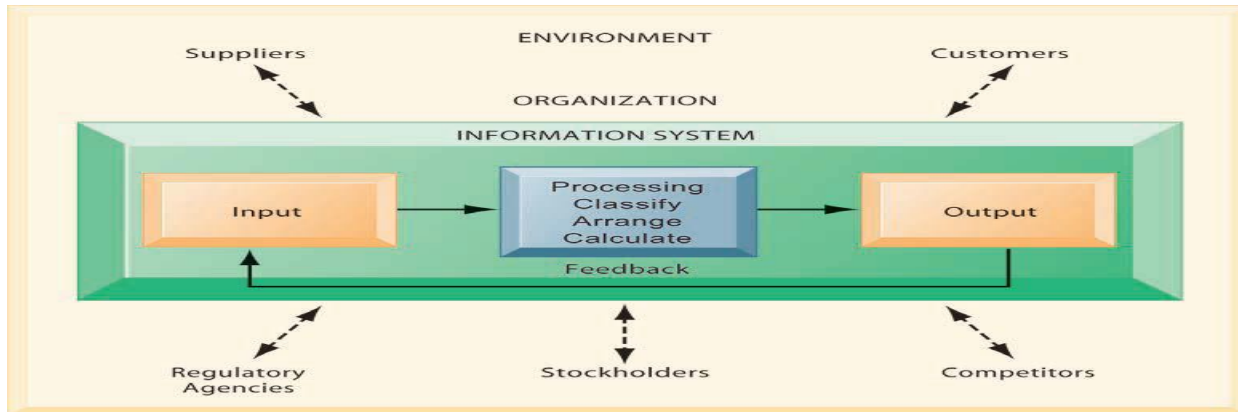**Branch: information system**

Management information system

2023-2024

Introduction

*An information system contains information about an organization and its surrounding environment.
Three basic activities—input, processing, and output—produce the information organizations need. Feedback is output returned to appropriate people or activities in the organization to evaluate and refine the input. Environmental actors, such as customers, suppliers, competitors, stockholders, and regulatory agencies, interact with the organization and its information systems.

DIMENSIONS OF INFORMATION SYSTEMS
To fully understand information systems, you must understand the broader organization, management, and information technology dimensions of systems (see Figure 1.5) and their power to provide solutions to challenges and problems in the business environment.
We refer to this broader understanding of information systems, which encompasses an understanding of the management and organizational dimensions of systems as well as the technical dimensions of systems, as **information systems literacy**.
Computer literacy, in contrast, focuses primarily on knowledge of information technology.
 **management information systems (MIS)** tries to achieve this broader information systems literacy. 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.

Organizations
Information systems are an integral part of organizations. Indeed, for some companies, such as credit reporting firms, there would be no business without an information system. The key elements of an organization are its people, structure, business processes, politics, and culture.

Organizations have a structure that is composed of different levels and specialties. Their structures reveal a clear-cut division of labor. Authority and responsibility in a business firm are organized as a hierarchy, or a pyramid structure. The upper levels of the hierarchy consist of managerial, professional, and technical employees, whereas the lower levels consist of operational personnel.
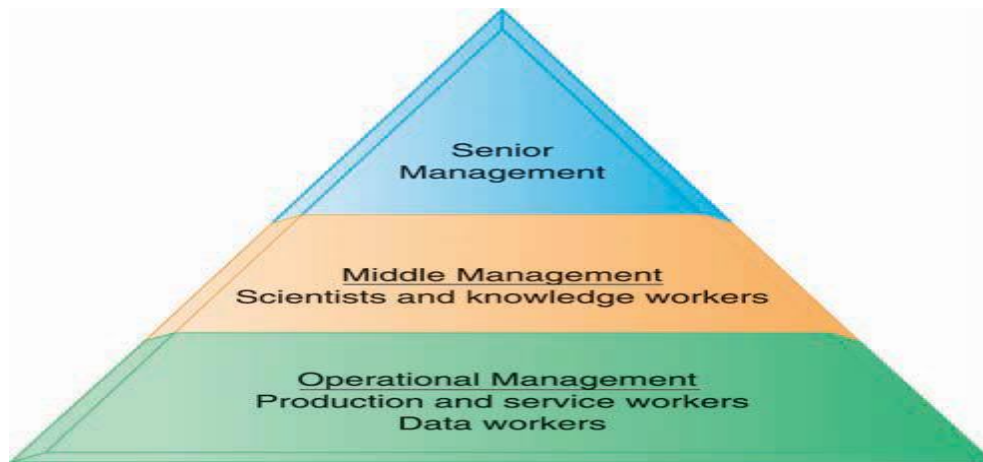
Senior management makes long-range strategic decisions about products and services as well as ensures financial performance of the firm.

Middle management carries out the programs and plans of senior management, and **operational management** is responsible for monitoring the daily activitiesof the business. **Knowledge workers**, such as engineers, scientists, or architects, design products or services and create new knowledge for the firm,whereas

data workers, such as secretaries or clerks, assist with scheduling and communications at all levels of the firm.

Production or service workers

actually produce the product and deliver the service (see Figure 1.6). Experts are employed and trained for different business functions. The major **business functions**, or specialized tasks performed by business organizations, consist of sales and marketing, manufacturing and production, finance and accounting, and human resources (see Table 1.2).

T A B L E 1 . 2 M A J O R B U S I N E S S F U N C T I O N S

FUNCTION	PURPOSE
Sales and marketing	Selling the organization's products and services
Manufacturing and production	Producing and delivering products and services
Finance and accounting	Managing the organization's financial assets and maintaining the organization's financial records
Human resources	Attracting, developing, and maintaining the organization's labor force; maintaining employee records

An organization coordinates work through its hierarchy and through its business processes, which are logically related tasks and behaviors for accomplishing work. Developing a new product, fulfilling an order, and hiring a new employee are examples of business processes.

Most organizations' business processes include formal rules that have been developed over a long time for accomplishing tasks. These rules guide employees in a variety of procedures, from writing an invoice to

responding to customer complaints. Some of these business processes have been written down, but others are informal work practices, such as a requirement to return telephone calls from coworkers or customers, that are not formally documented.

Information systems automate many business processes. For instance, how a customer receives credit or how a customer is billed is often determined by an information system that incorporates a set of formal business processes.

Each organization has a unique **culture**, or fundamental set of assumptions, values, and ways of doing things, that has been accepted by most of its members.

You can see organizational culture at work by looking around your university or college. Some bedrock assumptions of university life are that professors know more than students, the reasons students attend college is to learn, and that classes follow a regular schedule.

Parts of an organization's culture can always be found embedded in its information systems. For instance, UPS's first priority is customer service, which is an aspect of its organizational culture that can be found in the company's package tracking systems,

Management

Management's job is to make sense out of the many situations faced by organizations, make decisions, and formulate action plans to solve organizational problems. Managers perceive business challenges in the environment; they set the organizational strategy for responding to those challenges; and they allocate the human and financial resources to coordinate the work and achieve success. Throughout, they must exercise responsible leadership.

Managers must also create new products and services and even re-create the organization from time to time. A substantial part of management responsibility is creative work driven by new knowledge and information. Information technology can play a powerful role in helping managers design and deliver new products and services and redirecting and redesigning their organizations.

Information Technology

Information technology is one of many tools managers use to cope with change.

Computer hardware is the physical equipment used for input, processing, and output activities in an information system. It consists of the following: computers of various sizes and shapes (including mobile handheld devices); various input, output, and storage devices; and telecommunications devices that link
computers together.

Computer software consists of the detailed, preprogrammed instructions that control and coordinate the computer hardware components in an information System .

Data management technology consists of the software governing the organization of data on physical storage media.

Networking and telecommunications technology, consisting of both physical devices and software, links the various pieces of hardware and transfers data from one physical location to another. Computers and communications equipment can be connected in networks for sharing voice, data, images, sound, and video.

A **network** links two or more computers to share data or resources, such as a printer.

The world's largest and most widely used network is the **Internet**. The Internet is a global "network of networks" that uses universal standards to connect millions of different networks with nearly 2.3 billion users in over 230 countries around the world.

Information technology (IT) infrastructure. All of these technologies, along with the people required to run and manage them, represent resources that can be shared throughout the organization and constitute the firm's
The IT infrastructure provides the foundation, or *platform*, on which the firm can build its specific information systems. Each organization must carefully design and manage its IT infrastructure so that it has the set of technology services it needs for the work it wants to accomplish with information systems.

component of information technology infrastructure and show how they all work together to create the technology platform for the organization.

THE ROLE OF INFORMATION SYSTEMS IN BUSINESS TODAY

Information technology capital investment, defined as hardware, software, and communications equipment, grew from 32 percent to 52 percent of all invested capital between 1980 and 2011.
Management consulting and services—much of which involves redesigning firms' business operations to take advantage of these new technologies.
As managers, most of you will work for firms that are intensively using information systems and making large investments in information technology.
You will certainly want to know how to invest this money wisely. If you make wise choices, your firm can outperform competitors. If you make poor choices, you will be wasting valuable capital.

HOW INFORMATION SYSTEMS ARE TRANSFORMING BUSINESS
More wireless cell phone accounts were opened in 2012 than telephone landlines installed.
Smartphones, texting, e-mail, and online conferencing have all become essential tools of business. One hundred twenty-two million people in the United States access the Internet using mobile devices in 2012, which is half of the total Internet user population

More and more business computing is moving from PCs and desktop machines to these mobile devices. Managers are increasingly using these devices to coordinate work, communicate with employees, and provide information for decision making. We call these developments the "emerging mobile digital platform."

WHAT'S NEW IN MANAGEMENT INFORMATION SYSTEMS?
Lots! What makes management information systems the most exciting topic in business is the continual change in technology, management use of the technology, and the impact on business success.
New businesses and industries appear, old ones decline, and successful firms are those that learn how to use the new technologies.

There are three interrelated changes in the technology area:
(1) the emerging mobile digital platform,
(2) the growing business use of "big data,"and
(3) the growth in "cloud computing," where more and more business software runs over the Internet. IPhones, iPads, BlackBerrys, and Android tablets and smartphones are not just gadgets or entertainment outlets. They represent new emerging computing platforms based on an array of new hardware and software technologies.

TABLE 1.1 WHAT'S NEW IN MIS

CHANGE	BUSINESS IMPACT
TECHNOLOGY	
Cloud computing platform emerges as a major business area of innovation	A flexible collection of computers on the Internet begins to perform tasks traditionally performed on corporate computers. Major business applications are delivered online as an Internet service (Software as a Service, or SaaS).
Big data	Businesses look for insights from huge volumes of data from Web traffic, e-mail messages, social media content, and machines (sensors) that require new data management tools to capture, store, and analyze.
A mobile digital platform emerges to compete with the PC as a business system	The Apple iPhone and Android mobile devices are able to download hundreds of thousands of applications to support collaboration, location-based services, and communication with colleagues. Small tablet computers, including the iPad, Google Nexus, and Kindle Fire, challenge conventional laptops as platforms for consumer and corporate computing.
MANAGEMENT	
Managers adopt online collaboration and social networking software to improve coordination, collaboration, and knowledge sharing	Google Apps, Google Sites, Microsoft Windows SharePoint Services, and IBM Lotus Connections are used by over 100 million business professionals worldwide to support blogs, project management, online meetings, personal profiles, social bookmarks, and online communities.
Business intelligence applications accelerate	More powerful data analytics and interactive dashboards provide real-time performance information to managers to enhance decision making.
Virtual meetings proliferate	Managers adopt telepresence videoconferencing and Web conferencing technologies to reduce travel time, and cost, while improving collaboration and decision making.
ORGANIZATIONS	
Social business	Businesses use social networking platforms, including Facebook, Twitter, and internal corporate social tools, to deepen interactions with employees, customers, and suppliers. Employees use blogs, wikis, e-mail texting, and messaging to interact in online communities.
Telework gains momentum in the workplace	The Internet, wireless laptops, smartphones, and tablet computers make it possible for growing numbers of people to work away from the traditional office. Fifty-five percent of U.S. businesses have some form of remote work program.
Co-creation of business value	Sources of business value shift from products to solutions and experiences, and from internal sources to networks of suppliers and collaboration with customers. Supply chains and product development become more global and collaborative; customer interactions help firms define new products and services.

How are information systems transforming business, and what is their relationship to globalization?
E-mail, online conferencing, smartphones, and tablet computers have become essential tools for conducting business. Information systems are the foundation of fast-paced supply chains. The Internet allows many businesses to buy, sell, advertise, and solicit customer feedback online. Organizations are trying to become more competitive and efficient by digitally enabling their core business processes and evolving into digital firms. The Internet has stimulated globalization by dramatically reducing the costs of producing, buying, and selling goods on a global scale. New information system trends include the emerging mobile digital platform, online software as a service, and cloud computing.

Why are information systems so essential for running and managing a business today?
Information systems are a foundation for conducting business today. In many industries, survival and the ability to achieve strategic business goals are difficult without extensive use of information technology. Businesses today use information systems to achieve six major objectives: operational excellence; new products, services,

and business models; customer/supplier intimacy; improved decision making; competitive advantage; and day-to-day survival.

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. This includes not only computer machines, storage devices, and handheld mobile devices, but also software, such as the Windows or Linux operating systems, the Microsoft Office desktop productivity suite, and the many thousands of computer programs that can be found in a typical large firm.

"Information systems" are more complex and can be best be understood by looking at them from both a technology and a business perspective.

WHAT IS AN INFORMATION SYSTEM?

An **information system** can be defined technically as a set of interrelated components that collect (or retrieve), process, store, and distribute information to support decision making and control in an organization. In addition to supporting decision making, coordination, and control, information systems may also help managers and workers analyze problems, visualize complex subjects, and create new products.

Information systems contain information about significant people, places, and things within the organization or in the environment surrounding it.

By **information** we mean data that have been shaped into a form that is meaningful and useful to human beings. **Data**, in contrast, are streams of raw facts representing events occurring in organizations or the physical environment before they have been organized and arranged into a form that people can understand and use.

A brief example contrasting information and data may prove useful.
Supermarket checkout counters scan millions of pieces of data from bar codes, which describe each product. Such pieces of data can be totaled and analyzed to provide meaningful information, such as the total number of bottles of dish detergent sold at a particular store, which brands of dish detergent were selling the most rapidly at that store or sales territory, or the total amount spent on that brand of dish detergent at that store or sales region (see Figure 1.3).
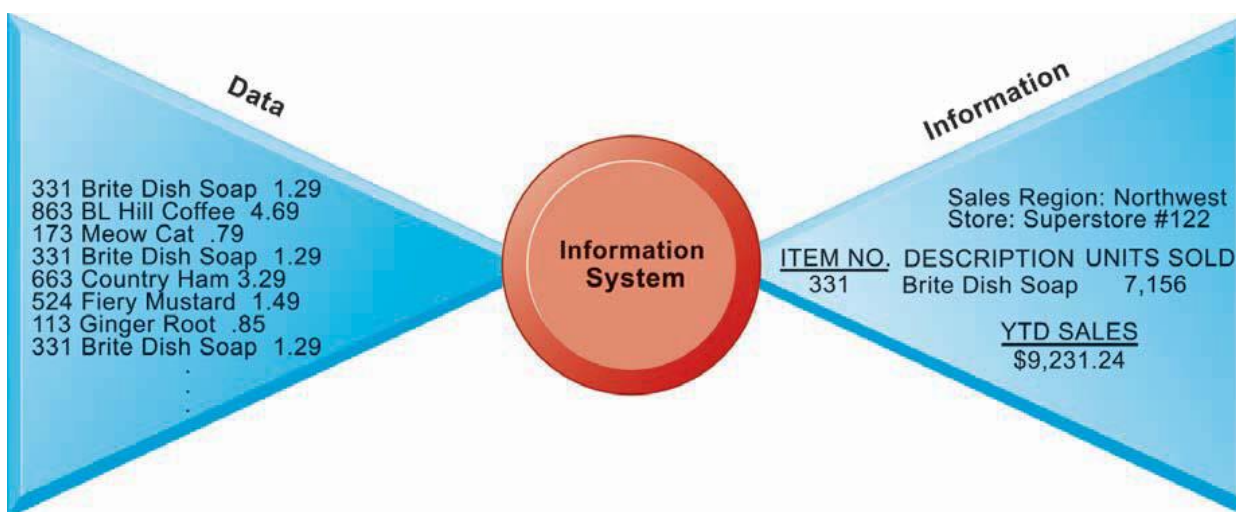
- Raw data from a supermarket checkout counter can be processed and organized to produce meaningful information, such as the total unit sales of dish detergent or the total sales revenue from dish detergent for a specific store or sales territory.

Three activities in an information system produce the information that organizations need to make decisions, control operations, analyze problems, and create new products or services. These activities are input, processing, and output (see Figure 1.4).

Input captures or collects raw data from within the organization or from its external environment.

Processing converts this raw input into a meaningful form.

Output transfers the processed information to the people who will use it or to the activities for which it will be used.

Information systems also require **feedback**, which is output that is returned to appropriate members of the organization to help them evaluate or correct the input stage.

For example, in Disney World's systems for controlling crowds, the raw input consists of data from airline bookings and hotel reservations, satellite weather data, historic attendance data for the date being analyzed, and images of crowds from video cameras stationed at key locations throughout the park.

Example:

Computers store these data and process them to calculate projected total attendance for a specific date as well as attendance figures and wait times for each ride and restaurant at various times during the day. The systems indicate which rides or attractions are too overcrowded, which have spare capacity, and which can add capacity. The system provides meaningful information such as the number of guests attending on a particular day or time period, the average wait time per ride, the average number of restaurant and shop visits, the average number of rides guests squeezed into a single day's visit, and the average amount spent per customer during a specific time period. Such information helps Disney management gauge the theme park's overall efficiency and profitability. Although computer-based information systems use computer technology to process raw data into meaningful information, there is a sharp distinction between a computer and a computer program on the one hand, and an information system on the other.

Electronic computers and related software programs are the technical foundation, the tools and materials, of modern information systems. Computers provide the equipment for storing and

processing information. Computer programs, or software, are sets of operating instructions that direct and control computer processing.

Knowing how computers and computer programs work is important in designing solutions to organizational problems, but computers are only part of an information system.

Computers and programs are the hammers, nails, and lumber of computer-based information systems, but alone they cannot produce the information a particular organization needs. To understand information systems

CONTEMPORARY APPROACHES TO INFORMATION SYSTEMS

Figure 1.9 illustrates the major disciplines that contribute problems, issues, and solutions in the study of information systems.

TECHNICAL APPROACH

The technical approach to information systems emphasizes mathematically based models to study information systems, as well as the physical technology and formal capabilities of these systems.

Computer science is concerned with establishing theories of computability, methods of computation, and methods of efficient data storage and access.

Management science emphasizes the development of models for decision-making and management practices.

Operations research focuses on mathematical techniques for optimizing selected parameters of organizations, such as transportation, inventory control, and transaction costs.

BEHAVIORAL APPROACH

An important part of the information systems field is concerned with behavioral issues that arise in the development and long-term maintenance of information systems.

 sociologists study information systems with an eye toward how groups and organizations shape the development of systems and also how systems affect individuals, groups, and organizations.

Psychologists study information systems with an interest in how human decision makers perceive and use formal information.

Economists study information systems with an interest in understanding the production of digital goods, the dynamics of digital markets, and how new information systems change the control and cost structures within the firm.

The behavioral approach concentrates on changes in attitudes, management and organizational policy, and behavior.

SOCIOTECHNICAL SYSTEMS

Throughout our lectures there is four main actors:

suppliers of hardware and software (the technologists);

business firms making investments and seeking to obtain value from the technology;

managers and employees seeking to achieve business value (and other goals); and

the contemporary legal, social, and cultural context (the firm's environment).

Together these actors produce what we call *management information systems*.

The study of management information systems (MIS) arose to focus on the use of computer-based information systems in business firms and government agencies.
MIS combines the work of computer science, management science, and operations research with a practical orientation toward developing system solutions to real-world problems and managing information technology resources.
It is also concerned with behavioral issues surrounding the development, use, and impact of information systems, which are typically discussed in the fields of sociology, economics, and psychology.

Note
From experience no single approach effectively captures the reality of information systems. The successes and failures of information are rarely all technical or all behavioral.

Adopting a sociotechnical systems perspective helps to avoid a purely technological approach to information systems. For instance, the fact that information technology is rapidly declining in cost and growing in power does not necessarily or easily translate into productivity enhancement or bottom-line profits. The fact that a firm has recently installed an enterprise-wide financial reporting system does not necessarily mean that it will be used, or used effectively. Likewise, the fact that a firm has recently introduced new business procedures and processes does not necessarily mean employees will be more productive in the absence of investments in new information systems to enable those processes.

Both the technical and behavioral components need attention. This means that technology must be changed and designed in such a way as to fit organizational and individual needs. Sometimes, the technology may have to be "de-optimized" to accomplish this fit. For instance, mobile phone users adapt this technology to their personal needs, and as a result manufacturers quickly seek to adjust the technology to conform with user expectations.
Organizations and individuals must also be changed through training, learning, and planned organizational change to allow the technology to operate and prosper.

Figure 1.10 illustrates this process of mutual adjustment in a sociotechnical system.
In a sociotechnical perspective, the performance of a system is optimized when both the technology and the organization mutually adjust to one another until a satisfactory fit is obtained.
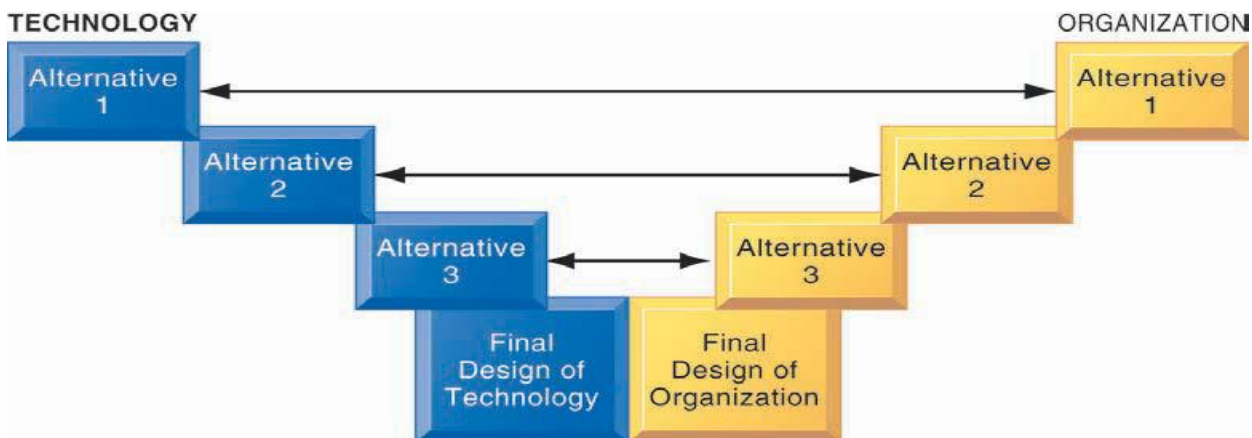
BUSINESS PROCESSES AND INFORMATION SYSTEMS

In order to operate, businesses must deal with many different pieces of information about suppliers, customers, employees, invoices, and payments, and of course their products and services.

They must organize work activities that use this information to operate efficiently and enhance the overall performance of the firm. Information systems make it possible for firms to manage all their information, make better decisions, and improve the execution of their business processes.

BUSINESS PROCESSES

Business processes,   refer to the manner in which work is organized, coordinated, and focused to produce a valuable product or service.

Business processes are the collection of activities required to produce a product or service. These activities are supported by flows of material, information, and knowledge among the participants in business processes.

Business processes also refer to the unique ways in which organizations coordinate work, information, and knowledge, and the ways in which management chooses to coordinate work.

To a large extent, the performance of a business firm depends on how well its business processes are designed and coordinated.

A company's business processes can be a source of competitive strength if they enable the company to innovate or to execute better than its rivals.

Business processes can also be liabilities if they are based on outdated ways of working that impede organizational responsiveness and efficiency.

The chapter-opening case describing TELUS's improvements in employee learning processes clearly illustrates these points, as do many of the other cases in this text.

Every business can be seen as a collection of business processes, some of which are part of larger encompassing processes. For instance, uses of mentoring, wikis, blogs, and videos are all part of the overall knowledge management process.

Many business processes are tied to a specific functional area. For example, the sales and marketing function is responsible for identifying customers, and the human resources function is responsible for hiring employees. Table 2.1 describes some typical business processes for each of the functional areas of business.

TABLE 2.1 EXAMPLES OF FUNCTIONAL 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

Other business processes cross many different functional areas and require coordination across departments. For instance, consider the seemingly simple business process of fulfilling a customer order (see Figure 2.1). Initially, the sales department receives a sales order. The order passes first to accounting to ensure the customer can pay for the order either by a credit verification or request for immediate payment prior to shipping. Once the customer credit is established, the production department pulls the product from inventory or produces the product. Then the product is shipped (and this may require working with a logistics firm, such as UPS or FedEx). A bill or invoice is generated by the accounting department, and a notice is sent to the customer indicating that the product has shipped. The sales department is notified of the shipment and prepares to support the customer by answering calls or fulfilling warranty claims.

FIGURE 2.1   THE ORDER FULFILLMENT PROCESS
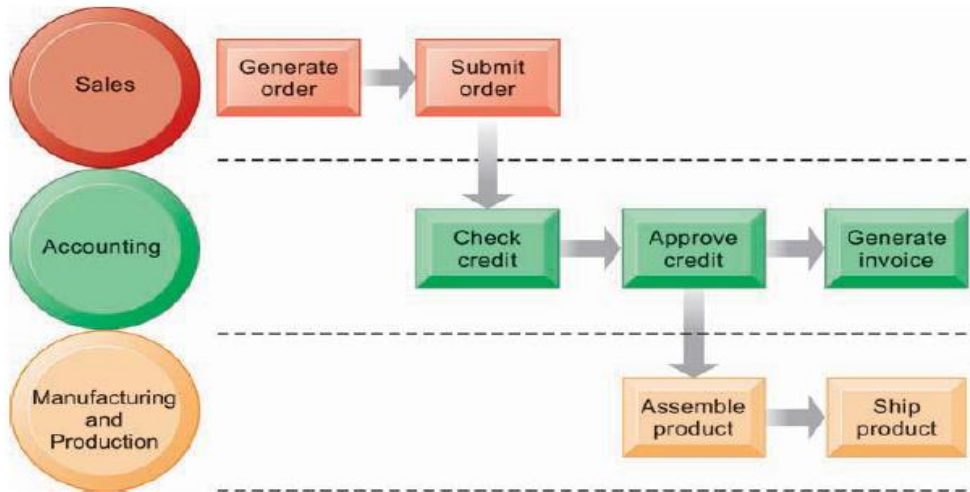
Fulfilling a customer order involves a complex set of steps that requires the close coordination of the sales, accounting, and manufacturing functions.

What at first appears to be a simple process, fulfilling an order, turns out to be a very complicated series of business processes that require the close coordination of major functional groups in a firm. Moreover, to efficiently perform all these steps in the order fulfillment process requires a great deal of information. The required information must flow rapidly both within the firm from one decision maker to another; with business partners, such as delivery firms; and with the customer. Computer-based information systems make this possible.

HOW INFORMATION TECHNOLOGY IMPROVES BUSINESS PROCESSES

Exactly how do information systems improve business processes?

Information systems automate many steps in business processes that were formerly performed manually, such as checking a client's credit, or generating an invoiceand shipping order.
 But today, information technology can do much more. New technology can actually change the flow of information, making it possible for many more people to access and share information, replacing sequential steps with tasks that can be performed simultaneously, and eliminating delays in decision making. New information technology frequently changes the way a business works and supports entirely new business models. Downloading a Kindle e-book from Amazon, buying a computer online at Best Buy, and downloading a music track from iTunes are entirely new business processes based on new business models that would be inconceivable without today's information technology.

By analyzing business processes, you can achieve a very clear understanding of how a business actually works. Moreover, by conducting a business process analysis, you will also begin to understand how to change the business by improving its processes to make it more efficient or effective.

NOTE: we will examine business processes with a view to understanding how they might be improved by using information technology to achieve greater efficiency, innovation, and customer service.

TYPES OF INFORMATION SYSTEMS

Now that you understand business processes, it is time to look more closely at how information systems support the business processes of a firm. Because there are different interests, specialties, and levels in an organization, there are different kinds of systems. No single system can provide all the information an organization needs.

A typical business organization has systems supporting processes for each of the major business functions sales and marketing, manufacturing and production, finance and accounting, and human resources.
Functional systems that operate independently of each other are becoming a thing of the past because they cannot easily share information to support cross-functional business processes. Many have been replaced with large-scale cross-functional systems that integrate the activities of related
business processes and organizational units.

A typical firm also has different systems supporting the decision-making needs of each of the main management groups.
Operational management, middle management, and senior management each use systems to support the decisions they must make to run the company. Let's look at these systems and the types of decisions they support.

SYSTEMS FOR DIFFERENT MANAGEMENT GROUPS

A business firm has systems to support different groups or levels of management. These systems include transaction processing systems and systems for business intelligence.

Transaction Processing Systems

Operational managers need systems that keep track of the elementary activities and transactions of the organization, such as sales, receipts, cash deposits, payroll, credit decisions, and the flow of materials in a factory. **Transaction processing systems (TPS)** provide this kind of information. A transaction processing system is a computerized system that performs and records the daily routine transactions necessary to conduct business, such as sales order entry, hotel reservations, payroll, employee record keeping, and shipping.
The principal purpose of systems at this level is to answer routine questions and to track the flow of transactions through the organization. How many parts are in inventory? What happened to Mr. Smith's payment? To answer these kinds of questions, information generally must be easily available, current, and accurate.
At the operational level, tasks, resources, and goals are predefined and highly structured. The decision to grant credit to a customer, for instance, is made by a lower-level supervisor according to predefined criteria. All that must be determined is whether the customer meets the criteria.

Figure 2.2 illustrates a TPS for payroll processing. A payroll system keeps track of money paid to employees. An employee time sheet with the employee's name, social security number, and number of hours worked per week represents a single transaction for this system. Once this transaction is input into the system, it updates the system's master file that permanently maintains employee information for the organization. The data in the system are combined in different ways to create reports of interest to management and government agencies and to send paychecks to employees.

Managers need TPS to monitor the status of internal operations and the firm's relations with the external environment.

TPS are also major producers of information for the other systems and business functions. For example, the payroll system illustrated in Figure 2.2, along with other accounting TPS, supplies data to the company's general ledger system, which is responsible for maintaining records of the firm's income and expenses and for producing reports such as income statements and balance sheets. It also supplies employee payment history data for insurance, pension, and other benefits calculations to the firm's human resources function, and employee payment data to government agencies such as the U.S. Internal Revenue Service and Social Security Administration. Transaction processing systems are often so central to a business that TPS failure for a few hours can lead to a firm's demise and perhaps that of other firms linked to it. Imagine what would happen to UPS if its package tracking system were not working! What would the airlines do without their computerized reservation systems?

The Interactive Session on Technology describes the impact on airline travel when automated baggage handling systems are not working properly. As you read this case, try to identify the transactions being processed and how the data generated from these systems impact business performance.
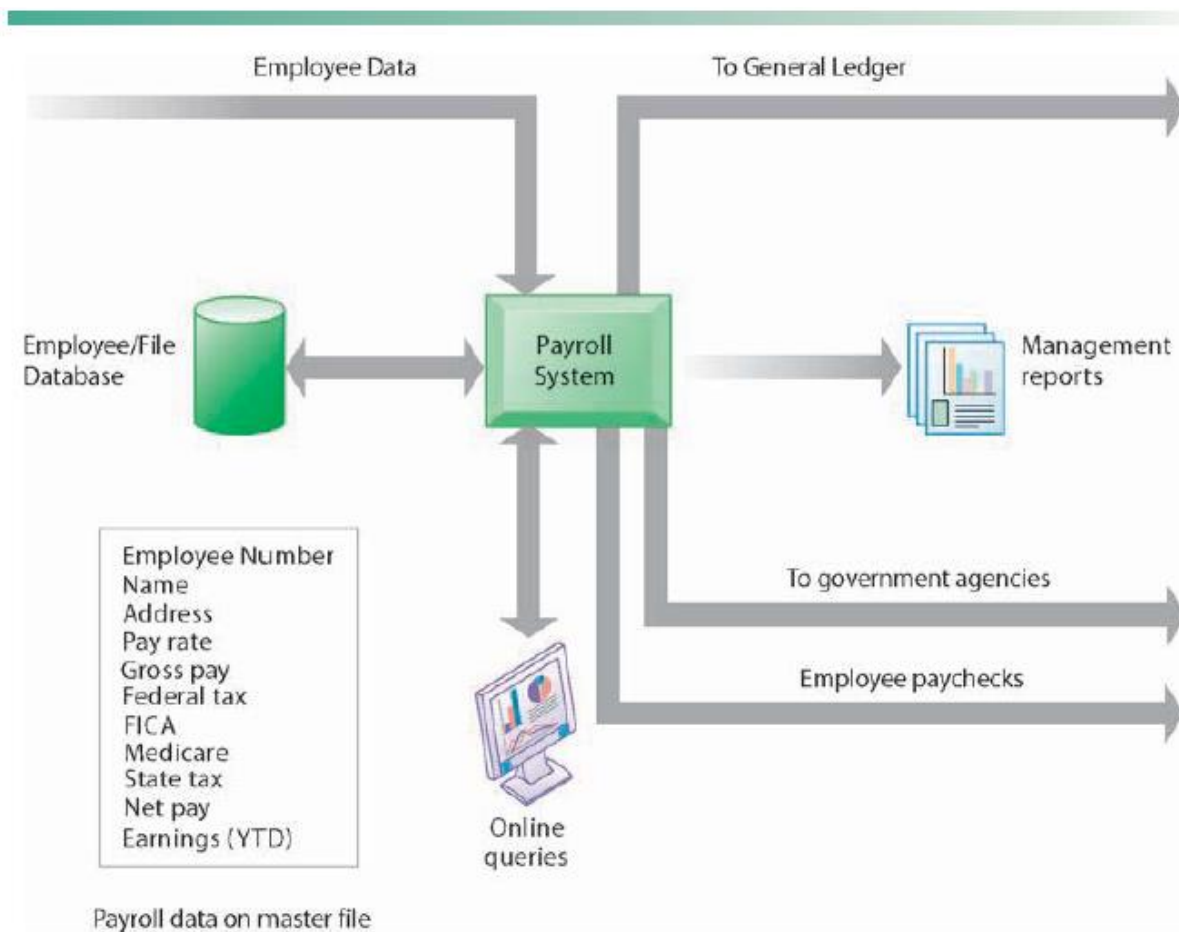
A TPS for payroll processing captures employee payment transaction data (such as a time card).
System outputs include online and hard-copy reports for management and employee paychecks.

Systems for Business Intelligence
Firms also have business intelligence systems that focus on delivering information to support management decision making.

Business intelligence
is a contemporary term for data and software tools for organizing, analyzing, and providing access to data to help managers and other enterprise users make more informed decisions. Business intelligence addresses the decision-making needs of all levels of management.

Business intelligence systems for middle management help with monitoring, controlling, decision-making, and administrative activities.

Management information systems (MIS)
- provide middle managers with reports on the organization's current performance. This information is used to monitor and control the business and predict future performance.
- MIS summarize and report on the company's basic operations using data supplied by transaction processing systems. The basic transaction data from TPS are compressed and usually presented in reports that are produced on a regular schedule.
- MIS typically provide answers to routine questions that have been specified in advance and have a predefined procedure for answering them.
- Most MIS use simple routines, such as summaries and comparisons, as opposed to sophisticated mathematical models or statistical techniques. Other types of business intelligence systems support more non-routine decision making.

Figure 2.3 shows how a typical MIS transforms transaction-level data from inventory, production , and accounting into MIS files that are used to provide managers with reports. Figure 2.4 shows a sample report from this system.

For instance, MIS reports might list the total pounds of lettuce used this quarter by a fast-food chain or, as illustrated in Figure 2.4, compare total annual sales figures for specific products to planned targets. These systems generally are not flexible and have little analytical capability.

FIGURE 2.3 HOW MANAGEMENT INFORMATION SYSTEMS OBTAIN THEIR DATA FROM THE ORGANIZATION'S TPS
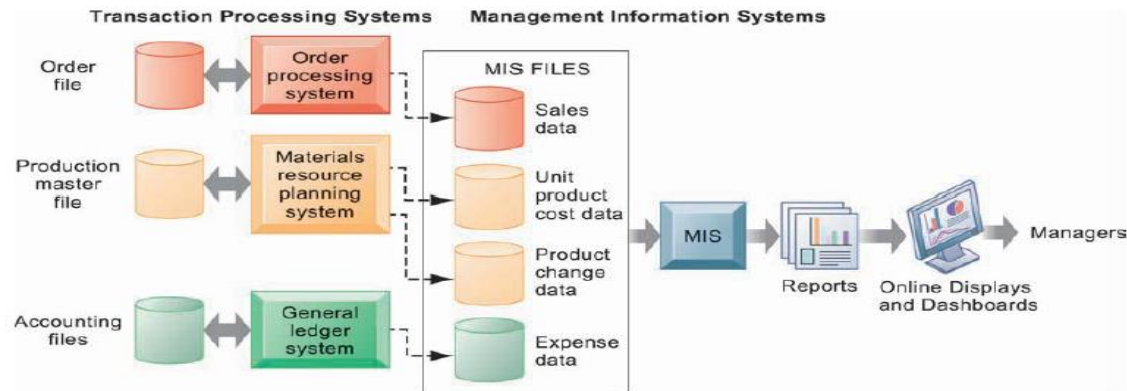
In the system illustrated by this diagram, three TPS supply summarized transaction data to the MIS reporting system at the end of the time period. Managers gain access to the organizational data through the MIS, which provides them with the appropriate reports.

FIGURE 2.4 SAMPLE MIS REPORT

Consolidated Consumer Products Corporation Sales by Product and Sales Region: 2013

PRODUCT CODE	PRODUCT DESCRIPTION	SALES REGION	ACTUAL SALES	PLANNED	ACTUAL versus PLANNED
4469	Carpet Cleaner	Northeast	4,066,700	4,800,000	0.85
		South	3,778,112	3,750,000	1.01
		Midwest	4,867,001	4,600,000	1.06
		West	4,003,440	4,400,000	0.91
	TOTAL		16,715,253	17,550,000	0.95
5674	Room Freshener	Northeast	3,676,700	3,900,000	0.94
		South	5,608,112	4,700,000	1.19
		Midwest	4,711,001	4,200,000	1.12
		West	4,563,440	4,900,000	0.93
	TOTAL		18,559,253	17,700,000	1.05

This report, showing summarized annual sales data, was produced by the MIS in Figure 2.3.

Decision-support systems (DSS)
- focus on problems that are unique and rapidly changing, for which the procedure for arriving at a solution may not be fully predefined in advance.
- They try to answer questions such as these: What would be the impact on production schedules if we were to double sales in the month of December? What would happen to our return on investment if a factory schedule were delayed for six months?
- DSS use internal information from TPS and MIS, they often bring in information from external sources, such as current stock prices or product prices of competitors. These systems are employed by "super-user" managers and business analysts who want to use sophisticated analytics and models to analyze data.

Example:
An interesting, small, but powerful DSS is the voyage-estimating system(figure 2.5) of a large global shipping company that transports bulk cargoes of coal, oil, ores, and finished products. The firm owns some vessels, charters others, and bids for shipping contracts in the open market to carry general cargo. A voyage estimating system calculates financial and technical voyage details. Financial calculations include shipping/time costs (fuel, labor, capital), freight rates for various types of cargo, and port expenses. Technical details include a myriad of factors, such as ship cargo capacity, speed, port distances, fuel and water consumption, and loading patterns (location of cargo for different ports).

The system can answer questions such as the following: Given a customer delivery schedule and an offered freight rate, which vessel should be assigned at what rate to maximize profits? What is the optimal speed at which a particular vessel can optimize its profit and still meet its delivery schedule? What is the optimal loading pattern for a ship bound for the U.S. West Coast from Malaysia?

FIGURE 2.5   VOYAGE-ESTIMATING DECISION-SUPPORT SYSTEM

This DSS operates on a powerful PC. It is used daily by managers who must develop bids on shipping contracts.
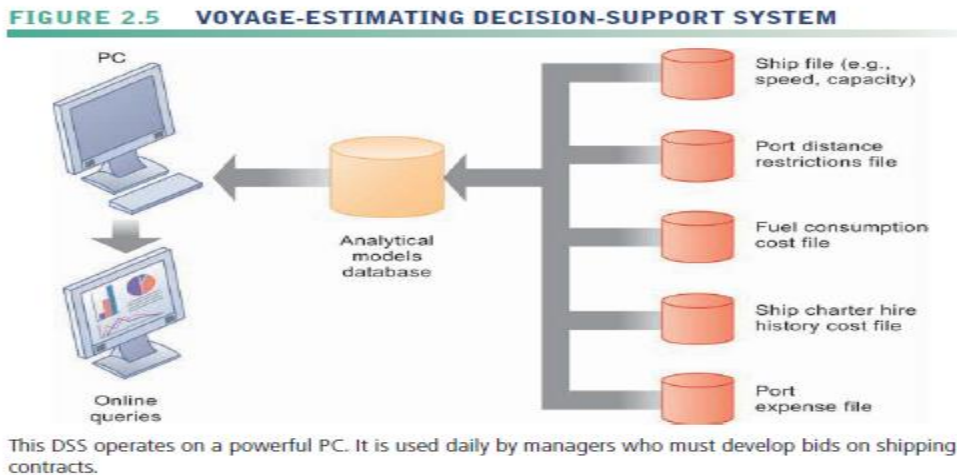
Business intelligence systems also address the decision-making needs of senior management. Senior managers need systems that focus on strategic issues and long-term trends, both in the firm and in the external environment.
They are concerned with questions such as:
What will employment levels be in five years?
What are the long-term industry cost trends?
What products should we be making in five years?

Executive support systems (ESS)

- help senior management make these decisions.
- They address non-routine decisions requiring judgment, evaluation, and insight because there is no agreed-on procedure for arriving at a solution.
- ESS present graphs and data from many sources through an interface that is easy for senior managers to use.
- ESS are designed to incorporate data about external events, such as new tax laws or competitors, but they also draw summarized information from internal MIS and DSS.
- They filter, compress, and track critical data, displaying the data of greatest importance to senior managers.
- such systems include business intelligence analytics for analyzing trends, forecasting, and "drilling down" to data at greater levels of detail.

For example, the CEO of Leiner Health Products, the largest manufacturer of private-label vitamins and supplements in the United States, has an ESS that provides on his desktop a minute-to-minute view of the firm's financial performance as measured by working capital, accounts receivable, accounts payable, cash flow, and inventory. The information is presented in the form of a **digital dashboard**, which displays on a single screen graphs and charts of key performance indicators for managing a company.

A digital dashboard delivers comprehensive and accurate information for decision making often using a single screen. The graphical overview of key performance indicators helps managers quickly spot areas that need attention.

Digital dashboards are becoming an increasingly popular tool for management decision makers.

Contemporary business intelligence and analytics technology have promoted data-driven management, where decision makers rely heavily on analytical tools and data at their fingertips to guide their work. Data captured at the factory or sales floor level are immediately available for high-level or detailed views in executive dashboards and reports. It's real-time management. The interactive Session on Management illustrates information- driven management at work in Procter & Gamble (P&G), a world-class corporation.

SYSTEMS FOR LINKING THE ENTERPRISE

how a business can manage all the information in these different systems.
how costly it is to maintain so many different systems.
how all these different systems can share information
and how managers and employees are able to coordinate their work.

Enterprise Applications
Getting all the different kinds of systems in a company to work together has proven a major challenge. One solution is to implement **enterprise applications**, which are systems that span functional areas, focus on executing business processes across the business firm, and include all levels of management.
There are four major enterprise applications:
  - enterprise systems,
  - supply chain management ystems,
  - customer relationship management systems,
  - and knowledge management systems.
Each of these enterprise applications integrates a related set of functions and business processes to enhance the performance of the organization as a whole.

 Enterprise Systems
Firms use **enterprise systems**, also known as enterprise resource planning (ERP) systems, to integrate business processesing manufacturing and production, finance and accounting, sales and marketing, and human resources into a single software system.
Information that was previously fragmented in many different systems is stored in a single comprehensive data repository where it can be used by many different parts of the business.

For example, when a customer places an order, the order data flow automatically to other parts of the company that are affected by them. The order transaction triggers the warehouse to pick the ordered products and schedule shipment. The warehouse informs the factory to replenish whatever has been depleted. The accounting department is notified to send the customer an invoice. Customer service representatives track the progress of the order through every step to inform customers about the status of their orders. Managers are able to use firm wide information to make more precise and timely decisions about daily operations and longer-term planning.

Supply Chain Management Systems
Firms use **supply chain management (SCM) systems** to help manage relationships with their suppliers. These systems help suppliers, purchasing firms, distributors, and logistics companies share information about orders, production, inventory levels, and delivery of products and services so they can source, produce, and deliver goods and services efficiently. The ultimate objective is to get the right amount of their products from their source to their point of consumption in the least amount of time and at the lowest cost. These systems increase firm profitability by lowering the costs of moving and making products and by enabling managers to make better decisions about how to organize and schedule sourcing, production, and distribution.

Supply chain management systems are one type of **interorganizational system** because they automate the flow of information across organizational boundaries. You will find examples of other types of interorganizational information systems throughout this text because such systems make it possible for firms to link electronically to customers and to outsource their work to other companies.

Customer Relationship Management Systems
Firms use **customer relationship management (CRM) systems**
- to help manage their relationships with their customers.
- CRM systems provide information to coordinate all of the business processes that deal with customers in sales, marketing, and service to optimize revenue, customer satisfaction, and customer retention.This information helps firms identify, attract, and retain the most profitable customers; provide better service to existing customers; and increase sales.

Knowledge Management Systems Some firms perform better than others because they have better knowledge about how to create, produce, and deliver products and services. This firm knowledge is unique, difficult to imitate, and can be leveraged into long-term strategic benefits.

Knowledge managementsystems (KMS)
enable organizations to better manage processes for capturing and applying knowledge and expertise. These systems collect all relevant knowledge and experience in the firm, and make it available wherever and whenever it is needed to improve business processes and management decisions. They also link the firm to external sources of knowledge.

FIGURE 2.6   ENTERPRISE APPLICATION ARCHITECTURE
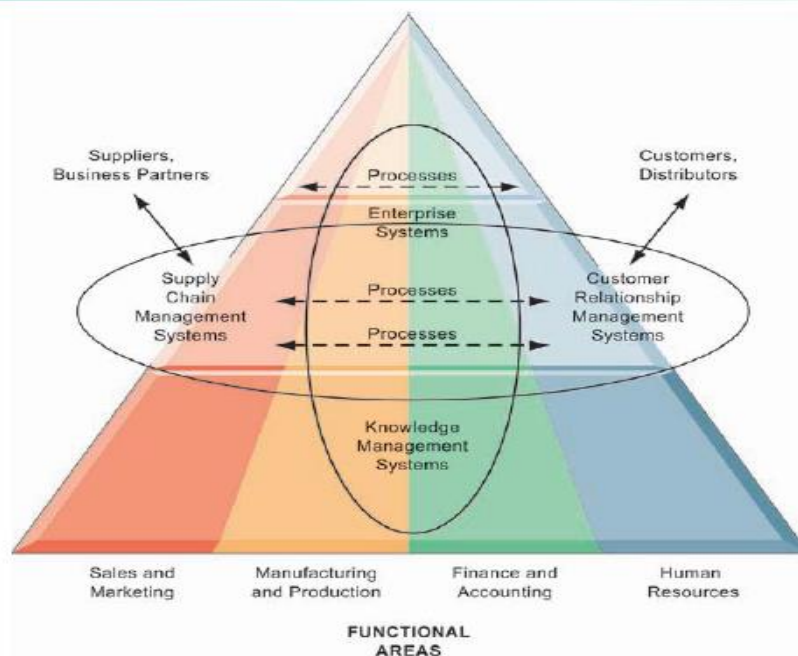
Enterprise applications automate processes that span multiple business functions and organizational levels and may extend outside the organization.

Intranets and Extranets
Enterprise applications create deep-seated changes in the way the firm conducts its business, offering many opportunities to integrate important business data into a single system. They are often costly and difficult to implement.
Intranets and extranets deserve mention here as alternative tools for increasing integration
and expediting the flow of information within the firm, and with customers and suppliers.

Intranets are simply internal company Web sites that are accessible only by employees. The term "intranet" refers to an internal network, in contrast to the Internet, which is a public network linking organizations and other external networks. Intranets use the same technologies and techniques as the larger Internet, and they often are simply a private access area in a larger company Web site.
  Extranets are company Web sites that are accessible to authorized vendors and suppliers, and are often used to coordinate the movement of supplies to the firm's production apparatus.

For example, Six Flags, which operates 19 theme parks throughout North America, maintains an intranet for its 2,500 full-time employees that provides company-related news and information on each park's day-to-day operations, including weather forecasts, performance schedules, and details about groups and celebrities visiting the parks. The company also uses an extranet to
broadcast information about schedule changes and park events to its 30,000 seasonal employees.

E-BUSINESS, E-COMMERCE, AND E-GOVERNMENT
The systems and technologies we have just described are transforming firms' relationships with customers, employees, suppliers, and logistic partners into digital relationships using networks and the Internet. Such as:
Electronic business, or **e-business**, refers to the use of digital technology and the Internet to execute the major business processes in the enterprise.
E-business includes activities for the internal management of the firm and for coordination with suppliers and other business partners.
electronic commerce, or **e-commerce**. is the part of e-business that deals with the buying and selling of goods and services over the Internet. It also encompasses activities supporting those market transactions, such as advertising, marketing, customer support,security, delivery, and payment.
E-government refers to the application of the Internet and networking technologies to digitally enable government and public sector agencies' relationships with citizens, businesses, and other arms of government.

SYSTEMS FOR COLLABORATION AND SOCIAL BUSINESS

Collaboration is working with others to achieve shared and explicit goals. Collaboration focuses on task or mission accomplishment and usually takes place in a business, or other organization, and between businesses. If you're in a law firm, you collaborate with accountants in an accounting firm in servicing the needs of a client with tax problems.

Collaboration can be short-lived, lasting a few minutes, or longer term, depending on the nature of the task and the relationship among participants. Collaboration can be one-to-one or many-to-many.

Teams have a specific mission that someone in the business assigned to them. Team members need to collaborate on the accomplishment of specific tasks and collectively achieve the team mission. The team mission might be to "win the game," or "increase online sales by 10 percent." Teams are often short-lived, depending on the problems they tackle and the length of time needed to find a solution and accomplish the mission.

Collaboration and teamwork are more important today than ever for a variety of reasons.

• *Changing nature of work*. The nature of work has changed from factory manufacturing and pre-computer office work where each stage in the production process occurred independently of one another, and was coordinated by supervisors.
Today, jobs require much closer coordination and interaction among the parties involved in producing the service or product.
A recent report from the consulting firm McKinsey & Company argued that 41 percent of the U.S. labor force is now composed of jobs where interaction (talking, e-mailing, presenting, and persuading) is the primary value-adding activity.

• *Growth of professional work.* "Interaction" jobs tend to be professional jobs in the service sector that require close coordination and collaboration. Professional jobs require substantial education, and the sharing of information and opinions to get work done. Each actor on the job brings specialized expertise to the problem, and all the actors need to take one another into account in order to accomplish the job.

• *Changing organization of the firm*. For most of the industrial age, managers organized work in a hierarchical fashion. Orders came down the hierarchy, and responses moved back up the hierarchy. Today, work is organized into groups and teams, and the members are expected to develop their own methods for accomplishing the task. Senior managers observe and measure
results, but are much less likely to issue detailed orders or operating procedures. In part, this is because expertise and decision-making power have been pushed down in organizations.

• *Changing scope of the firm*. The work of the firm has changed from a single location to multiple locations—offices or factories throughout a region, a nation, or even around the globe. For instance, Henry Ford developed the first mass-production automobile plant at a single Dearborn, Michigan factory. In 2012, Ford employed over 166,000 people at around 90 plants and facilities worldwide. With this kind of global presence, the need for close coordination of
design, production,marketing, distribution, and service obviously takes on new importance and scale. Large global companies need to have teams working on a global basis.

• *Emphasis on innovation*. Although we tend to attribute innovations in business and science to great individuals, these great individuals are most likely working with a team of brilliant colleagues. Think of Bill Gates and Steve Jobs (founders of Microsoft and Apple), both of whom are highly regarded innovators, and both of whom built strong collaborative teams to nurture and support innovation in their firms. Their initial innovations derived from close collaboration with colleagues and partners. Innovation, in other words, is a group and social process, and most innovations derive from collaboration among individuals in a lab, a business, or government agencies. Strong collaborative practices and technologies are believed to increase the rate and quality of innovation.

• *Changing culture of work and business*. Most research on collaboration supports the notion that diverse teams produce better outputs, faster, than individuals working on their own. Popular notions of the crowd ("crowdsourcing," and the "wisdom of crowds") also provide cultural support for collaboration and teamwork.

WHAT IS SOCIAL BUSINESS?
Many firms today enhance collaboration by embracing **social business**—the use of social networking platforms, including Facebook, Twitter, and internal corporate social tools—to engage their employees, customers, and suppliers.

A key word in social business is "conversations." Customers, suppliers, employees, managers, and even oversight agencies continually have conversations about firms, often without the knowledge of the firm or its key actors (employees and managers). Supporters of social business argue that, if firms could tune into these conversations, they would strengthen their bonds with consumers, suppliers, and employees, increasing their emotional involvement in the firm.

All of this requires a great deal of information transparency. People need to share opinions and facts with others quite directly, without intervention from executives or others. Employees get to know directly what customers and other employees think; suppliers will learn very directly the opinions of supply chain partners; and even managers presumably will learn more directly from their employees how well they are doing. Table 2.2 describes important applications of social business inside and outside the firm.

TABLE 2.2 APPLICATIONS OF SOCIAL BUSINESS

SOCIAL BUSINESS APPLICATION	DESCRIPTION
Social networks	Connect through personal and business profiles
Crowdsourcing	Harness collective knowledge to generate new ideas and solutions
Shared workspaces	Coordinate projects and tasks; co-create content
Blogs and wikis	Publish and rapidly access knowledge; discuss opinions and experiences
Social commerce	Share opinions about purchasing or purchase on social platforms
File sharing	Upload, share, and comment on photos, videos, audio, text documents
Social marketing	Use social media to interact with customers; derive customer insights
Communities	Discuss topics in open forums; share expertise

BUSINESS BENEFITS OF COLLABORATION AND SOCIAL BUSINESS

Table 2.3 summarizes some of the benefits of collaboration and social business that have been identified. Figure 2.7 graphically illustrates how collaboration is believed to impact business performance.

People need to share opinions and facts with others quite directly, without intervention from executives or others. Employees get to know directly what customers and other employees think; suppliers will learn very directly the opinions of supply chain partners; and even managers presumably will learn more directly from their employees how well they are doing. Nearly everyone involved in the creation of value will know much more about everyone else.

If such an environment could be created, it is likely to drive operational efficiencies, spur innovation, and accelerate decision making. If product designers can learn directly about how their products are doing in the market in real time, based on consumer feedback, they can speed up the redesign process. If employees can use social connections inside and outside the company to capture new knowledge and insights, they will be able to work more efficiently and solve more business problems.

TABLE 2.3 BUSINESS BENEFITS OF COLLABORATION AND SOCIAL BUSINESS

BENEFIT	RATIONALE
Productivity	People interacting and working together can capture expert knowledge and solve problems more rapidly than the same number of people working in isolation from one another. There will be fewer errors.
Quality	People working collaboratively can communicate errors, and corrective actions faster than if they work in isolation. Collaborative and take social technologies help reduce time delays in design and production.
Innovation	People working collaboratively can come up with more innovative ideas for products, services, and administration than the same number working in isolation from one another. Advantages to diversity and the "wisdom of crowds."
Customer service	People working together using collaboration and social tools can solve customer complaints and issues faster and more effectively than if they were working in isolation from one another.
Financial performance (profitability, sales, and sales growth)	As a result of all of the above, collaborative firms have superior sales, sales growth, and financial performance.

FIGURE 2.7 REQUIREMENTS FOR COLLABORATION
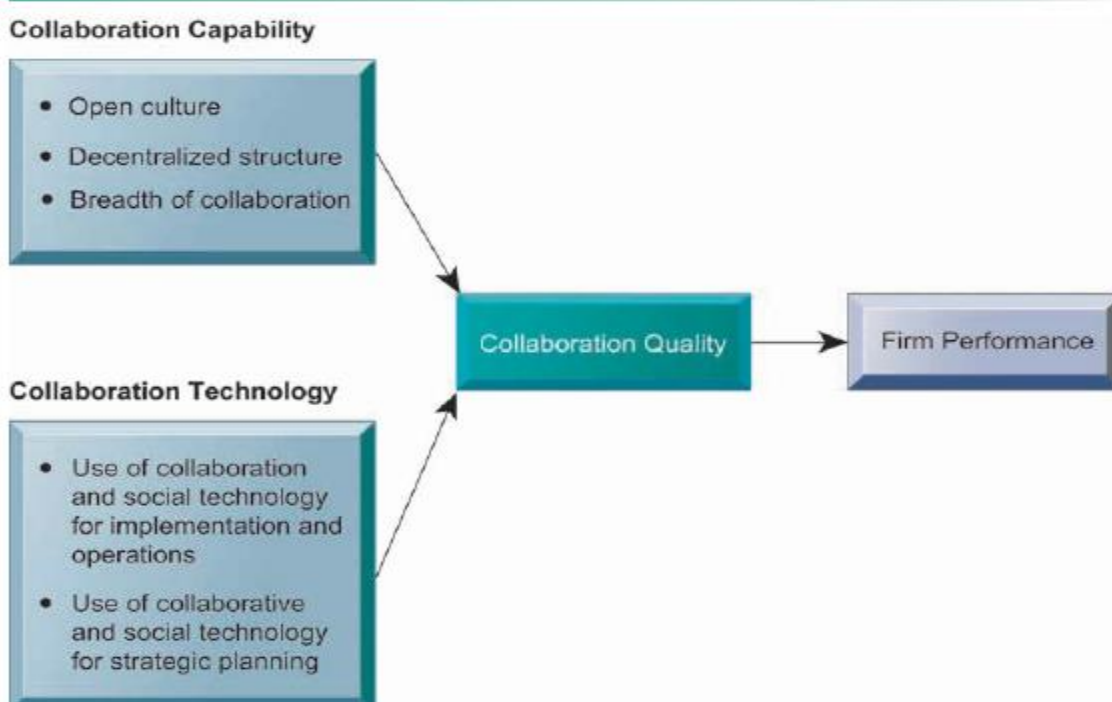
Successful collaboration requires an appropriate organizational structure and culture, along with appropriate collaboration technology.
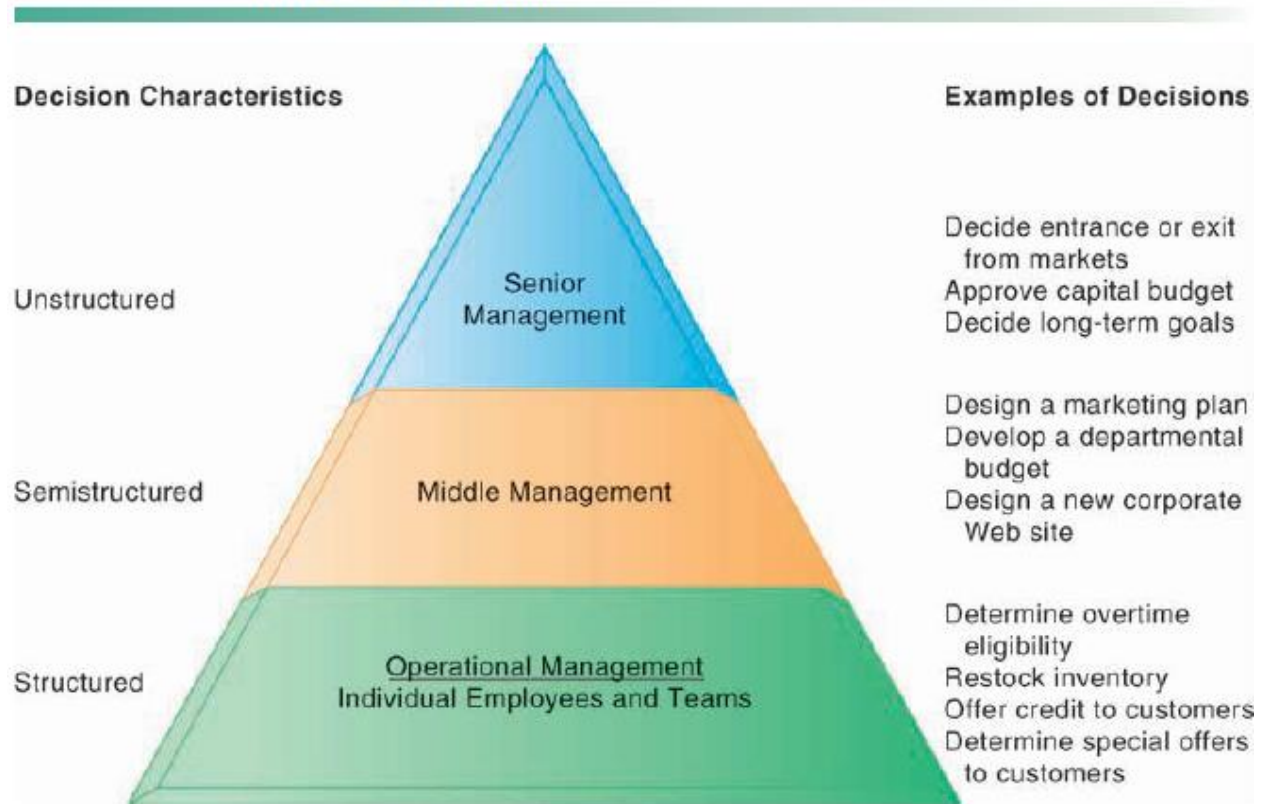
DECISION MAKING AND INFORMATION SYSTEMS
Decision making in businesses used to be limited to management. Today,lower-level employees
are responsible for some of these decisions, as information systems make information available
to lower levels of the business.

TYPES OF DECISIONS

there are different levels in an organization. Each of these levels has different information
requirements for decision support and responsibility for different types of decisions (see Figure
12.1). Decisions are classified as structured, semistructured, and unstructured.

FIGURE 12.1 INFORMATION REQUIREMENTS OF KEY DECISION-MAKING GROUPS IN A FIRM

Decision Characteristics

Examples of Decisions

Unstructured — Senior Management

- Decide entrance or exit from markets
- Approve capital budget
- Decide long-term goals

Semistructured — Middle Management

- Design a marketing plan
- Develop a departmental budget
- Design a new corporate Web site

Structured — Operational Management Individual Employees and Teams

- Determine overtime eligibility
- Restock inventory
- Offer credit to customers
- Determine special offers to customers

Senior managers, middle managers, operational managers, and employees have different types of
decisions and information requirements.

Unstructured decisions are those in which the decision maker must provide judgment,
evaluation, and insight to solve the problem. Each of these decisions is novel, important, and
nonroutine, and there is no well-understood or agreed-on procedure for making them.

Structured decisions, by contrast, are repetitive and routine, and they involve a definite
procedure for handling them so that they do not have to be treated each time as if they were new.

Many decisions have elements of both types of decisions and are **semistructured**, where only part of the problem has a clear-cut answer provided by an accepted procedure. In general, structured decisions are more prevalent at lower organizational levels, whereas unstructured problems are more common at higher levels of the firm.

Senior executives face many unstructured decision situations, such as establishing the firm's 5- or 10-year goals or deciding new markets to enter.
Answering the question "Should we enter a new market?" would require access to news, government reports, and industry views as well as high-level summaries of firm performance. However, the answer would also require senior managers to use their own best judgment and poll other managers for their opinions.

Middle management faces more structured decision scenarios but their decisions may include unstructured components. A typical middle-level management decision might be "Why is the reported order fulfillment report showing a decline over the past six months at a distribution center in Minneapolis?" This middle manager will obtain a report from the firm's enterprise system or distribution management system on order activity and operational efficiency at the Minneapolis distribution center.

This is the structured part of the decision. But before arriving at an answer, this middle manager will have to interview employees and gather more unstructured information from external sources about local economic conditions or sales trends.

INFORMATION REQUIREMENTS OF KEY DECISION-MAKING GROUPS IN A FIRM

Senior managers, middle managers, operational managers, and employees have different types of decisions and information requirements.
Operational management and rank-and-file employees tend to make more structured decisions. For example, a supervisor on an assembly line has to decide whether an hourly paid worker is entitled to overtime pay. If the employee worked more than eight hours on a particular day, the supervisor would routinely grant overtime pay for any time beyond eight hours that was clocked on that day.

A sales account representative often has to make decisions about extending credit to customers by consulting the firm's customer database that contains credit information. If the customer met the firm's prespecified criteria for granting credit, the account representative would grant that customer credit to make a purchase. In both instances, the decisions are highly structured
and are routinely made thousands of times each day in most large firms. The answer has been preprogrammed into the firm's payroll and accounts receivable systems.

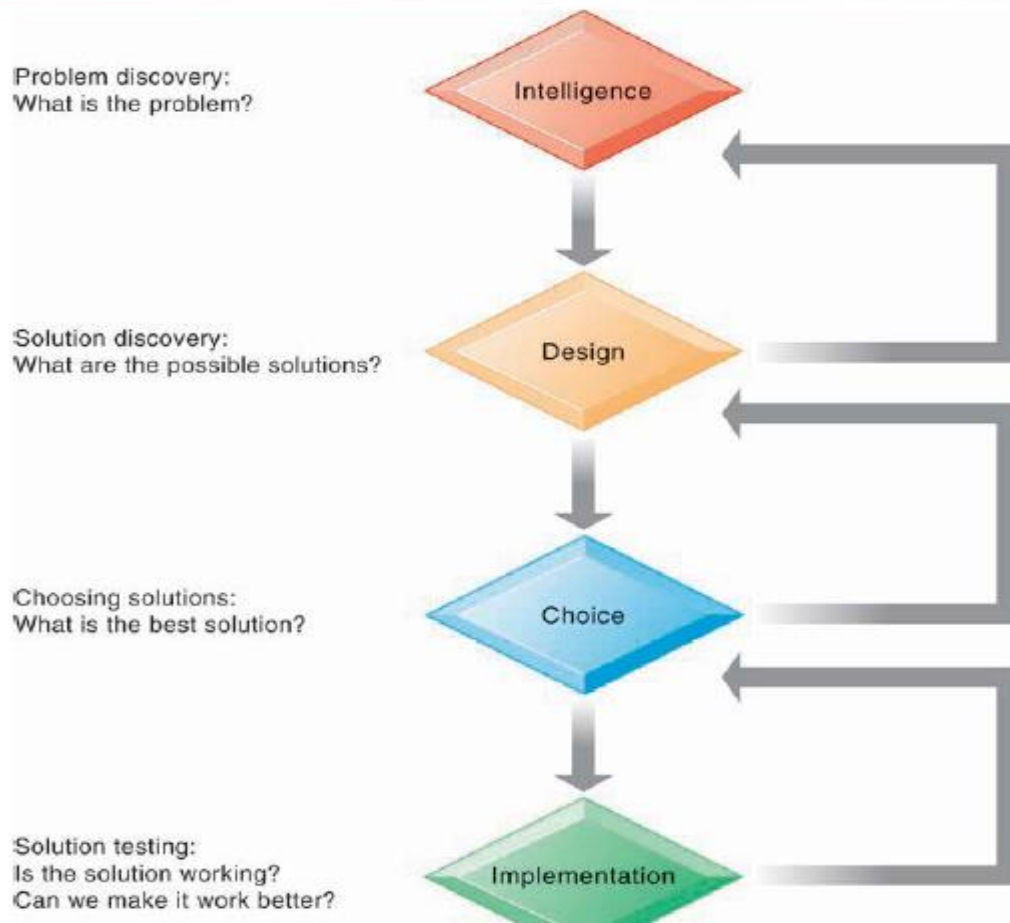## THE DECISION-MAKING PROCESS

Making a decision is a multistep process. Simon (1960) described four different stages in decision making: intelligence, design, choice, and implementation

FIGURE 12.2 STAGES IN DECISION MAKING

Problem discovery:
What is the problem? — Intelligence

Solution discovery:
What are the possible solutions? — Design

Choosing solutions:
What is the best solution? — Choice

Solution testing:
Is the solution working?
Can we make it work better? — Implementation

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

What happens if the solution you have chosen doesn't work? Figure 12.2 shows that you can return to an earlier stage in the decision-making process and repeat it if necessary. For instance, in the face of declining sales, a sales management team may decide to pay the sales force a higher commission for making more sales to spur on the sales effort. If this does not produce sales increases, managers would need to investigate whether the problem stems from poor product design, inadequate customer support, or a host of other causes that call for a different solution.

WHAT IS BUSINESS INTELLIGENCE?

When we think of humans as intelligent beings we often refer to their ability to take in data from their environment, understand the meaning and significance of the information, and then act appropriately. Can the same be said of business firms? The answer appears to be a qualified "yes." All organizations, including business firms, do indeed take in information from their environments, attempt to understand the meaning of the information, and then attempt to act on the information. Just like human beings, some business firms do this well, and others poorly.

"Business intelligence (BI)" is a term used by hardware and software vendors and information technology consultants to describe the infrastructure for warehousing, integrating, reporting, and analyzing data that comes from the business environment, including big data. The foundation infrastructure collects, stores, cleans, and makes relevant information available to managers. Think databases, data warehouses, data marts, Hadoop, and analytic platforms

"Business analytics (BA)" is also a vendor defined term that focuses more on tools and techniques for analyzing and understanding data. Think online analytical processing (OLAP), statistics, models, and data mining.

So, stripped to its essentials, business intelligence and analytics are about integrating all the information streams produced by a firm into a single, coherent enterprise-wide set of data, and then, using modeling, statistical analysis tools (like normal distributions, correlation and regression analysis, Chi square analysis, forecasting, and cluster analysis), and data mining tools (patterndiscovery and machine learning), to make sense out of all these data so managers can make better decisions and better plans, or at least know quickly when their firms are failing to meet planned targets.

One company that uses business intelligence is Hallmark Cards. The company uses SAS Analytics software to improve its understanding of buying patterns that could lead to increased sales at more than 3,000 Hallmark Gold Crown stores in the United Sates. Hallmark wanted to strengthen its relationship with frequent buyers.

Using data mining and predictive modeling, the company determined how to market to various consumer segments during holidays and special occasions as well as adjust promotions on the fly. Hallmark is able to determine which customer segments are most influenced by direct mail, which should be approached through e-mail, and what specific messages to send each group. Business intelligence has helped boost Hallmark sales to its loyalty program members by 5 to 10 percent. Another organization that has benefited from business intelligence is the Cincinnati Zoo, as described in the Interactive Session on Organizations.

Business Intelligence Vendors

It is important to remember that business intelligence and analytics are products defined by technology vendors and consulting firms. They consist of hardware and software suites sold primarily by large system vendors to very large Fortune 500 firms. The largest five providers of these products are Oracle, SAP, IBM, Microsoft, and SAS (see Table 12.4). Microsoft's products are aimed at small to medium-sized firms, and they are based on desktop tools familiar to employees (such as Excel spreadsheet software), Microsoft SharePoint collaboration tools, and Microsoft SQL Server database software.

According to the International Data Corporation, the global business intelligence and analytics market was $35.1 billion in 2012 and is expected to reach $50.7 billion by 2016 (Kern, 2012). This makes business intelligence and business analytics one of the fastest growing and largest segments in the U.S. software market.