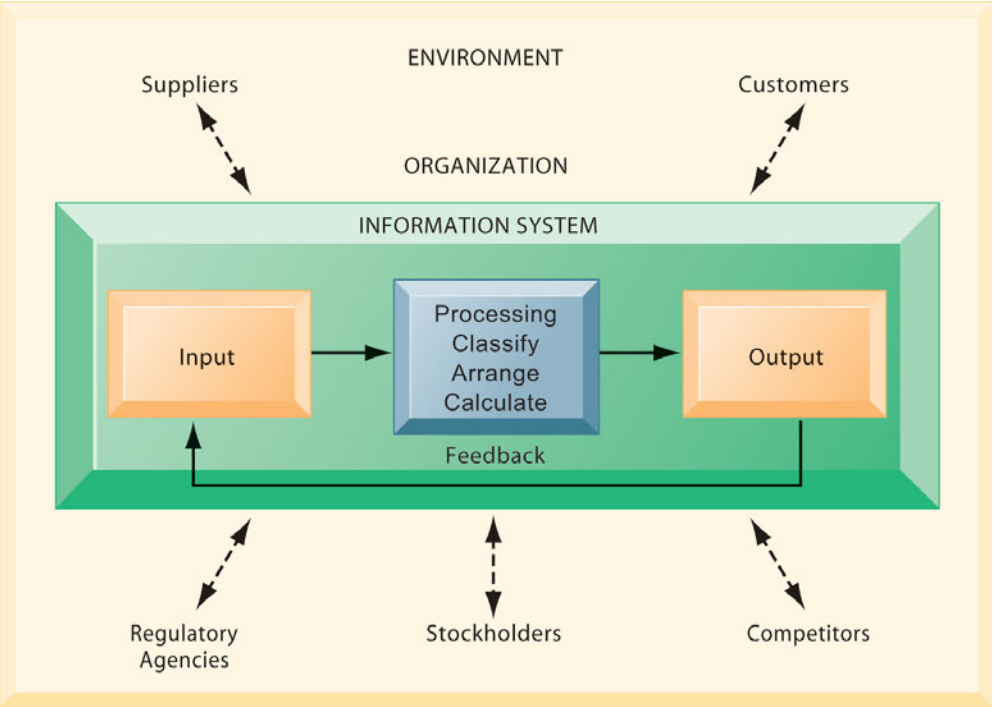
FIGURE 1-4 FUNCTIONS OF AN INFORMATION SYSTEM



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.

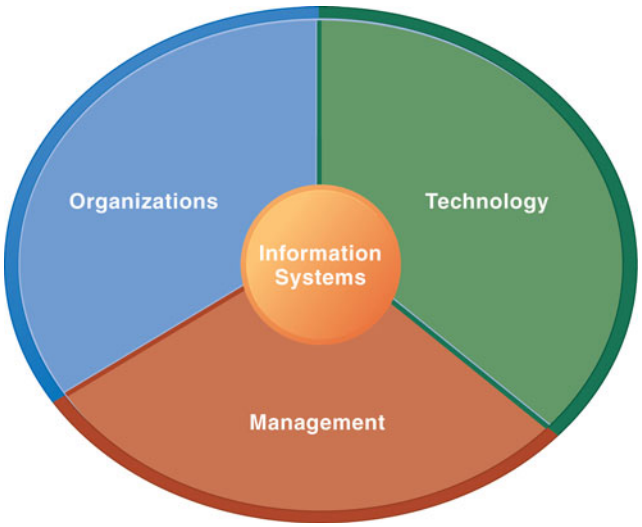
A house is an appropriate analogy. Houses are built with hammers, nails, and wood, but these do not make a house. The architecture, design, setting, landscaping, and all of the decisions that lead to the creation of these features are part of the house and are crucial for solving the problem of putting a roof over one's head. 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, you must understand the problems they are designed to solve, their architectural and design elements, and the organizational processes that lead to these solutions.

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.

The field of **management information systems (MIS)** tries to achieve this broader information systems literacy. MIS deals with behavioral issues as well

FIGURE 1-5 INFORMATION SYSTEMS ARE MORE THAN COMPUTERS



Using information systems effectively requires an understanding of the organization, management, and information technology shaping the systems. An information system creates value for the firm as an organizational and management solution to challenges posed by the environment.

as technical issues surrounding the development, use, and impact of information systems used by managers and employees in the firm.

Let's examine each of the dimensions of information systems—organizations, management, and information technology.

Organizations

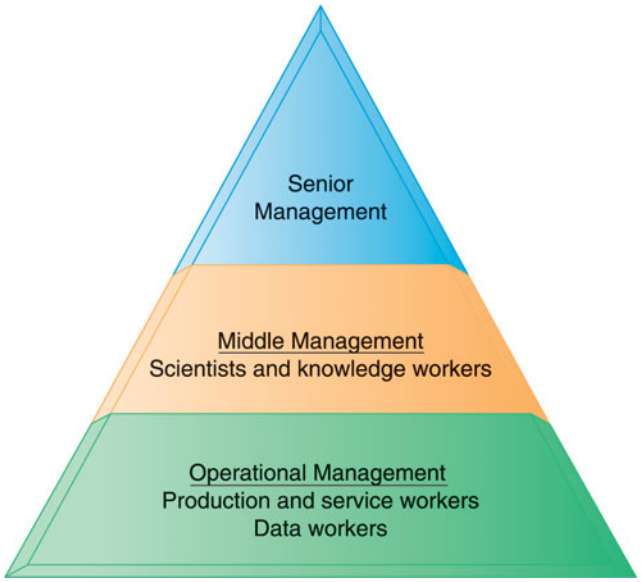
Information systems are an integral part of organizations. Indeed, for some companies, such as credit reporting firms, there would be no business without an information system. The key elements of an organization are its people, structure, business processes, politics, and culture. We introduce these components of organizations here and describe them in greater detail in Chapters 2 and 3.

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 activities of 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,

FIGURE 1-6 LEVELS IN A FIRM



Business organizations are hierarchies consisting of three principal levels: senior management, middle management, and operational management. Information systems serve each of these levels. Scientists and knowledge workers often work with middle management.

finance and accounting, and human resources (see Table 1-2). Chapter 2 provides more detail on these business functions and the ways in which they are supported by information systems.

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 co-workers 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.

TABLE 1-2 MAJOR BUSINESS FUNCTIONS

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

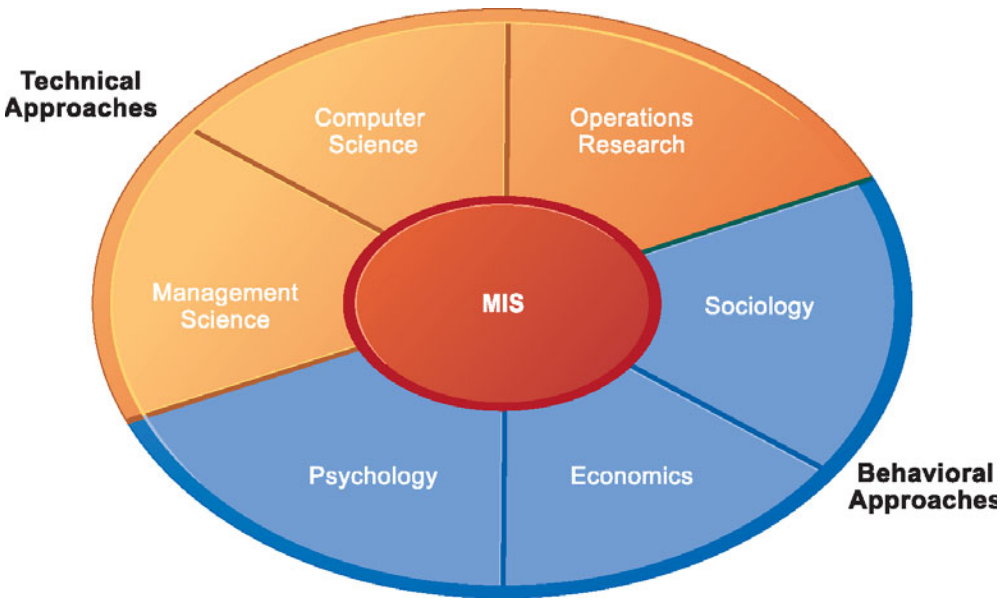
Important social investments (not made by the firm but by the society at large, other firms, governments, and other key market actors) are the Internet and the supporting Internet culture, educational systems, network and computing standards, regulations and laws, and the presence of technology and service firms.

Throughout the book we emphasize a framework of analysis that considers technology, management, and organizational assets and their interactions. Perhaps the single most important theme in the book, reflected in case studies and exercises, is that managers need to consider the broader organization and management dimensions of information systems to understand current problems as well as to derive substantial above-average returns from their information technology investments. As you will see throughout the text, firms that can address these related dimensions of the IT investment are, on average, richly rewarded.

1.3 Contemporary Approaches to Information Systems

The study of information systems is a multidisciplinary field. No single theory or perspective dominates. Figure 1-9 illustrates the major disciplines that contribute problems, issues, and solutions in the study of information systems. In general, the field can be divided into technical and behavioral approaches. Information systems are sociotechnical systems. Though they are composed of machines, devices, and "hard" physical technology, they require substantial social, organizational, and intellectual investments to make them work properly.

FIGURE 1-9 CONTEMPORARY APPROACHES TO INFORMATION SYSTEMS



The study of information systems deals with issues and insights contributed from technical and behavioral disciplines.

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. The disciplines that contribute to the technical approach are computer science, management science, and operations research.

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. Issues such as strategic business integration, design, implementation, utilization, and management cannot be explored usefully with the models used in the technical approach. Other behavioral disciplines contribute important concepts and methods.

For instance, 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 does not ignore technology. Indeed, information systems technology is often the stimulus for a behavioral problem or issue. But the focus of this approach is generally not on technical solutions. Instead, it concentrates on changes in attitudes, management and organizational policy, and behavior.

APPROACH OF THIS TEXT: SOCIOTECHNICAL SYSTEMS

Throughout this book you will find a rich story with 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.

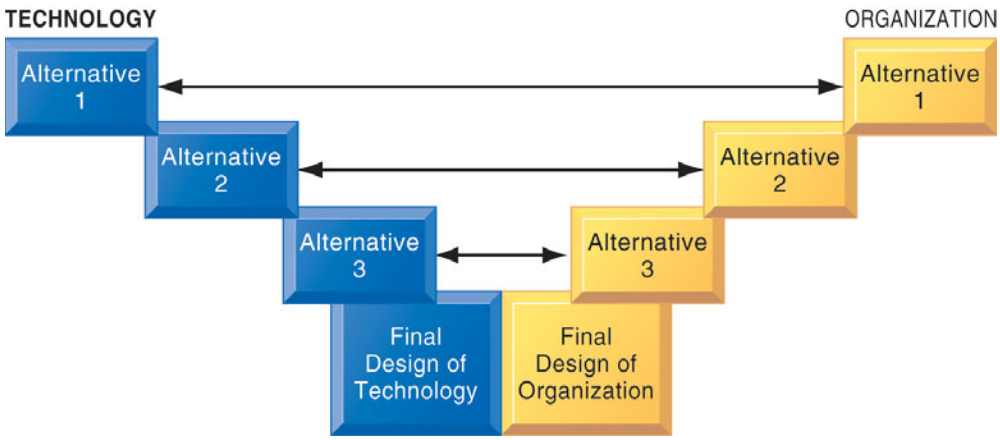
Our experience as academics and practitioners leads us to believe that no single approach effectively captures the reality of information systems. The successes and failures of information are rarely all technical or all behavioral. Our best advice to students is to understand the perspectives of many disciplines. Indeed, the challenge and excitement of the information systems field is that it requires an appreciation and tolerance of many different approaches.

The view we adopt in this book is best characterized as the **sociotechnical view** of systems. In this view, optimal organizational performance is achieved by jointly optimizing both the social and technical systems used in production.

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.

In this book, we stress the need to optimize the firm's performance as a whole. 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.

FIGURE 1-10 A SOCIOTECHNICAL PERSPECTIVE ON INFORMATION SYSTEMS



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.

The Challenge of Information Systems: Key Management Issues
Integrating Text with Technology: New Opportunities for Learning

LEARNING TO USE INFORMATION SYSTEMS: NEW OPPORTUNITIES WITH TECHNOLOGY

Although information systems are creating many exciting opportunities for both businesses and individuals, they are also a source of new problems, issues, and challenges for managers. In this course, you will learn about both the challenges and opportunities information systems pose, and you will be able to use information technology to enrich your learning experience.

The Challenge of Information Systems: Key Management Issues

Although information technology is advancing at a blinding pace, there is nothing easy or mechanical about building and using information systems. There are five major challenges confronting managers:

1. The information systems investment challenge: How can organizations obtain business value from their information systems? Earlier in this chapter we described the importance of information systems as investments that produce value for the firm. We showed that not all companies realize good returns from information systems investments. It is obvious that one of the greatest challenges facing managers today is ensuring that their companies do indeed obtain meaningful returns on the money they spend on information systems. It's one thing to use information technology to design, produce, deliver, and maintain new products. It's another thing to make money doing it. How can organizations obtain a sizable payoff from their investment in information systems? How can management ensure that information systems contribute to corporate value?

   Senior management can be expected to ask these questions: How can we evaluate our information systems investments as we do other investments? Are we receiving the return on investment from our systems that we should? Do our competitors get more? Far too many firms still cannot answer these questions. Their executives are likely to have trouble determining how much they actually spend on technology or how to measure the returns on their technology investments. Most companies lack a clear-cut decision-making process for deciding which technology investments to pursue and for managing those investments (Hartman, 2002).

2. The strategic business challenge: What complementary assets are needed to use information technology effectively? Despite heavy

information technology investments, many organizations are not realizing significant business value from their systems, because they lack—or fail to appreciate—the complementary assets required to make their technology assets work. The power of computer hardware and software has grown much more rapidly than the ability of organizations to apply and use this technology. To benefit fully from information technology, realize genuine productivity, and become competitive and effective, many organizations actually need to be redesigned. They will have to make fundamental changes in employee and management behavior, develop new business models, retire obsolete work rules, and eliminate the inefficiencies of outmoded business processes and organizational structures. New technology alone will not produce meaningful business benefits.

3. The globalization challenge: How can firms understand the business and system requirements of a global economic environment? The rapid growth in international trade and the emergence of a global economy call for information systems that can support both producing and selling goods in many different countries. In the past, each regional office of a multinational corporation focused on solving its own unique information problems. Given language, cultural, and political differences among countries, this focus frequently resulted in chaos and the failure of central management controls. To develop integrated, multinational, information systems, businesses must develop global hardware, software, and communications standards; create cross-cultural accounting and reporting structures; and design transnational business processes.

4. The information technology infrastructure challenge: How can organizations develop an information technology infrastructure that can support their goals when business conditions and technologies are changing so rapidly? Many companies are saddled with expensive and unwieldy information technology platforms that cannot adapt to innovation and change. Their information systems are so complex and brittle that they act as constraints on business strategy and execution. Meeting new business and technology challenges may require redesigning the organization and building a new information technology (IT) infrastructure.

   Creating the IT infrastructure for a digital firm is an especially formidable task. Most companies are crippled by fragmented and incompatible computer hardware, software, telecommunications networks, and information systems that prevent information from flowing freely between different parts of the organization. Although Internet standards are solving some of these connectivity problems, creating data and computing platforms that span the enterprise—and, increasingly, link the enterprise to external business partners—is rarely as seamless as promised. Many organizations are still struggling to integrate their islands of information and technology. Chapters 6

through 10 provide more detail on IT infrastructure issues.

5. Ethics and security: The responsibility and control challenge: How can organizations ensure that their information systems are used in an ethically and socially responsible manner? How can we design information systems that people can control and understand? Although information systems have provided enormous benefits and efficiencies, they have also created new ethical and social problems and challenges. Chapter 5 is devoted entirely to ethical and social issues raised by information systems, such as threats to individual privacy and intellectual property rights, computer-related health problems, computer crimes, and elimination of jobs. A major management challenge is to make informed decisions that are sensitive to the negative consequences of information systems as well to the positive ones.

   Managers face an ongoing struggle to maintain security and control. Today, the threat of unauthorized penetration or disruption of information systems has never been greater. Information systems are so essential to business, government, and daily life that organizations must take special steps to ensure their security, accuracy, and reliability. A firm invites disaster if it uses systems that can be disrupted or accessed by outsiders, that do not work as intended, or that do not deliver information in a form that people can correctly use. Information systems must be designed so that they are secure, function as intended, and so that humans can control the process. Chapter 10 treats these issues in detail. Managers will need to ask: Can we apply high-quality assurance standards to our information systems, as well as to our products and services? Can we build systems with tight security that are still easy to use? Can we design information systems that respect people's rights of privacy while still pursuing our organization's goals? Should information systems monitor employees? What do we do when an information system designed to increase efficiency and productivity eliminates people's jobs?

This text is designed to provide future managers with the knowledge and understanding required to deal with these challenges. To further this objective, each succeeding chapter concludes with a Management Opportunities, Challenges, and Solutions section that outlines the key issues of which managers should be aware.

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Integrating Text with Technology: New Opportunities for Learning

In addition to the changes in business and management that we have just described, we believe that information technology creates new opportunities for learning that can make the MIS course more meaningful and exciting. We have provided a series of hands-on projects, a student Web site, and an interactive multimedia CD-ROM for

Mango has a core of designers and production facilities that can churn out new fashion styles at lightning speed. But Mango would not be able stock its stores so quickly with hot fashion trends without its powerful information systems. These information systems support finely tuned business processes that organize merchandise based on style and customer tastes to drive inventory replenishment.

As a manager, you'll want to know exactly how information systems can help your company. You'll need to understand which types of information systems are available to businesses and what they can do for them.

In this chapter, we first look at different ways of classifying information systems based on the organizational level, business functions, and business processes they support. We then briefly examine enterprise applications, which consist of enterprise systems, supply chain management systems, customer relationship management systems, and knowledge management systems. These enterprise applications span the entire firm, integrating information from multiple functions and business processes to enhance the performance of the organization as a whole.

MAJOR TYPES OF SYSTEMS IN ORGANIZATIONS

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. Figure 2-1 illustrates one way to depict the kinds of systems found in an organization. In the illustration, the organization is divided into strategic, management, and operational levels and then is further divided into functional areas, such as sales and marketing, manufacturing and production, finance and accounting, and human resources. Systems are built to serve these different organizational interests (Anthony, 1965).

FIGURE 2-1 Types of information systems
Organizations can be divided into strategic, management, and operational levels and into four major functional areas: sales and marketing, manufacturing and production, finance and accounting, and human resources. Information systems serve each of these levels and functions.

Different Kinds of Systems

Three main categories of information systems serve different organizational levels: operational-level systems, management-level systems, and strategic-level systems. Operational-level systems support operational managers by keeping 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. 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. Williams's payment? To answer these kinds of questions, information generally must be easily available, current, and accurate. Examples of operational-level systems include a system to record bank deposits from automatic teller machines or one that tracks the number of hours worked each day by employees on a factory floor.

Management-level systems serve the monitoring, controlling, decision-making, and administrative activities of middle managers. The principal question addressed by such systems is this: Are things working well? Management-level systems typically

provide periodic reports rather than instant information on operations. An example is a relocation control system that reports on the total moving, house-hunting, and home financing costs for employees in all company divisions, noting wherever actual costs exceed budgets.

Some management-level systems support nonroutine decision making. They tend to focus on less-structured decisions for which information requirements are not always clear. These systems often answer “what-if” questions: 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? Answers to these questions frequently require new data from outside the organization, as well as data from inside that cannot be easily drawn from existing operational-level systems.

Strategic-level systems help senior management tackle and address strategic issues and long-term trends, both in the firm and in the external environment. Their principal concern is matching changes in the external environment with existing organizational capability. What will employment levels be in five years? What are the long-term industry cost trends, and where does our firm fit in? What products should we be making in five years?

Information systems also serve the major business functions, such as sales and marketing, manufacturing and production, finance and accounting, and human resources. A typical organization has operational-, management-, and strategic-level systems for each functional area. For example, the sales function generally has a sales system on the operational level to record daily sales figures and to process orders. A management-level system tracks monthly sales figures by sales territory and reports on territories where sales exceed or fall below anticipated levels. A system to forecast sales trends over a five-year period serves the strategic level. We first describe the specific categories of systems serving each organizational level and their value to the organization. Then we show how organizations use these systems for each major business function.

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Four Major Types of Systems

Figure 2-2 shows the specific types of information systems that correspond to each organizational level. The organization has executive support systems (ESS) at the strategic level; management information systems (MIS) and decision-support systems (DSS) at the management level; and transaction processing systems (TPS) at the operational level. Systems at each level in turn are specialized to serve each of the major functional areas. Thus, the typical systems found in organizations are designed to assist workers or managers at each level and in the functions of sales and marketing, manufacturing and production, finance and accounting, and human resources.

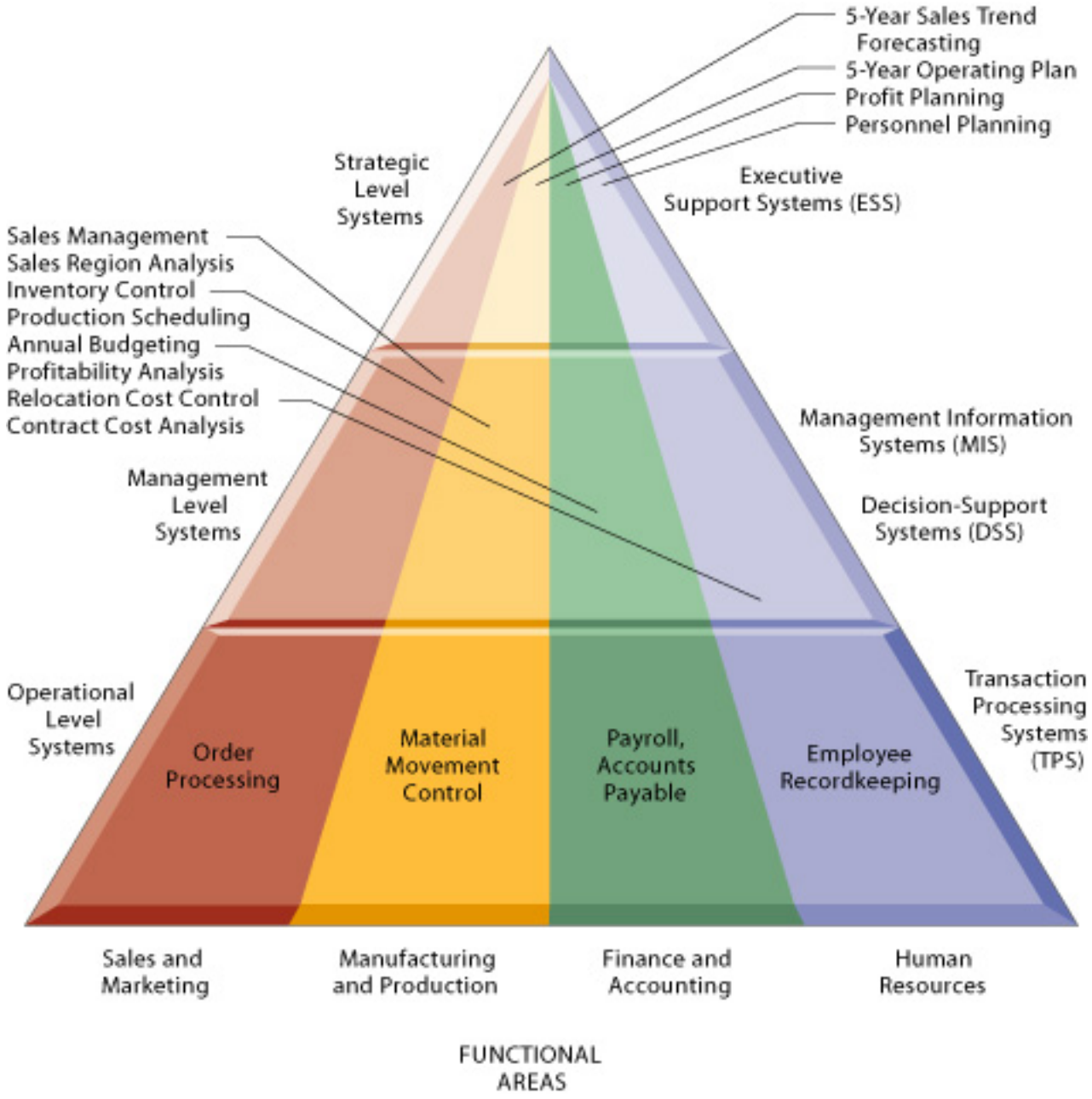


FIGURE 2-2 The four major types of information systems
This figure provides examples of TPS, DSS, MIS, and ESS, showing the level of the organization and business function that each supports.

Table 2-1 summarizes the features of the four types of information systems. It should be noted that each of the different systems may have components that are used by organizational levels and groups other than its main constituencies. A secretary may find information on an MIS, or a middle manager may need to extract data from a TPS.

TABLE 2-1 Characteristics of Information Processing Systems

Type of System	Information Inputs	Processing	Information Outputs	Users
ESS	Aggregate data; external, internal	Graphics; simulations; interactive	Projections; responses to queries	Senior managers
DSS	Low-volume data or massive databases optimized for data analysis; analytic models and data analysis tools	Interactive; simlulations; analysis	Special reports; decision analyses; responses to queries	Professionals; staff managers
MIS	Summary transaction data; high-volume data; simple models	Routine reports; simple models; low-level analysis	Summary and exception reports	Middle managers
TPS	Transactions; events	Sorting; listing; merging; updating	Detailed reports; lists; summaries	Operations personnel; supervisors

TRANSACTION PROCESSING SYSTEMS

Transaction processing systems (TPS) are the basic business systems that serve the operational level of the organization. A transaction processing system is a computerized system that performs and records the daily routine transactions necessary to conduct business. Examples are sales order entry, hotel reservation systems, payroll, employee record keeping, and shipping.

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 2-3 depicts a payroll TPS, which is a typical accounting transaction processing system found in most firms. A payroll system keeps track of the money paid to employees. The master file is composed of discrete pieces of information (such as a name, address, or employee number) called data elements. Data are keyed into the system, updating the data elements. The elements on the master file are combined in different ways to make up reports of interest to management and government agencies and to send paychecks to employees. These TPS can generate other report combinations of existing data elements.

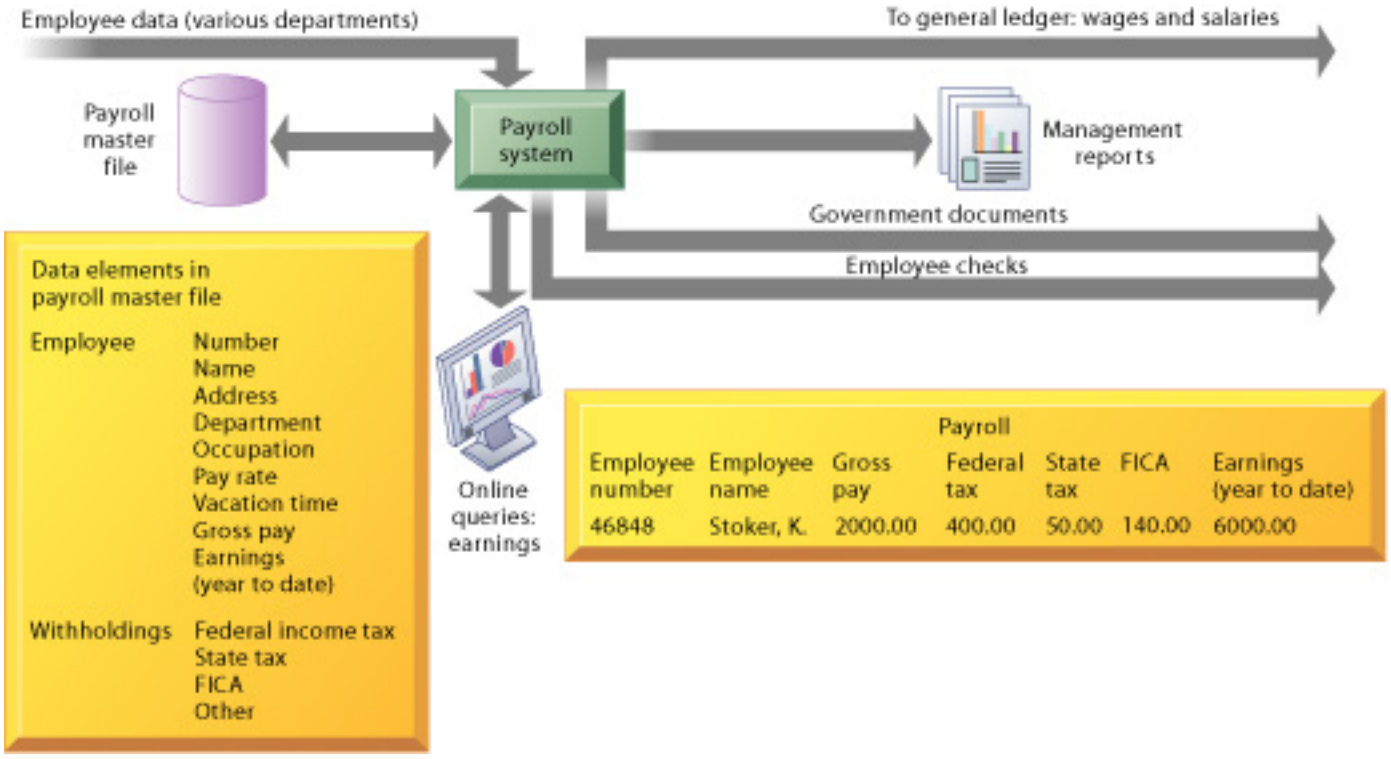
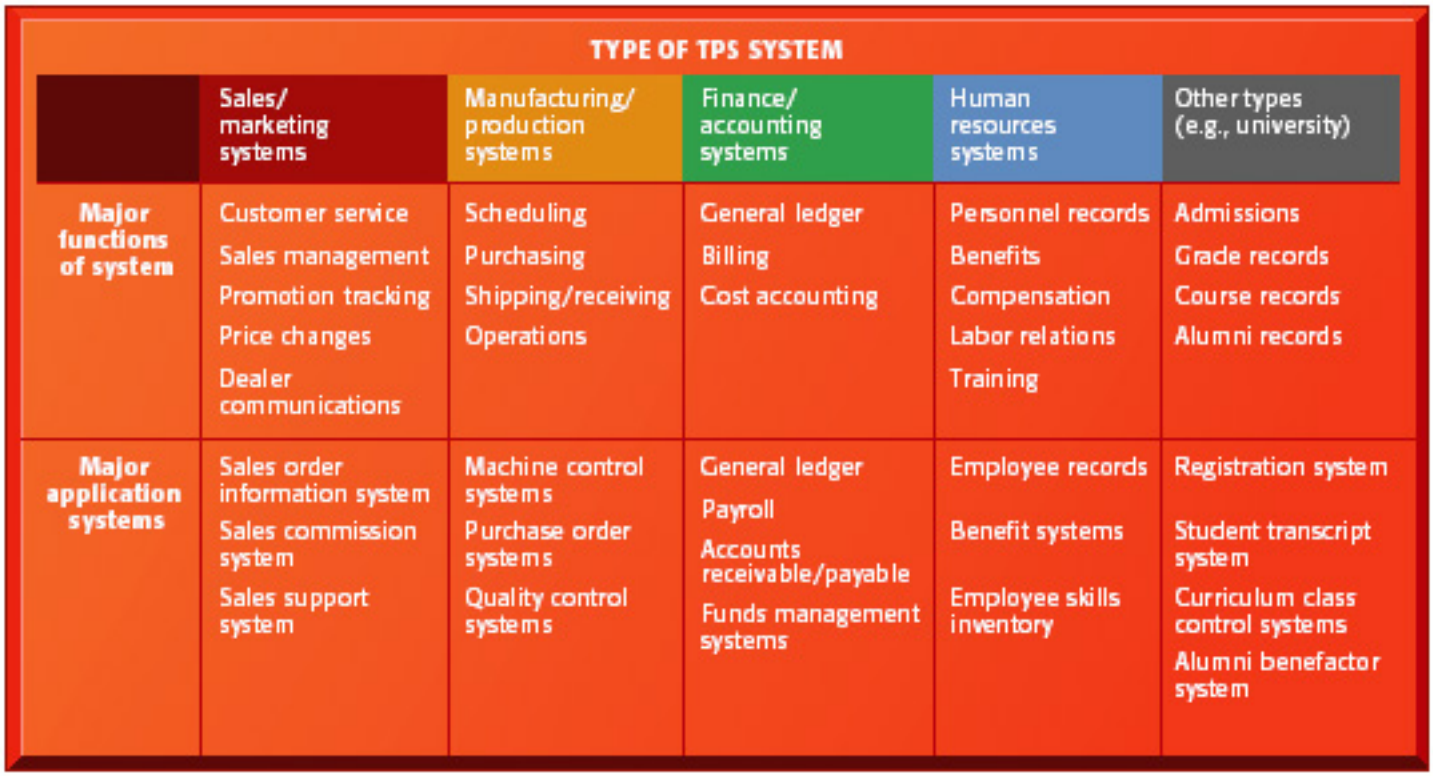


FIGURE 2-3 A symbolic representation for a payroll TPS
A payroll system is a typical accounting TPS that processes transactions such as employee time cards and changes in employee salaries and deductions. It keeps track of money paid to employees, withholding tax, and paychecks.

Other typical TPS applications are identified in Figure 2-4. The figure shows that there are five functional categories of TPS: sales/marketing, manufacturing/production, finance/accounting, human resources, and other types of TPS that are unique to a particular industry. The United Parcel Service (UPS) package tracking system described in Chapter 1 is an example of a manufacturing TPS. UPS sells package delivery services; the TPS system keeps track of all of its package shipment transactions.



TYPE OF TPS SYSTEM	Sales/ marketing systems	Manufacturing/ production systems	Finance/ accounting systems	Human resources systems	Other types (e.g., university)
Major functions of system	Customer service Sales management Promotion tracking Price changes Dealer communications	Scheduling Purchasing Shipping/receiving Operations	General ledger Billing Cost accounting	Personnel records Benefits Compensation Labor relations Training	Admissions Grade records Course records Alumni records
Major application systems	Sales order information system Sales commission system Sales support system	Machine control systems Purchase order systems Quality control systems	General ledger Payroll Accounts receivable/payable Funds management systems	Employee records Benefit systems Employee skills inventory	Registration system Student transcript system Curriculum class control systems Alumni benefactor system

FIGURE 2-4 Typical applications of TPS
There are five functional categories of TPS: sales/marketing, manufacturing/production, finance/ accounting, human resources, and other types of systems specific to a particular industry. Within each of these major functions are subfunctions. For each of these subfunctions (e.g., sales management) there is a major application system.

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?

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 types of systems. (For example, the payroll system illustrated here, 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.)

MANAGEMENT INFORMATION SYSTEMS

In Chapter 1, we define management information systems as the study of information systems in business and management. The term management information systems (MIS) also designates a specific category of information systems serving management-level functions. Management information systems (MIS) serve the management level of the organization, providing managers with reports and often online access to the

Consolidated Consumer Products Corporation Sales by Product and Sales Region: 2005

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

FIGURE 2-6 A sample MIS report
This report showing summarized annual sales data was produced by the MIS in Figure 2-5.

MIS usually serve managers primarily interested in weekly, monthly, and yearly results, although some MIS enable managers to drill down to see daily or hourly data if required. MIS generally provide answers to routine questions that have been specified in advance and have a predefined procedure for answering them. For instance, MIS reports might list the total pounds of lettuce used this quarter by a fast-food chain or, as illustrated in Figure 2-6, compare total annual sales figures for specific products to planned targets. These systems are generally not flexible and have little analytical capability. Most MIS use simple routines such as summaries and comparisons, as opposed to sophisticated mathematical models or statistical techniques.

DECISION-SUPPORT SYSTEMS

Decision-support systems (DSS) also serve the management level of the organization. DSS help managers make decisions that are unique, rapidly changing, and not easily specified in advance. They address problems where the procedure for arriving at a solution may not be fully predefined in advance. Although 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.

Clearly, by design, DSS have more analytical power than other systems. They use a variety of models to analyze data, or they condense large amounts of data into a form in which they can be analyzed by decision makers. DSS are designed so that users can work with them directly; these systems explicitly include user-friendly software. DSS are interactive; the user can change assumptions, ask new questions, and include new data.

An interesting, small, but powerful DSS is the voyage-estimating system of a subsidiary of a large American metals company that exists primarily to carry bulk cargoes of coal, oil, ores, and finished products for its parent company. 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 ship/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 2-7 illustrates the DSS built for this company. The system operates on a powerful desktop personal computer, providing a system of menus that makes it easy for users to enter data or obtain information.

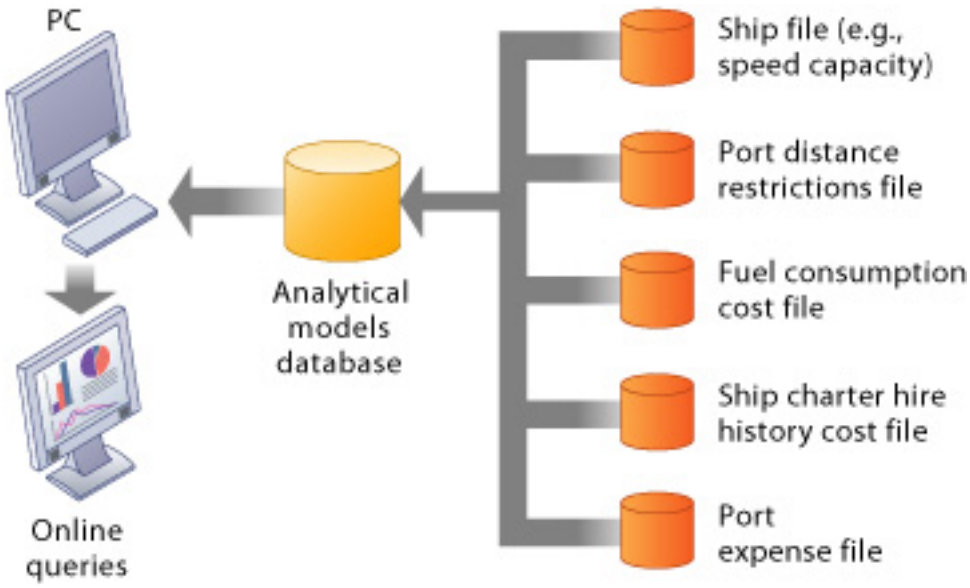


FIGURE 2-7 Voyage-estimating decision-support system
This DSS operates on a powerful PC. It is used daily by managers who must develop bids on shipping contracts.

This voyage-estimating DSS draws heavily on analytical models. Other types of DSS are less model-driven, focusing instead on extracting useful information to support decision making from massive quantities of data. For example, Intrawest—the largest ski operator in North America—collects and stores vast amounts of customer data from its Web site, call center, lodging reservations, ski schools, and ski equipment rental stores. It uses special software to analyze these data to determine the value, revenue potential, and loyalty of each customer so managers can make better decisions on how

to target their marketing programs. The system segments customers into seven categories based on needs, attitudes, and behaviors, ranging from “passionate experts” to “value-minded family vacationers.” The company then e-mails video clips that would appeal to each segment to encourage more visits to its resorts.

Sometimes you’ll hear DSS systems referred to as business intelligence systems because they focus on helping users make better business decisions. You’ll learn more about them in Chapter 13.

Executive Support Systems

Senior managers use executive support systems (ESS) to help them make decisions. ESS serve the strategic level of the organization. They address nonroutine decisions requiring judgment, evaluation, and insight because there is no agreed-on procedure for arriving at a solution.

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. 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.

ESS employ the most advanced graphics software and can present graphs and data from many sources. Often the information is delivered to senior executives through a portal, which uses a Web interface to present integrated personalized business content from a variety of sources. You will learn more about other applications of portals in Chapters 4, 11, and 12.

Unlike the other types of information systems, ESS are not designed primarily to solve specific problems. Instead, ESS provide a generalized computing and communications capacity that can be applied to a changing array of problems. Although many DSS are designed to be highly analytical, ESS tend to make less use of analytical models.

Questions ESS assist in answering include the following: In what business should we be? What are the competitors doing? What new acquisitions would protect us from cyclical business swings? Which units should we sell to raise cash for acquisitions? Figure 2-8 illustrates a model of an ESS. It consists of workstations with menus, interactive graphics, and communications capabilities that can be used to access historical and competitive data from internal corporate systems and external databases such as Dow Jones News/Retrieval or Standard & Poor’s. Because ESS are designed to be used by senior managers who often have little, if any, direct contact or experience with computer-based information systems, they incorporate easy-to-use graphic interfaces. More details on leading-edge applications of DSS and ESS can be found in Chapter 13.

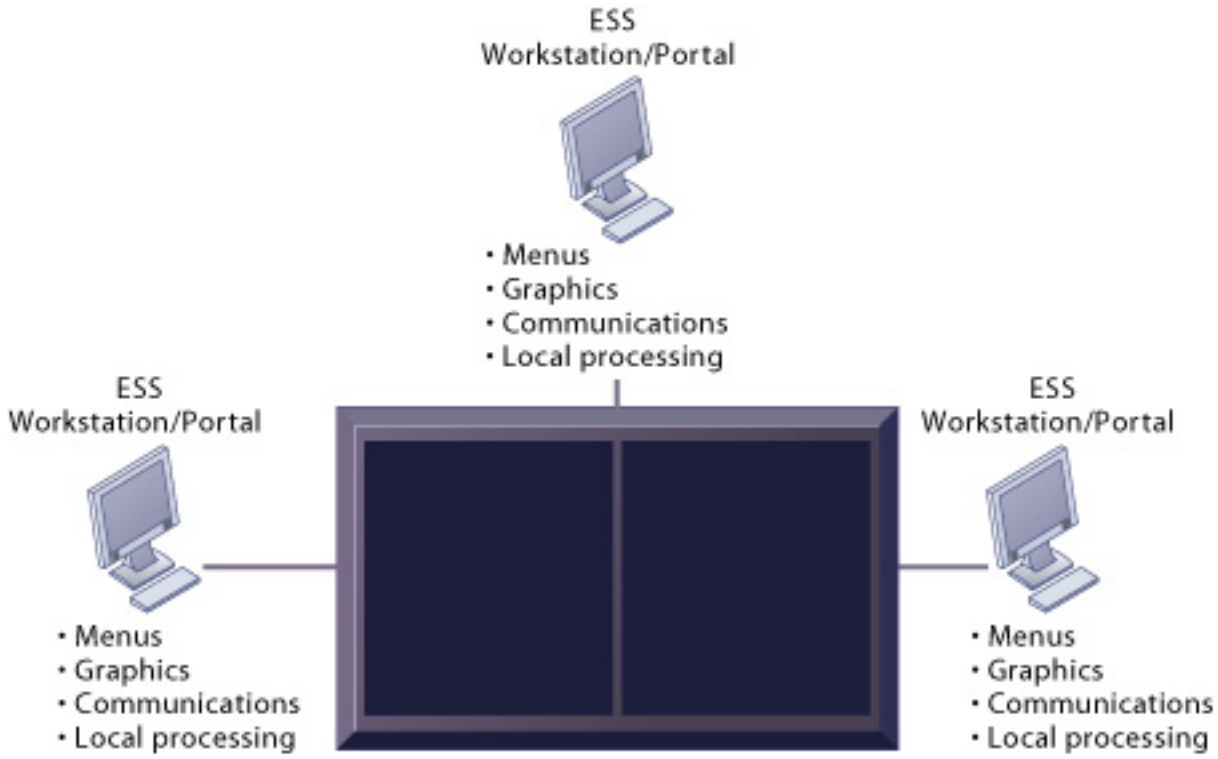


FIGURE 2-8 Model of a typical executive support system
This system pools data from diverse internal and external sources and makes them available to executives in an easy-to-use form.

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Relationship of Systems to One Another

Figure 2-9 illustrates how the systems serving different levels in the organization are related to one another. TPS are typically a major source of data for other systems, whereas ESS are primarily a recipient of data from lower-level systems. The other types of systems may exchange data with each other as well. Data may also be exchanged among systems serving different functional areas. For example, an order captured by a sales system may be transmitted to a manufacturing system as a transaction for producing or delivering the product specified in the order or to a MIS for financial reporting.

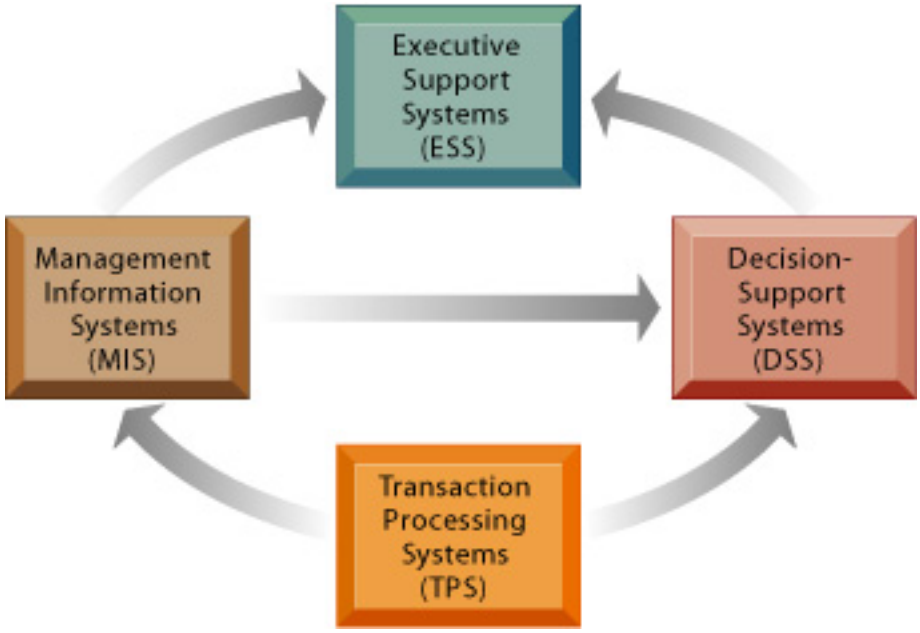

FIGURE 2-9 Interrelationships among systems
The various types of systems in the organization have interdependencies. TPS are major producers of information that is required by the other systems, which, in turn, produce information for other systems. These different types of systems have been loosely coupled in most organizations.

It is definitely advantageous to integrate these systems so that information can flow easily between different parts of the organization and provide management with an enterprise-wide view of how the organization is performing as a whole. But integration costs money, and integrating many different systems is extremely time consuming and complex. This is a major challenge for large organizations, which are typically saddled with hundreds, even thousands of different applications serving different levels and business functions. Each organization must weigh its needs for integrating systems against the difficulties of mounting a large-scale systems integration effort. Section 2.3 and Chapter 11 treat this issue in greater detail.

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SYSTEMS FROM A FUNCTIONAL PERSPECTIVE

Information systems can be classified by the specific organizational function they serve as well as by organizational level. We now describe typical information systems that support each of the major business functions and provide examples of functional applications for each organizational level.

Sales and Marketing Systems

The sales and marketing function is responsible for selling the organization's products or services. Marketing is concerned with identifying the customers for the firm's products or services, determining what customers need or want, planning and developing products and services to meet their needs, and advertising and promoting these products and services. Sales is concerned with contacting customers, selling the products and services, taking orders, and following up on sales. Sales and marketing information systems support these activities.

Table 2-2 shows that information systems are used in sales and marketing in a number of ways. At the strategic level, sales and marketing systems monitor trends affecting new products and sales opportunities, support planning for new products and services, and monitor the performance of competitors. At the management level, sales and marketing systems support market research, advertising and promotional campaigns, and pricing decisions. They analyze sales performance and the performance of the sales staff. At the operational level, sales and marketing systems assist in locating and contacting prospective customers, tracking sales, processing orders, and providing customer service support.

TABLE 2-2 Examples of Sales and Marketing Information Systems

System	Description	Organizational Level
Order processing	Enter, process, and track orders	Operational
Pricing analysis	Determine prices for products and services	Management
Sales trend forecasting	Prepare 5-year sales forecasts	Strategic

Review Figure 2-6. It shows the output of a typical sales information system at the

management level. The system consolidates data about each item sold (such as the product code, product description, and amount sold) for further management analysis. Company managers examine these sales data to monitor sales activity and buying trends.

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Manufacturing and Production Systems

The manufacturing and production function is responsible for actually producing the firm's goods and services. Manufacturing and production systems deal with the planning, development, and maintenance of production facilities; the establishment of production goals; the acquisition, storage, and availability of production materials; and the scheduling of equipment, facilities, materials, and labor required to fashion finished products. Manufacturing and production information systems support these activities.

Information systems can guide the actions of machines and equipment to help pharmaceutical and other types of firms monitor and control the manufacturing process.

Table 2-3 shows some typical manufacturing and production information systems arranged by organizational level. Strategic-level manufacturing systems deal with the firm's long-term manufacturing goals, such as where to locate new plants or whether to invest in new manufacturing technology. At the management level, manufacturing and production systems analyze and monitor manufacturing and production costs and

resources. Operational manufacturing and production systems deal with the status of production tasks.

TABLE 2-3 Examples of Manufacturing and Production Information Systems

System	Description	Organizational Level
Machine control	Control the actions of machines and equipment	Operational
Production planning	Decide when and how many products should be produced	Management
Facilities location	Decide where to locate new production facilities	Strategic

Most manufacturing and production systems use some sort of inventory system, as illustrated in Figure 2-10. Data about each item in inventory, such as the number of units depleted because of a shipment or purchase or the number of units replenished by reordering or returns, are either scanned or keyed into the system. The inventory master file contains basic data about each item, including the unique identification code for each item, a description of the item, the number of units on hand, the number of units on order, and the reorder point (the number of units in inventory that triggers a decision to reorder to prevent a stockout). Companies can estimate the number of items to reorder, or they can use a formula for calculating the least expensive quantity to reorder called the economic order quantity. The system produces reports that give information about such things as the number of each item available in inventory, the number of units of each item to reorder, or items in inventory that must be replenished.

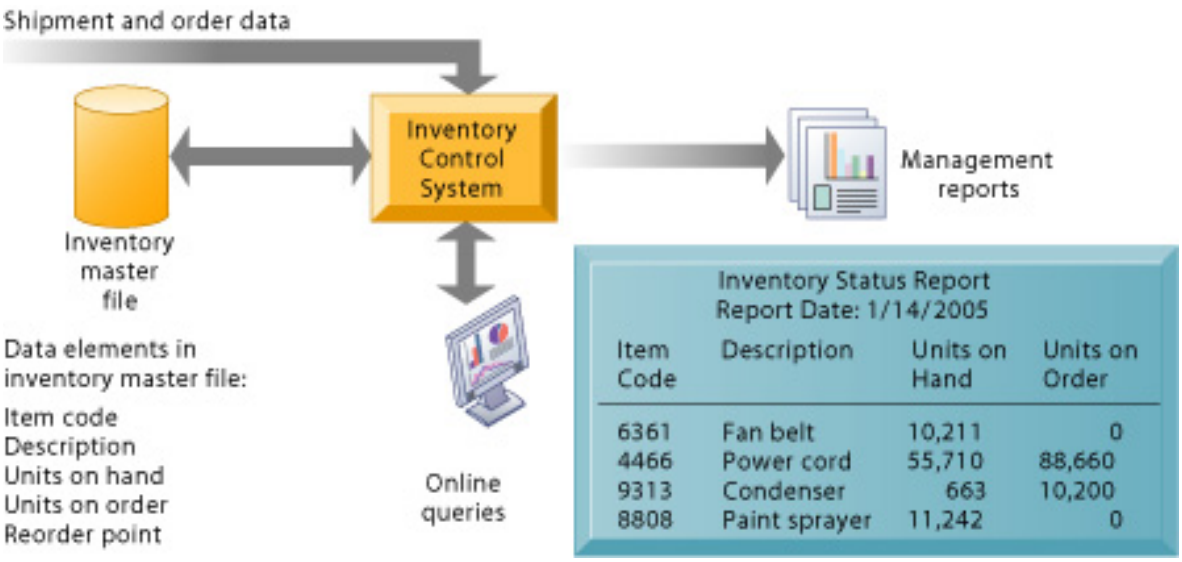

FIGURE 2-10 Overview of an inventory system
This system provides information about the number of items available in inventory to support manufacturing and production activities.

Product life cycle management (PLM) systems are one type of manufacturing and production system that has become increasingly valuable in the automotive, aerospace, and consumer products industries. PLM systems are based on a data repository that organizes every piece of information that goes into making a particular product, such as formula cards, packaging information, shipping specifications, and patent data. Once all these data are available, companies can select and combine the data they need to serve specific functions. For, example, designers and engineers can use the data to determine which parts are needed for a new design, whereas retailers can use them to determine shelf height and how materials should be stored in warehouses.

For many years, engineering-intensive industries have used computer-aided design (CAD) systems to automate the modeling and design of their products. The software enables users to create a digital model of a part, a product, or a structure and make changes to the design on the computer without having to build physical prototypes. PLM software goes beyond CAD software to include not only automated modeling and design capabilities but also tools to help companies manage and automate materials sourcing, engineering change orders, and product documentation, such as test results, product packaging, and postsales data. The Window on Organizations describes how these systems are providing new sources of value.

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Window on Organizations

PRODUCT LIFE CYCLE MANAGEMENT SYSTEMS: FASTER PRODUCTS, FASTER PROCESSES

What if there were a way to determine automatically the feasibility of a new product's design? What if all the information related to that product—the marketing plan, design criteria, product specifications, testing data, and packaging data—were immediately available to make sure that design could be easily manufactured and sold? What if this information were instantly available to designers, engineers, suppliers, marketing staff, and anyone else involved in the development and rollout of a new product? Enter product life cycle management (PLM) systems.

Nissan Diesel Motor Company, established in 1950, manufactures trucks and buses. Its product line includes a wide range of light-, medium-, and heavy-duty vehicles, buses, and bus chassis, engines, vehicle components, and special-purpose engines. The company has distributors in nearly 60 countries around the world.

Developing a truck model involves more components and complex assembly combinations than developing passenger cars, generating vast amounts of data to manage. Like other truck manufacturers, Nissan Diesel Motor Company faced a challenge in keeping this complex product data organized. It turned to IBM and Dassault Systems' ENOVIA Product Life Cycle Management product for a solution.

Nissan Diesel used ENOVIA's Digital Mock-Up (DMU) Navigator to manage and

percent while saving as much as $150,000 per year.

Source: Debra D'Agostino, "PLM: The Means of Production," eWeek, February 7, 2004; Beth Bacheldor, "Deeper Than Designs," Information Week, August 9, 2004, and "Product Life-Cycle Management Market Ramps Up," Information Week, July 19, 2004; and Dassault Systems, "Nissan Diesel Develops Vehicle Configuration Management System with PLM Solutions from IBM and Dassault Systems," July 12, 2004.

To Think About: How do project life cycle management systems provide value for these companies? Should every company that manufactures products use this software? Explain your answer.

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Finance and Accounting Systems

The finance function is responsible for managing the firm's financial assets, such as cash, stocks, bonds, and other investments, to maximize the return on these financial assets. The finance function is also in charge of managing the capitalization of the firm (finding new financial assets in stocks, bonds, or other forms of debt). To determine whether the firm is getting the best return on its investments, the finance function must obtain a considerable amount of information from sources external to the firm.

The accounting function is responsible for maintaining and managing the firm's financial records—receipts, disbursements, depreciation, payroll—to account for the flow of funds in a firm. Finance and accounting share related problems—how to keep track of a firm's financial assets and fund flows. They provide answers to questions such as these: What is the current inventory of financial assets? What records exist for disbursements, receipts, payroll, and other fund flows?

Table 2-4 shows some of the typical finance and accounting information systems found in large organizations. Strategic-level systems for the finance and accounting function establish long-term investment goals for the firm and provide long-range forecasts of the firm's financial performance. At the management level, information systems help managers oversee and control the firm's financial resources. Operational systems in finance and accounting track the flow of funds in the firm through transactions such as paychecks, payments to vendors, securities reports, and receipts.

TABLE 2-4 Examples of Finance and Accounting Information Systems

System	Description	Organizational Level
Accounts receivable	Tracks money owed the firm	Operational
Budgeting	Prepares short-term budgets	Management
Profit planning	Plans long-term profits	Strategic

Review Figure 2-3, which illustrates a payroll system, a typical accounting TPS found in all businesses with employees. You can find more examples of financial systems in the chapter-ending case study on Snyder's of Hanover.

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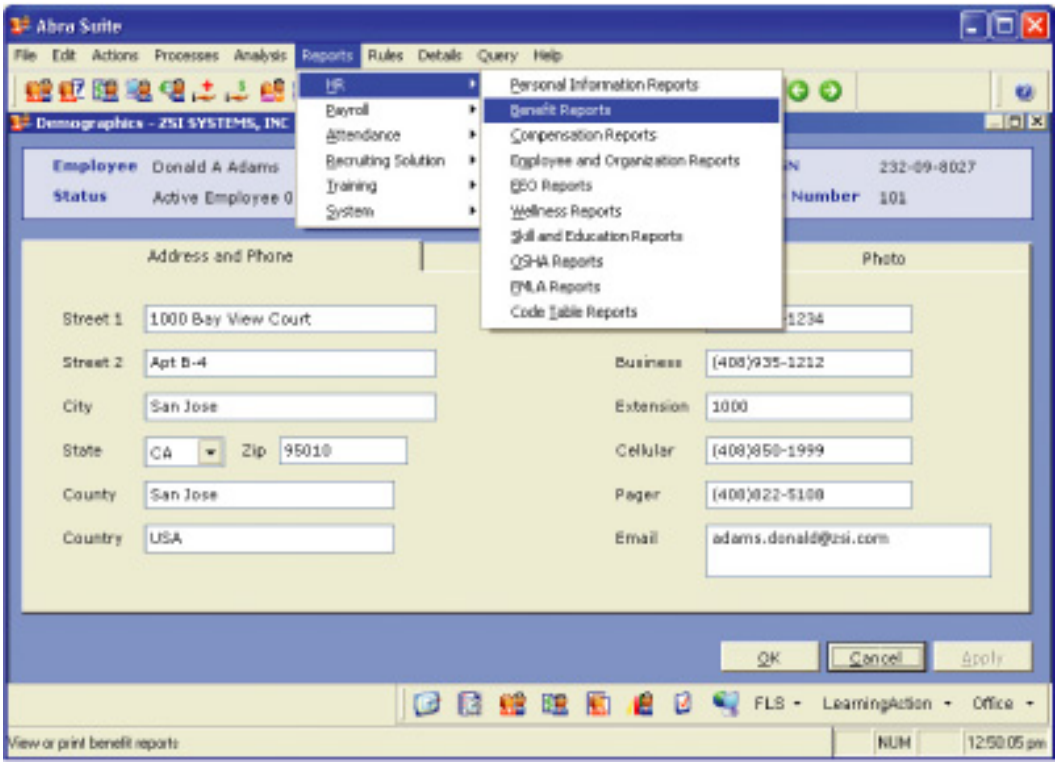
Human Resources Systems

The human resources function is responsible for attracting, developing, and maintaining the firm's workforce. Human resources information systems support activities, such as identifying potential employees, maintaining complete records on existing employees, and creating programs to develop employees' talents and skills.



Delphia Consulting's ABRA Suite software for human resources and payroll management includes online tools to view and change employment and payroll information. Human resources information systems reduce administrative costs, provide faster service to employees, and help firms manage their workforce.

Internet Connection

The Internet Connection for this chapter will take you to a series of Web sites where you can complete an exercise to evaluate the capabilities of human resources software.

Strategic-level human resources systems identify the manpower requirements (skills, educational level, types of positions, number of positions, and cost) for meeting the firm's long-term business plans. At the management level, human resources systems help managers monitor and analyze the recruitment, allocation, and compensation of employees. Human resources operational systems track the recruitment and placement of the firm's employees (see Table 2-5).

TABLE 2-5 Examples of Human Resources Information Systems

System	Description	Organizational Level
Training and development	Tracks employee training, skills, and performance appraisals	Operational
Compensation analysis	Monitors the range and distribution of employee wages, salaries, and benefits	Management
Human resources planning	Plans the long-term labor force needs of the organization	Strategic

Figure 2-11 illustrates a typical human resources TPS for employee record keeping. It maintains basic employee data, such as the employee's name, age, sex, marital status, address, educational background, salary, job title, date of hire, and date of termination. The system can produce a variety of reports, such as lists of newly hired employees, employees who are terminated or on leaves of absence, employees classified by job type or educational level, or employee job performance evaluations. Such systems are typically designed to provide data that can satisfy federal and state record keeping requirements for Equal Employment Opportunity (EEO) and other purposes.

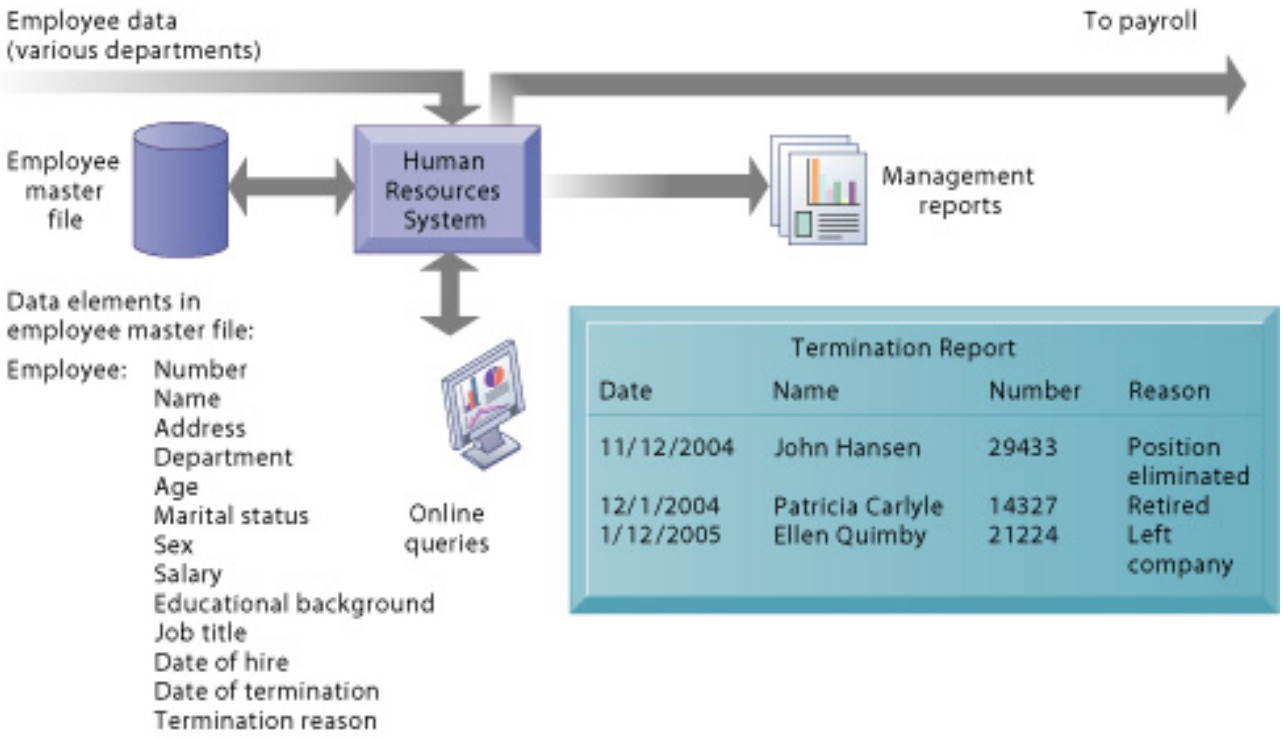


FIGURE 2-11 An employee record keeping system
This system maintains data on the firm's employees to support the human resources function.

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INTEGRATING FUNCTIONS AND BUSINESS PROCESSES: INTRODUCTION TO ENTERPRISE APPLICATIONS

One of the major challenges facing firms today is putting together data from the systems we have just described to make information flow across the enterprise. Electronic commerce, electronic business, and intensifying global competition are forcing firms to focus on speed to market, improving customer service, and more efficient execution. The flow of information and work needs to be orchestrated so that the organization can perform like a well-oiled machine. These changes require powerful new systems that can integrate information from many different functional areas and organizational units and coordinate firm activities with those of suppliers and other business partners.

Business Processes and Information Systems

The new digital firm business environment requires companies to think more strategically about their business processes, which we introduced in Chapter 1. Business processes refer to sets of logically related activities for accomplishing a specific business result. Business processes also refer to the unique ways in which organizations and management coordinate these activities. A company's business processes can be a source of competitive strength if they enable the company to innovate better 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.

Some business processes support the major functional areas of the firm, others are cross-functional. Table 2-6 describes some typical business processes for each of the functional areas.

TABLE 2-6 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

Many business processes are cross-functional, transcending the boundaries between sales, marketing, manufacturing, and research and development. These cross-functional processes cut across the traditional organizational structure, grouping employees from different functional specialties to complete a piece of work. For example, the order fulfillment process at many companies requires cooperation among the sales function (receiving the order, entering the order), the accounting function (credit checking and billing for the order), and the manufacturing function (assembling and shipping the order). Figure 2-12 illustrates how this cross-functional process might work. Information systems support these cross-functional processes as well as processes for the separate business functions.

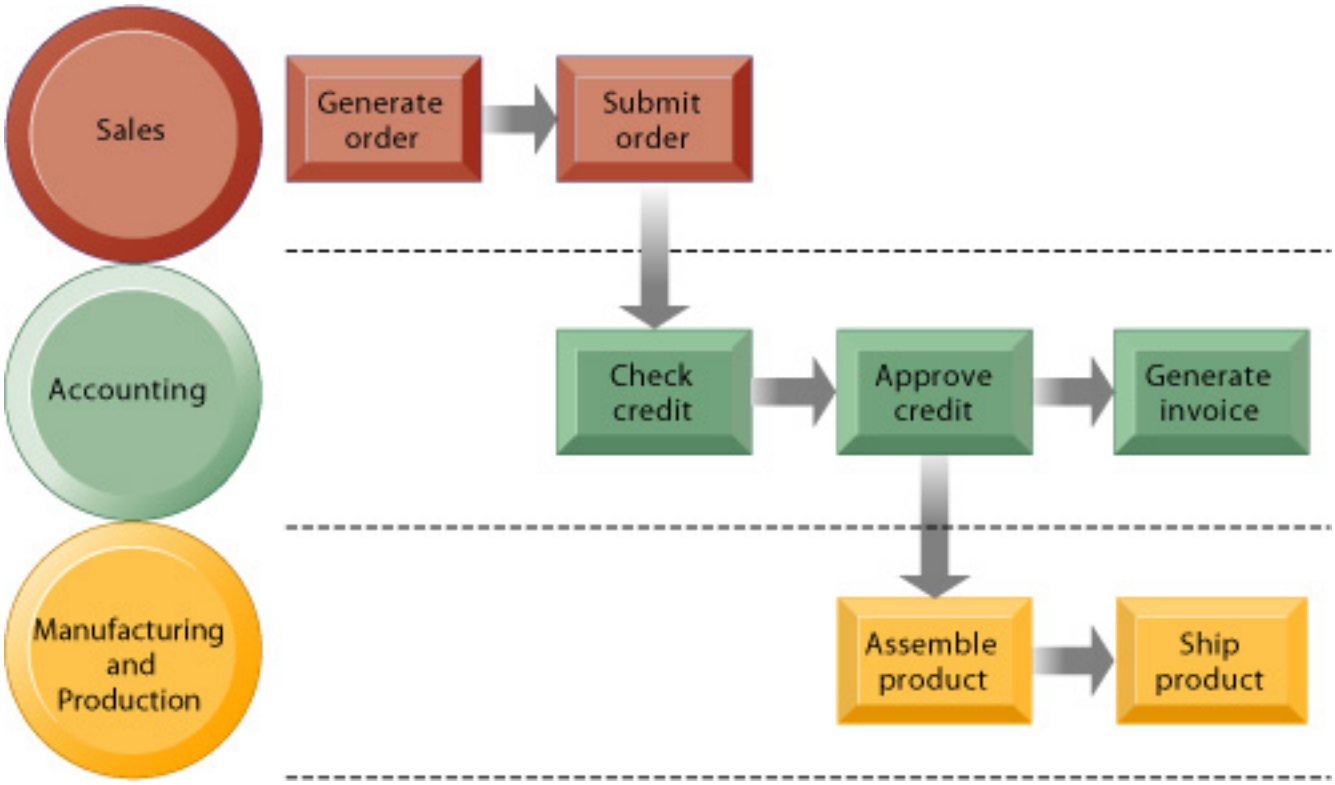

FIGURE 2-12 The order fulfillment process
Generating and fulfilling an order is a multistep process involving activities performed by the sales, manufacturing and production, and accounting functions.

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Systems for Enterprise-Wide Process Integration

Today's firms are finding that they can become more flexible and productive by coordinating their business processes more closely and, in some cases, integrating these processes so they focus on efficient management of resources and customer service. Enterprise applications are designed to support organization-wide process coordination and integration. These enterprise applications consist of enterprise systems, supply chain management systems, 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.

Generally, these more contemporary systems take advantage of corporate intranets and Web technologies that enable the efficient transfer of information within the firm and to partner firms. These systems are inherently cross-level, cross-functional, and business process oriented. Figure 2-13 shows that the architecture for these enterprise applications encompasses processes spanning the entire organization and, in some cases, extending beyond the organization to customers, suppliers, and other key business partners.

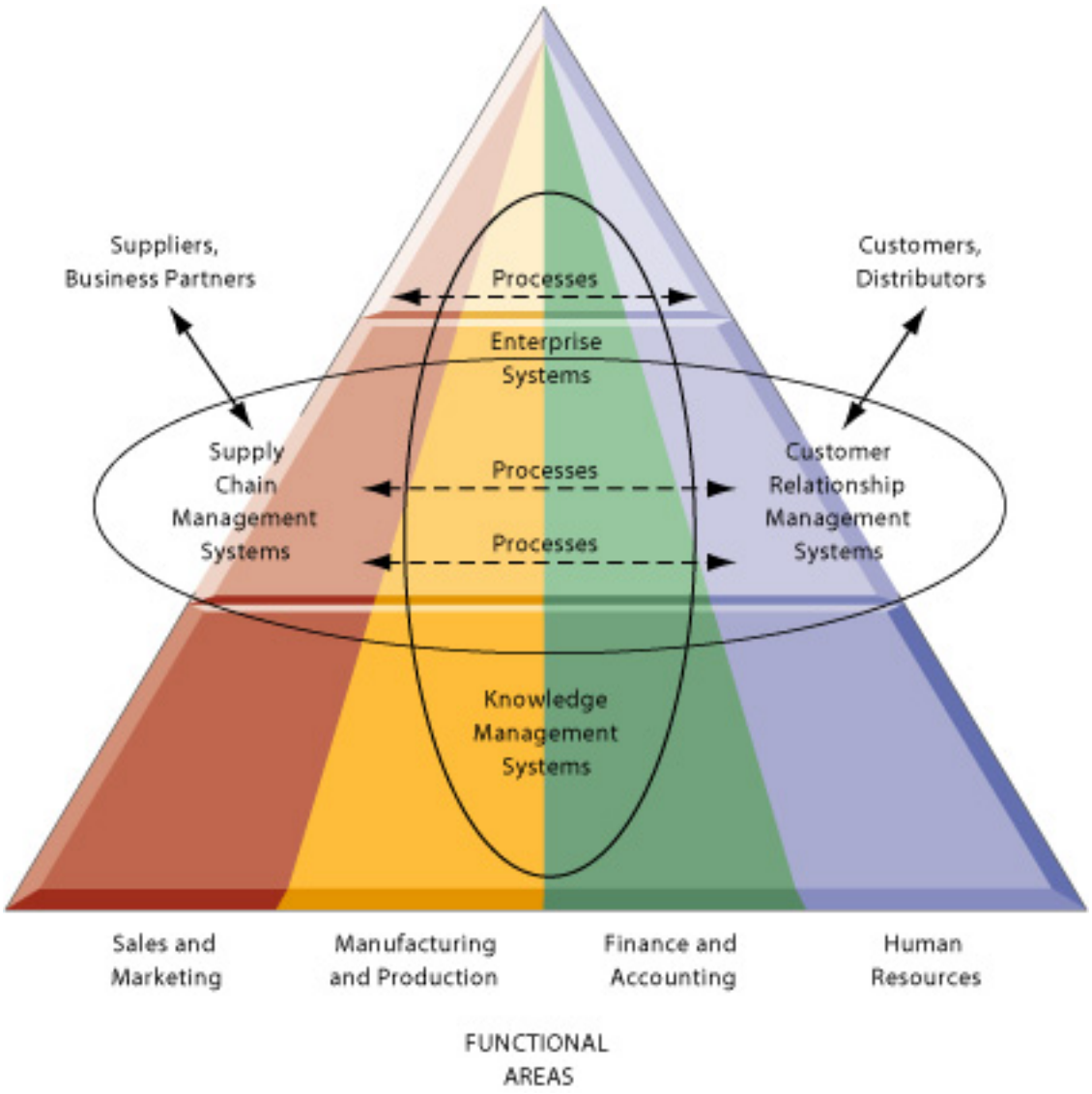

FIGURE 2-13 Enterprise application architecture
Enterprise applications automate processes that span multiple business functions and organizational levels and may extend outside the organization.

Enterprise systems create an integrated organization-wide platform to coordinate key internal processes of the firm. Information systems for supply chain management (SCM) and customer relationship management (CRM) help coordinate processes for managing the firm's relationship with its suppliers and customers. Knowledge management systems enable organizations to better manage processes for capturing and applying knowledge and expertise. Collectively, these four systems represent the areas in which corporations are digitally integrating their information flows and making major information system investments.

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Overview of Enterprise Applications

Let's look briefly at each of the major enterprise applications to see how they fit into the overall information architecture of the enterprise. We examine enterprise systems and systems for supply chain management and customer relationship management in greater detail in Chapter 11 and cover knowledge management applications in Chapter 12.

OVERVIEW OF ENTERPRISE SYSTEMS

A large organization typically has many different kinds of information systems that support different functions, organizational levels, and business processes. Most of these systems were built around different functions, business units, and business processes that do not "talk" to each other and thus cannot automatically exchange information. Managers might have a hard time assembling the data they need for a comprehensive, overall picture of the organization's operations. For instance, sales personnel might not be able to tell at the time they place an order whether the items that were ordered were in inventory; customers could not track their orders; and manufacturing could not communicate easily with finance to plan for new production. This fragmentation of data in hundreds of separate systems could thus have a negative impact on organizational efficiency and business performance. Figure 2-14 illustrates the traditional arrangement of information systems.

FIGURE 2-14 Traditional view of systems
In most organizations today, separate systems built over a long period of time support discrete business processes and discrete segments of the business value chain. The organization's systems rarely include vendors and customers.

Enterprise systems, also known as enterprise resource planning (ERP) systems solve this problem by providing a single information system for organization-wide coordination and integration of key business processes. Information that was previously fragmented in different systems can seamlessly

flow throughout the firm so that it can be shared by business processes in manufacturing, accounting, human resources, and other areas. Discrete business processes from sales, production, finance, and logistics can be integrated into company-wide business processes that flow across organizational levels and functions. Figure 2-15 illustrates how enterprise systems work.

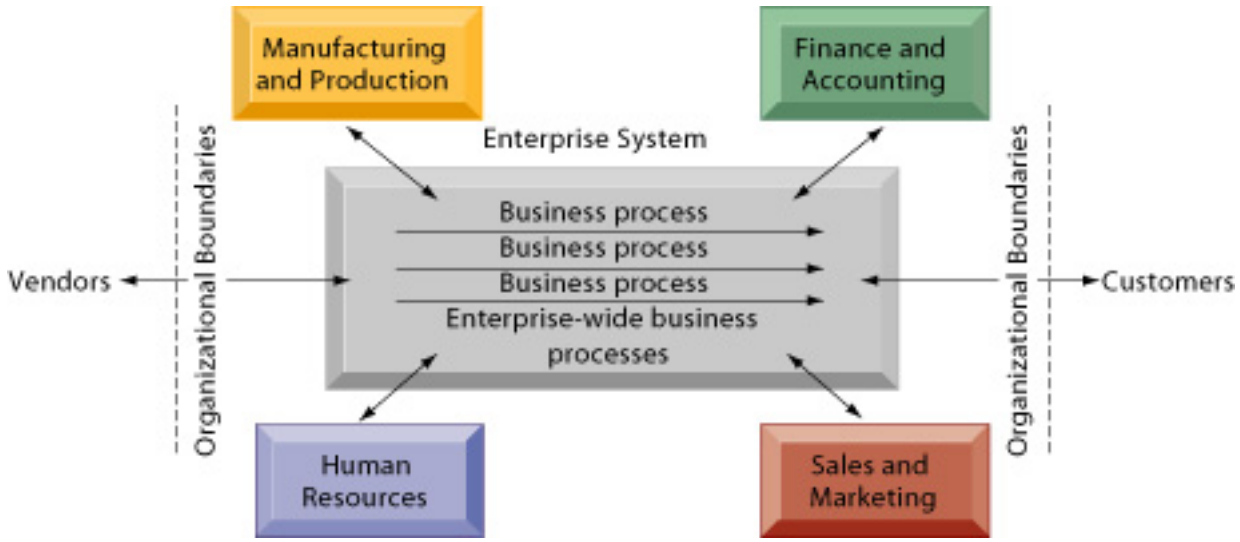

FIGURE 2-15 Enterprise systems
Enterprise systems integrate the key business processes of an entire firm into a single software system that enables information to flow seamlessly throughout the organization. These systems focus primarily on internal processes but may include transactions with customers and vendors.

The enterprise system collects data from various key business processes in manufacturing and production, finance and accounting, sales and marketing, and human resources and stores the data in a single comprehensive data repository where they can be used by other parts of the business. Managers emerge with more precise and timely information for coordinating the daily operations of the business and a firmwide view of business processes and information flows.

For instance, when a sales representative in Brussels enters a customer order, the data flow automatically to others in the company who need to see them. The factory in Hong Kong receives the order and begins production. The warehouse checks its progress online and schedules the shipment date. The warehouse can check its stock of parts and replenish whatever the factory has depleted. The enterprise system stores production information, where it can be accessed by customer service representatives to track the progress of the order through every step of the manufacturing process. Updated sales and production data automatically flow to the accounting department. The system transmits information for calculating the salesperson's commision to the payroll department. The system also automatically recalculates the company's balance sheets, accounts receivable and payable ledgers, cost-center accounts, and available cash. Corporate headquarters in London can view up-to-the-minute data on sales, inventory, and production at every step of the process, as well as updated sales and production forecasts and

calculations of product cost and availability. Chapter 11 provides more detail on enterprise system capabilities.

OVERVIEW OF SUPPLY CHAIN MANAGEMENT SYSTEMS

Supply chain management (SCM) systems are more outward facing, focusing on helping the firm manage its relationship with suppliers to optimize the planning, sourcing, manufacturing, and delivery of products and services. These systems provide information to help suppliers, purchasing firms, distributors, and logistics companies coordinate, schedule, and control business processes for procurement, production, inventory management, and delivery of products and services.

Supply chain management systems are one type of interorganizational system because they automate the flow of information across organizational boundaries. A firm using a supply chain management system would exchange information with its suppliers about availability of materials and components, delivery dates for shipments of supplies, and production requirements. It might also use the system to exchange information with its distributors about inventory levels, the status of orders being fulfilled, or delivery dates for shipments of finished goods. 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.

Table 2-7 describes how firms can benefit from supply chain management systems. The ultimate objective is to get the right amount of their products from their source to their point of consumption with the least amount of time and with the lowest cost. Supply chain management systems can be built using intranets, extranets, or special supply chain management software.

TABLE 2-7 How Information Systems Facilitate Supply Chain Management

INFORMATION FROM SUPPLY CHAIN MANAGEMENT SYSTEMS HELPS FIRMS:
Decide when and what to produce, store, and move
Rapidly communicate orders
Track the status of orders
Check inventory availability and monitor inventory levels
Reduce inventory, transportation, and warehousing costs
Track shipments
Plan production based on actual customer demand
Rapidly communicate changes in product design

Figure 2-16 illustrates the supply chain management systems used by Haworth, a world-leading manufacturer and designer of office furniture described in the Window on

Technology. Haworth needed to synchronize manufacturing and distribution activities to cut costs and boost efficiency by having material flow continuously from multiple manufacturing centers to multiple distribution centers. It implemented new systems for warehouse management and transportation management. These systems enable Haworth to deliver multipart shipments requiring assembly in the correct sequence, accommodate shipping volumes that can vary by a factor of 10 from one day to the next, and handle last-minute changes in customer orders.

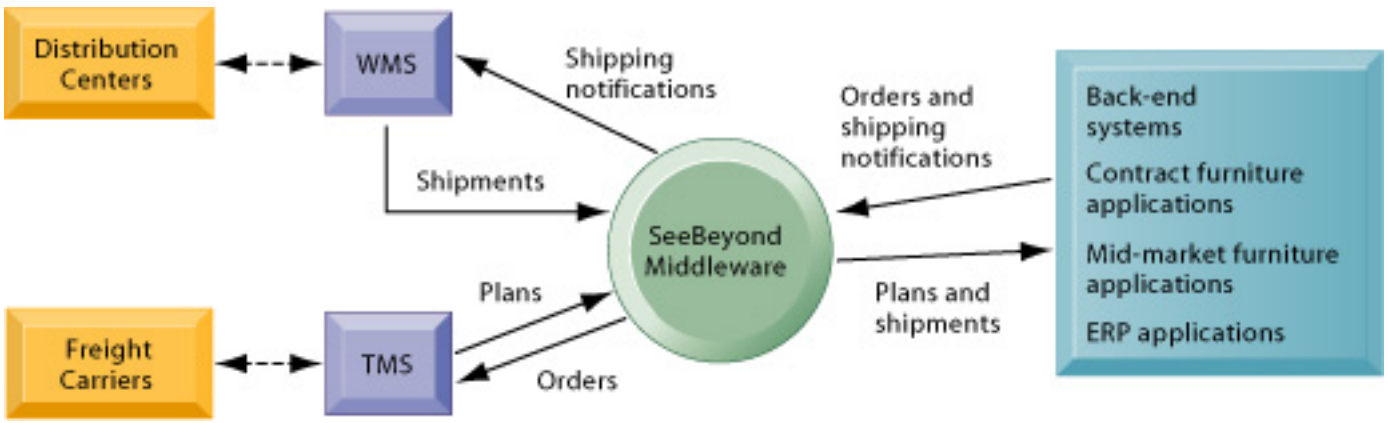

FIGURE 2-16 Haworth's supply chain management systems
Customer orders, shipping notifications, optimized shipping plans, and other supply chain information flow among Haworth's Warehouse Management System (WMS), Transportation Management System (TMS), and its back-end enterprise systems and other corporate applications.

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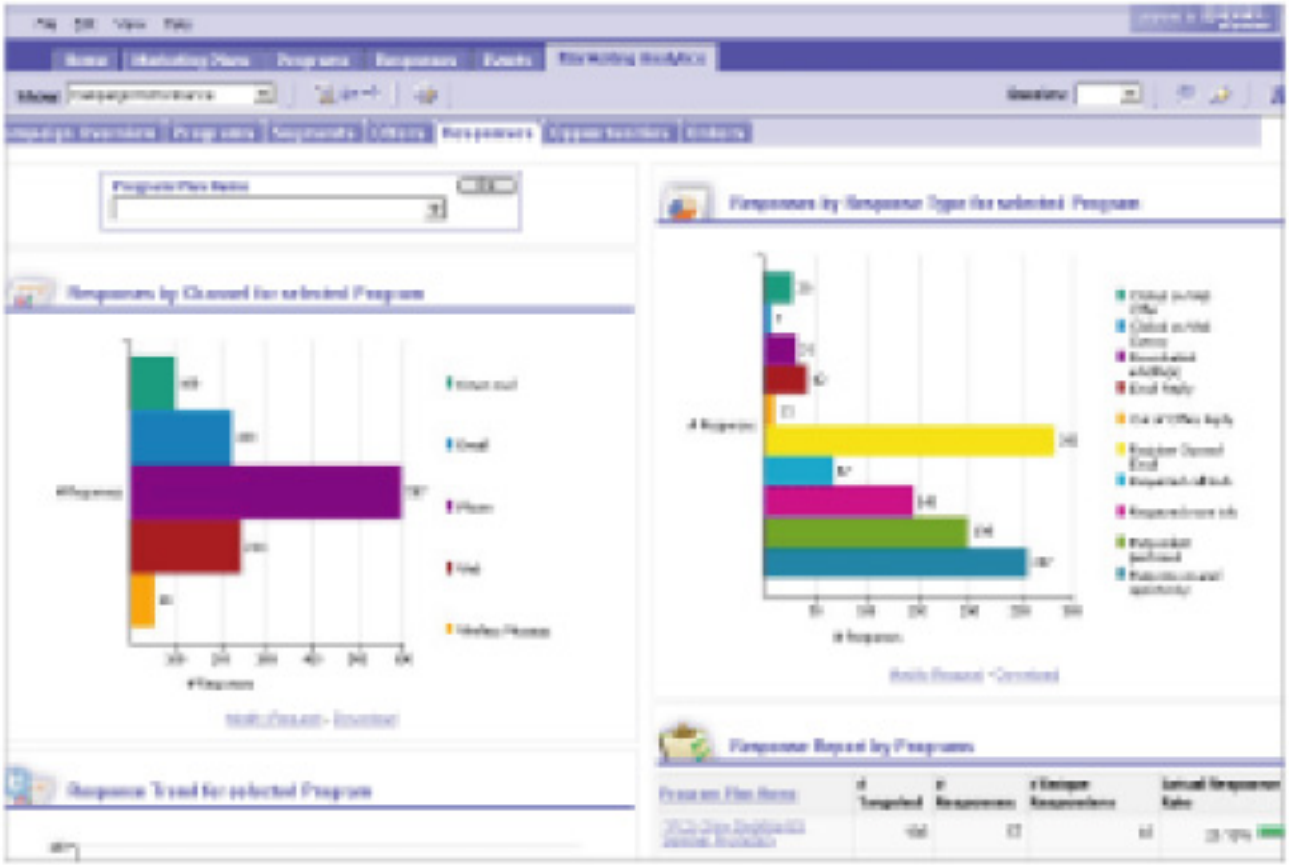
OVERVIEW OF CUSTOMER RELATIONSHIP MANAGEMENT SYSTEMS

Instead of treating customers as exploitable sources of income, businesses are now viewing them as long-term assets to be nurtured through customer relationship management. Customer relationship management (CRM) systems focus on coordinating all of the business processes surrounding the firm's interactions with its customers in sales, marketing, and service to optimize revenue, customer satisfaction, and customer retention. The ideal CRM system provides end-to-end customer care from receipt of an order through product delivery.

In the past, a firm's processes for sales, service, and marketing were highly compartmentalized, and these departments did not share much essential customer information. Some information on a specific customer might be stored and organized in terms of that person's account with the company. Other pieces of information about the same customer might be organized by products that were purchased. There was no way to consolidate all of this information to provide a unified view of a customer across the company. CRM systems try to solve this problem by integrating the firm's customer-related processes and consolidating customer information from multiple communication channels— telephone, e-mail,



Siebel Systems customer relationship management software provides a single point through which users can manage and evaluate marketing campaigns across multiple channels, including e-mail, telephone, direct mail, the Web, and wireless messages.

Good CRM systems provide data and analytical tools for answering questions such as these: What is the value of a particular customer to the firm over his or her lifetime? Who are our most loyal customers? (It can cost six times more to sell to a new customer than to an existing customer.) Who are our most profitable customers? What do these profitable customers want to buy? Firms can then use the answers to these questions to acquire new customers, provide better service and support to existing customers, customize their offerings more precisely to customer preferences, and provide ongoing value to retain profitable customers.

OVERVIEW OF KNOWLEDGE MANAGEMENT SYSTEMS

The value of a firm's products and services is based not only on its physical resources but also on intangible knowledge assets. 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 difficult to imitate, unique, and can be leveraged into long-term strategic benefit. Knowledge management systems collect all relevant knowledge and experience in the firm and make it available wherever and whenever it is needed to support business processes and management decisions. They also link the firm to external sources of knowledge.

Knowledge management systems support processes for acquiring, storing, distributing, and applying knowledge, as well as processes for creating new knowledge and integrating it into the organization. They include enterprise-wide systems for managing and distributing documents, graphics, and other digital knowledge objects, systems for creating corporate knowledge directories of employees with special areas of expertise, office systems for distributing knowledge and information, and knowledge work systems to facilitate knowledge creation. Other knowledge management applications are expert systems that codify the knowledge of experts in information systems that can be used by other members of the organization and tools for knowledge discovery that recognize patterns and important relationships in large pools of data. Table 2-8 provides examples of knowledge management systems, and Chapter 12 describes these knowledge management applications in detail.

TABLE 2-8 Knowledge Management Systems in the Organization

Organizational Process	Role of Knowledge Management Systems
Acquiring knowledge	Knowledge discovery systems can find patterns or relationships in vast quantities of data, whereas other intelligent techniques can find solutions to problems that are too complex to be solved by humans. Knowledge work systems provide knowledge workers with graphics, analytical, communication, and document management tools, as well as access to internal and external sources of data to help them generate new ideas. Knowledge networks provide online directories of employees with special areas of expertise.
Storing knowledge	Knowledge repositories collect documents and digital media containing knowledge from internal and external sources in a single location. Expert systems elicit and incorporate expertise from human experts and embed it in software systems that can be accessed by other members of the organization.
Distributing knowledge	Office systems and communication tools distribute documents and other forms of information among information and knowledge workers and link offices to other business units inside and outside the firm. Group collaboration systems help employees access and work simultaneously on the same document from many different locations and coordinate their activities.
Applying knowledge	Organizational knowledge can be incorporated into management decision making through decision-support systems and incorporated into important business processes by being captured by key application systems, including enterprise applications.

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Window on Technology

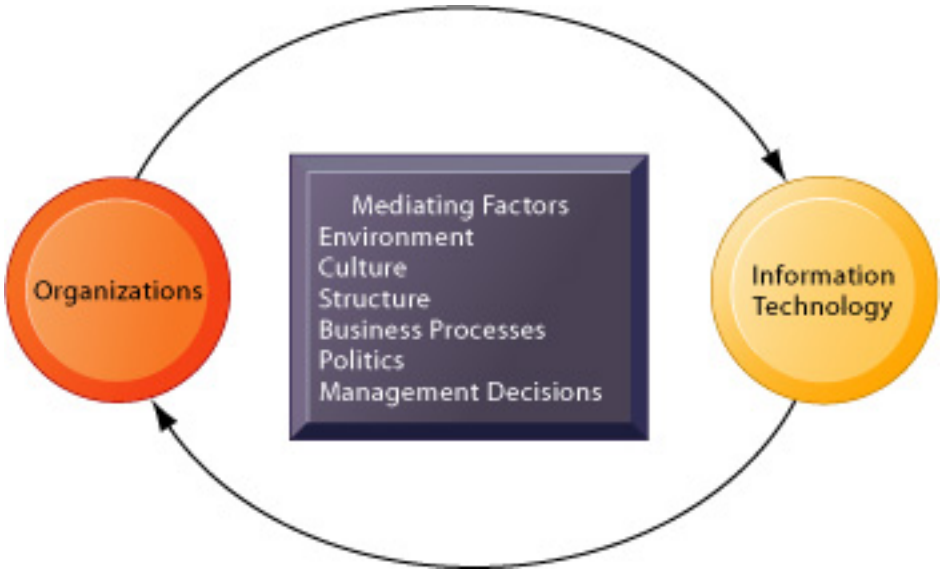

FIGURE 3-1 The two-way relationship between organizations and information technology

This complex two-way relationship is mediated by many factors, not the least of which are the decisions made—or not made—by managers. Other factors mediating the relationship include the organizational culture, structure, politics, business processes, and environment.

As a manager, you will be the one to decide which systems will be built, what they will do, and how they will be implemented. You may not be able to anticipate all of the consequences of these decisions. Some of the changes that occur in business firms because of new information technology (IT) investments cannot be foreseen and have results that may or may not meet your expectations. Who would have imagined five years ago, for instance, that e-mail and instant messaging would become a dominant form of business communication and that many managers would be inundated with more than 200 e-mail messages each day (Walker, 2004)? A technology introduced to boost productivity may actually wind up lowering it.

What is an Organization?

An organization is a stable, formal social structure that takes resources from the environment and processes them to produce outputs. This technical definition focuses on three elements of an organization. Capital and labor are primary production factors provided by the environment. The organization (the firm) transforms these inputs into products and services in a production function. The products and services are consumed by environments in return for supply inputs (see Figure 3-2).

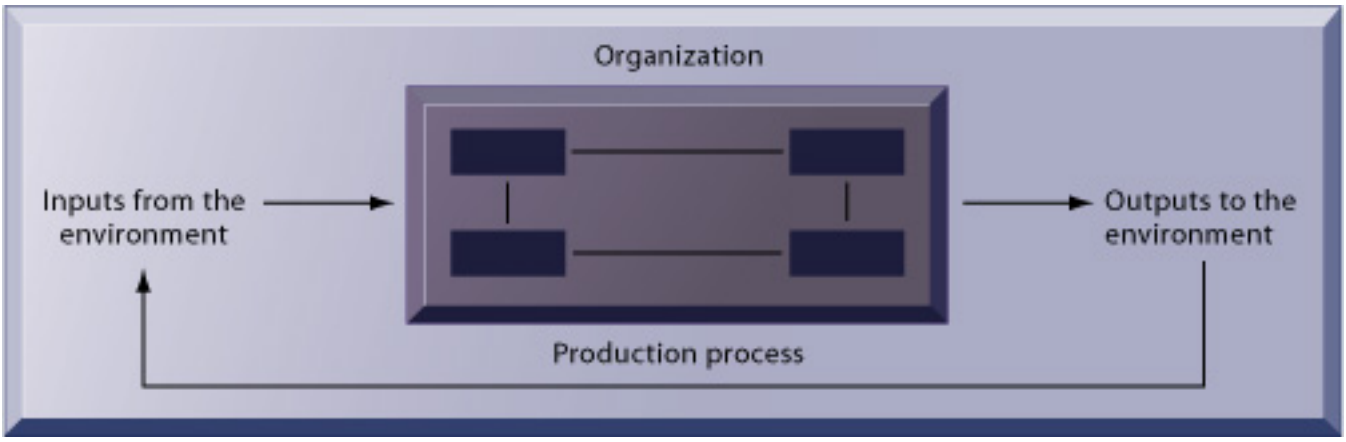

FIGURE 3-2 The technical microeconomic definition of the organization
In the microeconomic definition of organizations, capital and labor (the primary production factors provided by the environment) are transformed by the firm through the production process into products and services (outputs to the environment). The products and services are consumed by the environment, which supplies additional capital and labor as inputs in the feedback loop.

An organization is more stable than an informal group (such as a group of friends that meets every Friday for lunch) in terms of longevity and routineness. Organizations are formal legal entities with internal rules and procedures, which must abide by laws. Organizations are also social structures because they are a collection of social elements, much as a machine has a structure—a particular arrangement of valves, cams, shafts, and other parts.

This definition of organizations is powerful and simple, but it is not very descriptive or even predictive of real-world organizations. A more realistic behavioral definition of an organization is that it is a collection of rights, privileges, obligations, and responsibilities that is delicately balanced over a period of time through conflict and conflict resolution (see Figure 3-3).

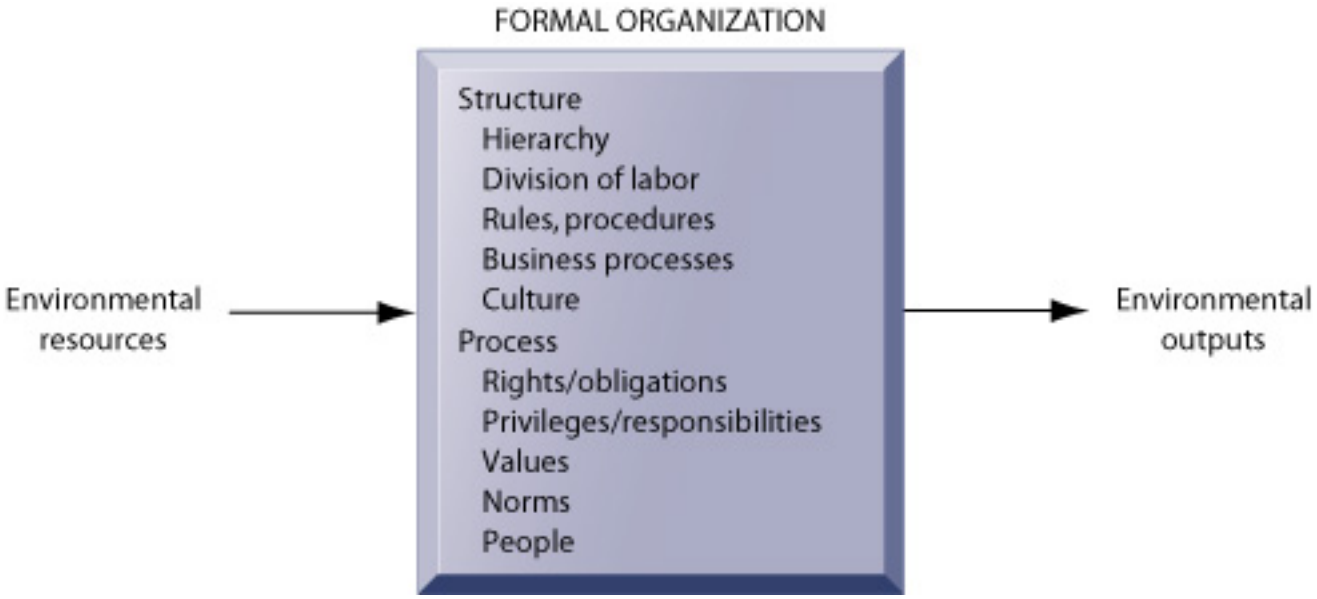

FIGURE 3-3 The behavioral view of organizations
The behavioral view of organizations emphasizes group relationships, values, and structures.

In this behavioral view of the firm, people who work in organizations develop customary ways of working; they gain attachments to existing relationships; and they make arrangements with subordinates and superiors about how work will be done, the amount of work that will be done, and under what conditions work will be done. Most of these arrangements and feelings are not discussed in any formal rulebook.

How do these definitions of organizations relate to information systems technology? A technical view of organizations encourages us to focus on how inputs are combined to create outputs when technology changes are introduced into the company. The firm is seen as infinitely malleable, with capital and labor substituting for each other quite easily. But the more realistic behavioral definition of an organization suggests that building new information systems, or rebuilding old ones, involves much more than a technical rearrangement of machines or workers. Some information systems change the organizational balance of rights, privileges, obligations, responsibilities, and feelings that have been established over a long period of time.

Changing these elements can take a long time, be very disruptive, and require more resources to support training and learning. For instance, the length of time required to implement effectively a new information system is much longer than usually anticipated simply because there is a lag between implementing a technical system and teaching employees and managers how to use the system.

Technological change requires changes in who owns and controls information; who has the right to access and update that information; and who makes decisions about whom, when, and how. This more complex view forces us to look at the way work is designed and the procedures used to achieve outputs.

The technical and behavioral definitions of organizations are not contradictory.

Indeed, they complement each other: The technical definition tells us how thousands of firms in competitive markets combine capital, labor, and information technology, whereas the behavioral model takes us inside the individual firm to see how that technology affects the organization's inner workings. Section 3.2 describes how each of these definitions of organizations can help explain the relationships between information systems and organizations.

Some features of organizations are common to all organizations; others distinguish one organization from another. Let us look first at the features common to all organizations.

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Common Features of Organizations

You might not think that Apple Computer, United Airlines, and the Aspen, Colorado, Police Department have much in common, but they do. In some respects, all modern organizations are alike because they share the characteristics that are listed in Table 3-1. German sociologist Max Weber was the first to describe these "ideal-typical" characteristics of organizations in 1911. He called organizations bureaucracies that have certain "structural" features.

TABLE 3-1 Structural Characteristics of All Organizations

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

According to Weber, all modern bureaucracies have clear-cut divisions of labor and specialization. Organizations arrange specialists in a hierarchy of authority in which everyone is accountable to someone and authority is limited to specific actions. Authority and action are further limited by abstract rules or procedures (standard operating procedures, or SOPs) that are interpreted and applied to specific cases. These rules create a system of impartial and universal decision making; everyone is treated equally. Organizations try to hire and promote employees on the basis of technical qualifications and professionalism (not personal connections). The organization is devoted to the principle of efficiency: maximizing output using limited inputs.

According to Weber, bureaucracies are prevalent because they are the most efficient form of organization. Other scholars have supplemented Weber, identifying additional features of organizations. All organizations develop business processes (routines), politics, and cultures.

ROUTINES AND BUSINESS PROCESSES

All organizations, including business firms, become very efficient over time because individuals in the firm develop routines for producing goods and services. Routines—sometimes called standard operating procedures—are precise rules, procedures, and practices that have been developed to cope with virtually all expected situations. As employees learn these routines, they become highly productive and efficient, and the firm is able to reduce its costs over time as efficiency increases. For instance, when you visit a doctor's office, receptionists have a well-developed set of routines for gathering basic information from you; nurses have a different set of routines for preparing you for an interview with a doctor; and the doctor has a well-developed set of routines for diagnosing you.

Business processes, which we describe in Chapters 1 and 2, are collections of such routines. A business firm in turn is a collection of business processes (Figure 3-4). By analyzing business processes and individual routines, 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 to make it more efficient or effective. Throughout this book we examine business processes with a view to understanding how they might be changed, or replaced, by using information technology to achieve greater efficiency and higher levels of customer service.

many examples of where internal politics defeated the best-laid plans for an information system.

ORGANIZATIONAL CULTURE

All organizations have bedrock, unassailable, unquestioned (by the members) assumptions that define their goals and products. Organizational culture is this set of fundamental assumptions about what products the organization should produce, how it should produce them, where, and for whom. Generally, these cultural assumptions are taken totally for granted and are rarely publicly announced or spoken about (Schein, 1985). Business processes—the actual way business firms produce value—are usually anchored in the organization's culture.

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 reason students attend college is to learn, and classes follow a regular schedule. Organizational culture is a powerful unifying force that restrains political conflict and promotes common understanding, agreement on procedures, and common practices. If we all share the same basic cultural assumptions, agreement on other matters is more likely.

At the same time, organizational culture is a powerful restraint on change, especially technological change. Most organizations will do almost anything to avoid making changes in basic assumptions. Any technological change that threatens commonly held cultural assumptions usually meets a great deal of resistance. However, there are times when the only sensible way for a firm to move forward is to employ a new technology that directly opposes an existing organizational culture. When this occurs, the technology is often stalled while the culture slowly adjusts. You will find many examples in later chapters that describe the difficulties of changing the culture of a business to implement a new information system.

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Unique Features of Organizations

Although all organizations do have common characteristics, no two organizations are identical. Organizations have different structures, goals, constituencies, leadership styles, tasks, and surrounding environments.

DIFFERENT ORGANIZATIONAL TYPES

One important way in which organizations differ is in their structure or shape. The differences among organizational structures are characterized in many ways. Mintzberg's classification, described in Table 3-2, identifies five basic kinds of organizations (Mintzberg, 1979).

TABLE 3-2 Organizational 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

The kind of information systems you find in a business firm—and the nature of problems with these systems—often reflects the type of organization. For instance, in a professional bureaucracy such as a hospital it is not unusual to find parallel patient record systems operated by the administration, another by doctors, and another by other professional staff such as nurses and social workers. In small entrepreneurial firms you will often find poorly designed systems developed in a rush that often outgrow their usefulness quickly. In huge multidivisional firms operating in hundreds of locations you will often find there is not a single integrating information system, but instead each locale or each division has its set of information systems.

ORGANIZATIONS AND ENVIRONMENTS

Organizations reside in environments from which they draw resources and to which they supply goods and services. Organizations and environments have a reciprocal relationship. On the one hand, organizations are open to, and dependent on, the social and physical environment that surrounds them. Without financial and human resources —people willing to work reliably and consistently for a set wage or revenue from customers—organizations could not exist. Organizations must respond to legislative and other requirements imposed by government, as well as the actions of customers and competitors. On the other hand, organizations can influence their environments. For example, business firms form alliances with other businesses to influence the political process; they advertise to influence customer acceptance of their products.

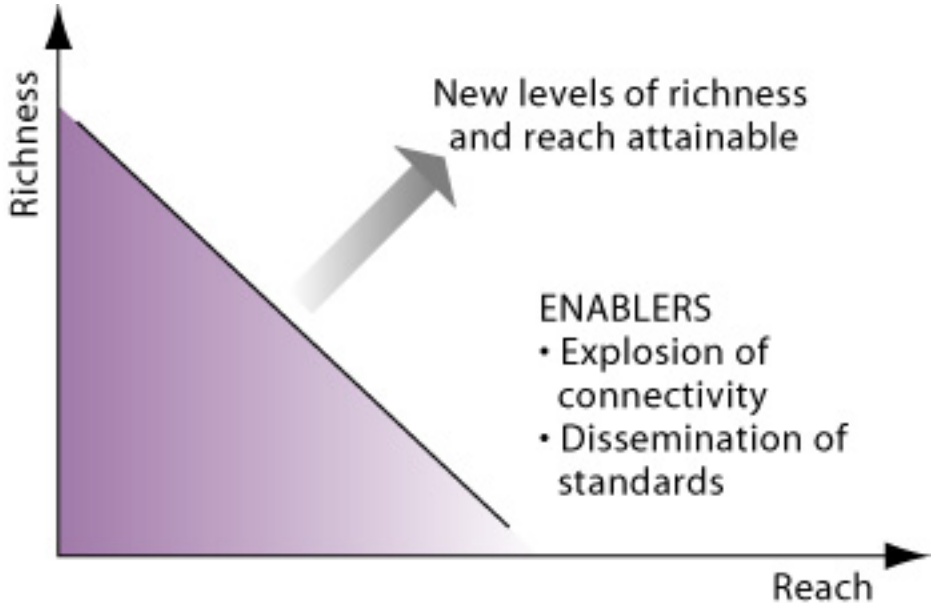

FIGURE 4-1 The changing economics of information
In the past, companies have had to trade off between the richness and reach of their information. Internet connectivity and universal standards for information sharing radically lower the cost of providing rich, detailed information to large numbers of people, reducing the trade-off.

INTERNET BUSINESS MODELS

The Internet helps companies create and capture profit in new ways by adding extra value to existing products and services or by providing the foundation for new products and services. Table 4-2 describes some of the most important Internet business models that have emerged. All in one way or another add value: They provide the customer with a new product or service; they provide additional information or service along with a traditional product or service; or they provide a product or service at a lower cost than traditional means.

TABLE 4-2 Internet Business Models

Category	Description	Examples
Virtual storefront	Sells physical products directly to consumers or to individual businesses.	Amazon.com EPM.com
Information broker	Provides product, pricing, and availability information to individuals and businesses. Generates revenue from advertising or from directing buyers to sellers.	Edmunds.com Kbb.com Insweb.com Realtor.com
Transaction broker	Saves users money and time by processing online sales transactions, generating a fee each time a transaction occurs. Also provides information on rates and terms.	E*TRADE.com Expedia.com
Online marketplace	Provides a digital environment where buyers and sellers can meet, search for products, display products, and establish prices for those products. Can provide online auctions or reverse auctions in which buyers submit bids to multiple sellers to purchase at a buyer-specified price as well as negotiated or fixed pricing. Can serve consumers or B2B e-commerce, generating revenue from transaction fees.	eBay.com Priceline.com ChemConnect.com Pantellos.com
Content provider	Creates revenue by providing digital content, such as digital news, music, photos, or video, over the Web. The customer may pay to access the content, or revenue may be generated by selling advertising space.	WSJ.com CNN.com TheStreet.com GettyImages.com MP3.com
Online service provider	Provides online service for individuals and businesses. Generates revenue from subscription or transaction fees, from advertising, or from collecting marketing information from users.	@Backup.com Xdrive.com Employease.com Salesforce.com
Virtual community	Provides an online meeting place where people with similar interests can communicate and find useful information.	Motocross.com Friendster.com iMilage.com Sailnet.com
Portal	Provides initial point of entry to the Web along with specialized content and other services.	Yahoo.com MSN.com StarMedia.com

Some of these new business models take advantage of the Internet's rich communication capabilities. eBay is an online auction forum that uses e-mail and other interactive features of the Web. People can make online bids for items, such as computer equipment, antiques and collectibles, wine, jewelry, rock-concert tickets, and electronics, which are posted by sellers from around the world. The system accepts bids for items entered on the Internet, evaluates the bids, and notifies the highest bidder. eBay collects a small commission on each listing and sale. (eBay has become so popular that its site serves as a huge trading platform for other companies, hosting around 225,000 "virtual storefronts.")

Business-to-business auctions are proliferating as well. GoIndustry, for instance, features Web-based auction services for business-to-business sales of industrial equipment and machinery. Online bidding, also known as dynamic pricing, is expected to grow rapidly because buyers and sellers can interact so easily through the Internet to determine what an item is worth at any particular moment.

ELECTRONIC COMMERCE

Although most commercial transactions still take place through conventional channels, rising numbers of consumers and businesses are using the Internet for electronic commerce. Projections show that by 2006, total e-commerce spending by consumers and businesses could surpass $5 trillion (eMarketer, 2004 and 2003).

Categories of Electronic Commerce

There are many ways to classify electronic commerce transactions. One is by looking at the nature of the participants in the electronic commerce transaction. The three major electronic commerce categories are business-to-consumer (B2C) e-commerce, business-to-business (B2B) e-commerce, and consumer-to-consumer (C2C) e-commerce.

- Business-to-consumer (B2C) electronic commerce involves retailing products and services to individual shoppers. BarnesandNoble.com, which sells books, software, and music to individual consumers, is an example of B2C e-commerce.

- Business-to-business (B2B) electronic commerce involves sales of goods and services among businesses. Milacron's Web site for selling machinery, mold bases, and related tooling, supplies, and services to companies engaged in plastics processing is an example of B2B e-commerce.

- Consumer-to-consumer (C2C) electronic commerce involves consumers selling directly to consumers. For example, eBay, the giant Web auction site, enables people to sell their goods to other consumers by auctioning the merchandise off to the highest bidder.

exchange ideas about projects and company news.

The cost of customer surveys and focus groups is very high. Learning how customers feel or what they think about products or services by examining customer visits to Web sites and online feedback is much cheaper. Customer information that can be acquired over the Internet has become so useful that new third-party services have arisen to provide businesses with customer-generated information that cannot be obtained by directly interacting with customers on the company Web site. Such services monitor customer discussions about products that are taking place through online communities and message boards, conduct online market research surveys, or monitor the online surfing and buying behavior of large numbers of customers at many different Web sites (Sawhney, Prandelli, and Veroa, 2003).

CUSTOMER SELF-SERVICE

The Web and other network technologies are inspiring new approaches to customer service and support. Many companies are using their Web sites and e-mail to answer customer questions or to provide customers with helpful information. The Web provides a medium for customers to interact with the company, at the customers' convenience, and find information that previously required a human customer-support expert. Automated self-service or other Web-based responses to customer questions cost only a fraction of what a live customer service representative on the telephone costs.

Companies are realizing substantial cost savings from Web-based customer self-service applications. For instance, American, Northwest, and other major airlines have created Web sites where customers can review flight departure and arrival times, seating charts, and airport logistics; check frequent-flyer miles; and purchase tickets online. Chapter 1 describes how customers of UPS can use its Web site to track shipments, calculate shipping costs, determine time in transit, and arrange for a package pickup. FedEx and other package delivery firms provide similar Web-based services.

New software products are even integrating the Web with customer call centers, where customer service problems have been traditionally handled over the telephone. A call center is an organizational department responsible for handling customer service issues by telephone and other channels. For example, visitors can click on a "push to talk" link on the Lands' End Web site that lets a user request a phone call. The user enters his or her telephone number and a call-center system directs a customer service representative to place a voice telephone call to the user's phone. Some systems also let the customer interact with a service representative on the Web while talking on the phone at the same time.

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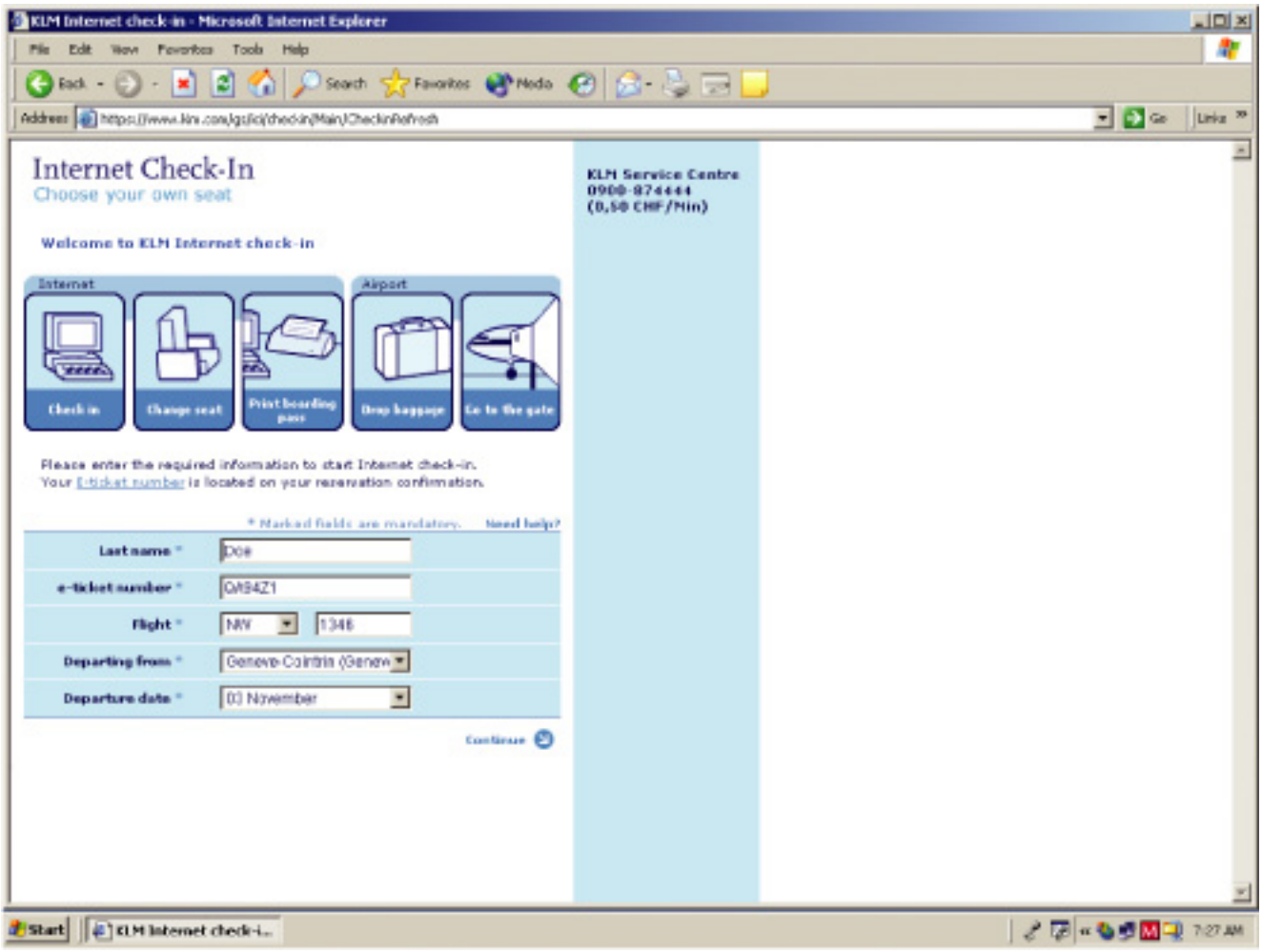
Business-to-Business Electronic Commerce: New Efficiencies and Relationships

Today, about 80 percent of B2B e-commerce is based on proprietary systems for

electronic data interchange (EDI). Electronic data interchange (EDI) enables the computer-to-computer exchange between two organizations of standard transactions, such as invoices, bills of lading, shipment schedules, or purchase orders. Transactions are automatically transmitted from one information system to another through a network, eliminating the printing and handling of paper at one end and the inputting of data at the other. Each major industry in the United States and much of the rest of the world has EDI standards that define the structure and information fields of electronic documents for that industry.



Visitors to the Web sites of KLM and its partner Northwest Airlines can find flight schedules and gates, select seats, print boarding passes, and check themselves in for flights. Web sites for customer self-service are convenient for customers and help firms lower their customer service and support costs.

EDI originally automated the exchange of documents such as purchase orders, invoices, and shipping notices. Although some companies still use EDI for document automation, firms engaged in just-in-time inventory replenishment and continuous production use EDI as a system for continuous replenishment. Suppliers have online access

to selected parts of the purchasing firm's production and delivery schedules and automatically ship materials and goods to meet prespecified targets without intervention by firm purchasing agents (see Figure 4-5).

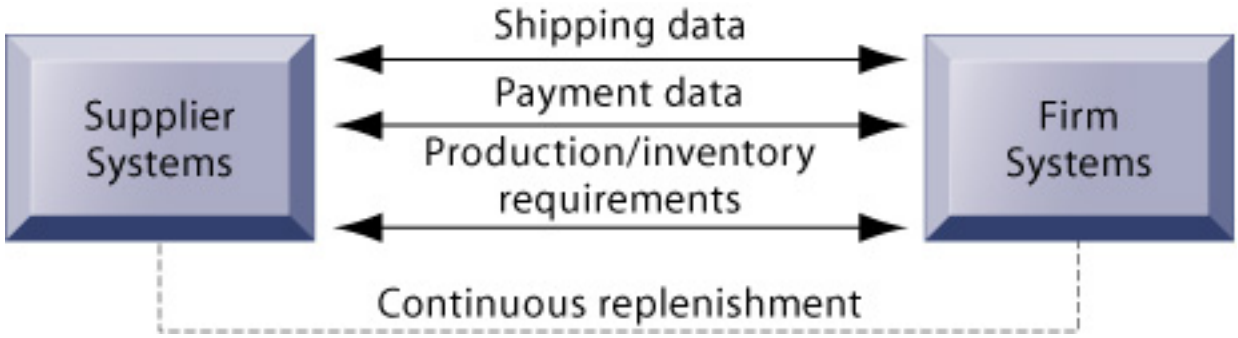


FIGURE 4-5 Electronic data interchange (EDI)
Companies use EDI to automate transactions for B2B e-commerce and continuous inventory replenishment. Suppliers can automatically send data about shipments to purchasing firms. The purchasing firms can use EDI to provide production and inventory requirements and payment data to suppliers.

Although many organizations still use private networks for EDI, companies are increasingly turning to the Internet for this purpose because it provides a much more flexible and low-cost platform for linking to other firms. Using the Internet, businesses can extend digital technology to a wider range of activities and broaden their circle of trading partners.

Take procurement, for example. Procurement involves not only purchasing goods and materials but also sourcing, negotiating with suppliers, paying for goods, and making delivery arrangements. Businesses can now use the Internet to locate the most low-cost supplier, search online catalogs of supplier products, negotiate with suppliers, place orders, make payments, and arrange transportation. They are not limited to partners linked by traditional EDI networks but use the Web to work with any other business that is linked to the Internet. E-procurement over the Internet provides new opportunities for lowering costs and improving service because Internet technology enables businesses to cast their nets more widely.

The Internet and Web technology enable businesses to create new electronic storefronts for selling to other businesses with multimedia graphic displays and interactive features similar to those for B2C commerce. Alternatively, businesses can use Internet technology to create extranets or electronic marketplaces for linking to other businesses for purchase and sale transactions. Extranets, which we introduced in Chapter 1, are private intranets extended to authorized users outside the company.

Private industrial networks are B2B extranets that focus on continuous business

process coordination between companies for collaboration and supply chain management. A private industrial network typically consists of a large firm using an extranet to link to its suppliers and other key business partners (see Figure 4-6). The network is owned by the buyer, and it permits the firm and designated suppliers, distributors, and other business partners to share product design and development, marketing, production scheduling, inventory management, and unstructured communication, including graphics and e-mail. Another term for a private industrial network is a private exchange. Private exchanges are currently the fastest-growing type of B2B commerce.

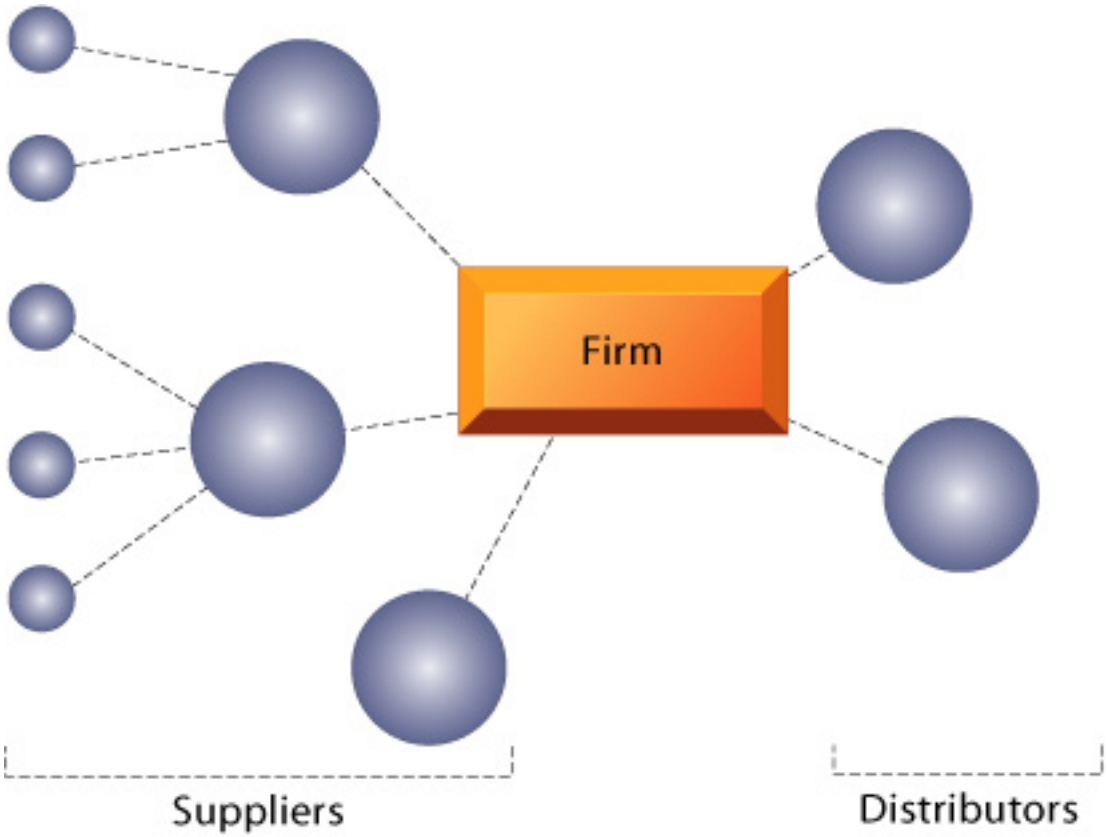


FIGURE 4-6 A private industrial network
A private industrial network, also known as a private exchange, links a firm to its suppliers, distributors, and other key business partners for efficient supply chain management and other collaborative activities.

Net marketplaces, which are sometimes called e-hubs, provide a single digital marketplace based on Internet technology for many different buyers and sellers (see Figure 4-7). They are industry-owned or operate as independent intermediaries between buyers and sellers. Net marketplaces are more transaction oriented (and less relationship oriented) than private industrial networks, generating revenue from purchase and sale transactions and other services provided to clients. Participants in Net marketplaces can establish prices through online negotiations, auctions, or requests for quotations, or they can use fixed prices. Customers benefit from lower search costs, lower transaction costs, and wider selection.

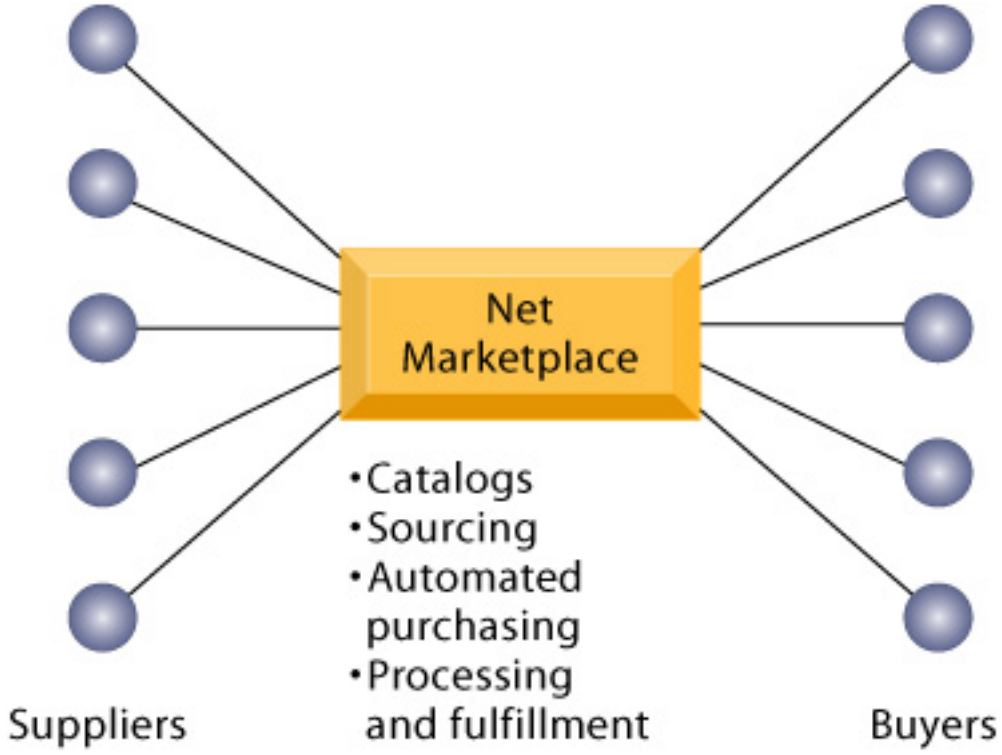


FIGURE 4-7 A Net marketplace
Net marketplaces are online marketplaces where multiple buyers can purchase from multiple sellers.

There are many different types of Net marketplaces and ways of classifying them. Some Net marketplaces sell direct goods and some sell indirect goods. Direct goods are goods used in a production process, such as sheet steel for auto body production. Indirect goods are all other goods not directly involved in the production process, such as office supplies or products for maintenance and repair. Some Net marketplaces support contractual purchasing based on long-term relationships with designated suppliers, and others support short-term spot purchasing, where goods are purchased based on immediate needs, often from many different suppliers. Some Net marketplaces serve vertical markets for specific industries, such as automobiles, telecommunications, or machine tools, whereas others serve horizontal markets for goods and services that can be found in many different industries, such as office equipment or transportation.

Ariba bundles extensive e-commerce services with a Net marketplace for long-term contractual purchasing of both indirect and direct goods. It provides both buyers and sellers with software systems and Net marketplace services, aggregating hundreds of catalogs into a single marketplace and customizing procurement and sales processes to work with their systems. For buyers, Ariba automates sourcing, contract management, purchase orders, requisitions, business rules enforcement, and payment. For sellers, Ariba provides services for catalog creation and content management, order management, invoicing, and settlement.

FedEx uses Ariba's e-procurement system for $8 million in purchases. Employees use Ariba to order from more than 32 MRO (maintenance, repair, and operations) suppliers and catalogs. The system automatically invokes FedEx's

business rules for purchasing to route, review, and approve requisitions electronically. By using this Net marketplace, FedEx has reduced the cost of processing purchases by 75 percent and the prices paid for MRO supplies by 12 percent, and it has cut parts delivery time from an average of seven days to two days.

Industry-owned Net marketplaces focus on long-term contract purchasing relationships and on providing common networks and computing platforms for reducing supply chain inefficiencies. Buyer firms benefit from competitive pricing among alternative suppliers, and suppliers benefit from stable long-term selling relationships with large firms.

Exostar is an example. This aerospace and defense industry-sponsored Net marketplace was founded jointly by BAE Systems, Boeing, Lockheed Martin, Raytheon, and Rolls-Royce PLC to connect these companies to their suppliers and facilitate collaboration on major projects. More than 16,000 trading partners in the commercial, military, and government sectors use Exostar's sourcing, e-procurement, and collaboration tools for both direct and indirect goods. Exostar includes capabilities for auctioning, purchase forecasting, issuing electronic payments and receipts, and linking to participants' internal corporate systems. Also featured are capabilities for collaboration on joint development projects and sharing engineering product data.

Grainger.com provides a single online source from which customers can make spot purchases of maintenance, repair, and operations products from many different companies.

Other industry-owned Net marketplaces include ChemConnect.com, for the chemical industry, Transora.com, for the food industry, and Pantellos.com for the energy services and utilities industries.

Exchanges are independently owned third-party Net marketplaces that can connect thousands of suppliers and buyers for spot purchasing. Many exchanges provide vertical markets for a single industry, such as food, electronics, or industrial equipment, and they primarily deal with direct inputs. For example, FoodTrader.com automates spot purchases among buyers and sellers from over 180 countries in the food and agriculture industry.

Exchanges proliferated during the early years of e-commerce, but many have failed. Suppliers were reluctant to participate because the exchanges encouraged competitive bidding that drove prices down and did not offer any long-term relationships with buyers or services to make lowering prices worthwhile. Many essential direct purchases are not conducted on a spot basis because they require contracts and consideration of issues such as delivery timing, customization, and quality of products (Laudon, 2003; Wise and Morrison, 2000).

The Window on Technology sheds light on these issues. The Volkswagen

Group opted for a private industrial network (private exchange) instead of an industry-sponsored Net marketplace or exchange precisely because it wanted to preserve its control over supplier relationships and its unique business processes for supply chain management. VWGroupSupply.com has become one of Europe's most successful B2B sites and a model for the global automobile industry.

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Electronic Commerce Payment Systems

Special electronic payment systems have been developed to pay for goods electronically on the Internet. Electronic payment systems for the Internet include systems for credit card payments, digital cash, digital wallets, accumulated balance digital payment systems, stored value payment systems, peer-to-peer payment systems, electronic checks, and electronic billing presentment and payment systems.

Credit cards account for 80 percent of online payments in the United States and about 50 percent of online purchases outside the United States. The more sophisticated electronic commerce software has capabilities for processing credit card purchases on the Web. Businesses can also contract with services that extend the functionality of existing credit card payment systems. Digital credit card payment systems extend the functionality of credit cards so they can be used for online shopping payments. They make credit cards safer and more convenient for online merchants and consumers by providing mechanisms for authenticating the purchaser's credit card to make sure it is valid and arranging for the bank that issued the credit card to deposit money for the amount of the purchase in the seller's bank account.

Digital wallets make paying for purchases over the Web more efficient by eliminating the need for shoppers to enter their address and credit card information repeatedly each time they buy something. A digital wallet securely stores credit card and owner identification information and provides that information at an electronic commerce site's "checkout counter." The digital wallet enters the shopper's name, credit card number, and shipping information automatically when invoked to complete the purchase. Amazon.com's 1-Click Shopping, which enables a consumer to fill in shipping and credit card information automatically by clicking one button, uses electronic wallet technology. MSN Wallet, MasterCard Wallet, and America Online's Quick Checkout are other digital wallet systems.

Micropayment systems have been developed for purchases of less than $10, such as downloads of individual articles or music clips, that would be too small for conventional credit card payments. Accumulated balance payment systems or stored value payment systems are useful for such purposes.

Accumulated balance digital payment systems enable users to make micropayments and purchases on the Web, accumulating a debit balance that they must pay periodically on their credit card or telephone bills. IPIN has been widely adopted by online music sites that sell music tracks for 99 cents. It invoices

customers through existing consumer billing services such as telephone and wireless service companies, Internet service providers, and banks. PaymentOne and Trivnet enable consumers to charge small purchases to their monthly telephone bill.

Stored value payment systems enable consumers to make instant online payments to merchants and other individuals based on value stored in a digital account. Online value systems rely on the value stored in a consumer's bank, checking, or credit card account, and some of these systems require the use of a digital wallet. Ecount offers a prepaid debit account for online purchases, and RocketCash is a new online stored value system aimed at teenagers.

Smart cards are another type of stored value system used for micropayments. A smart card is a plastic card the size of a credit card that stores digital information. The smart card can store health records, identification data, or telephone numbers, or it can serve as an "electronic purse" in place of cash. The Mondex and American Express Blue smart cards contain electronic cash and can be used to transfer funds to merchants in physical storefronts and to merchants on the Internet. Both are contact smart cards that require use of special card-reading devices whenever the cards need to transfer cash to either an online or offline merchant. (Internet users must attach a smart card reader to their PCs to use the card. To pay for a Web purchase, the user would swipe the smart card through the card reader.)

Digital cash (also known as electronic cash or e-cash) can also be used for micropayments or larger purchases. Digital cash is currency represented in electronic form that moves outside the normal network of money (paper currency, coins, checks, credit cards). Users are supplied with client software and can exchange money with another e-cash user over the Internet or with a retailer accepting e-cash. eCoin.net is an example of a digital cash service. In addition to facilitating micropayments, digital cash can be useful for people who do not have credit cards and wish to make Web purchases.

New Web-based peer-to-peer payment systems have sprung up to serve people who want to send money to vendors or individuals who are not set up to accept credit card payments. The party sending money uses his or her credit card to create an account with the designated payment at a Web site dedicated to peer-to-peer payments. The recipient "picks up" the payment by visiting the Web site and supplying information about where to send the payment (a bank account or a physical address). PayPal has become a popular peer-to-peer payment system.

Digital checking payment systems, such as Western Union MoneyZap and eCheck, extend the functionality of existing checking accounts so they can be used for online shopping payments. Digital checks are less expensive than credit cards and much faster than traditional paper-based checking. These checks are encrypted with a digital signature that can be verified and used for payments in electronic commerce. Electronic check systems are useful in business-to-business electronic commerce.

Electronic billing presentment and payment systems are used for paying routine monthly bills. They enable users to view their bills electronically and pay

them through electronic fund transfers from bank or credit card accounts. These services support payment for online and physical store purchases of goods or services after the purchase has taken place. They notify purchasers about bills that are due, present the bills, and process the payments. Some of these services, such as CheckFree, consolidate subscribers' bills from various sources so that they can all be paid at one time. Table 4-3 summarizes the features of some of these payment systems.

TABLE 4-3 Examples of Electronic Payment Systems for E-Commerce

Payment System	Description	Commercial Example
Digital credit card payment systems	Secure services for credit card payments on the Internet that protect information transmitted among users, merchant sites, and processing banks	eCharge
Digital wallet	Software that stores credit card and other information to facilitate payment for goods on the Web	MSN Wallet MasterCard Wallet AOL Quick Checkout
Accumulated balance payment systems	Accumulates micropayment purchases as a debit balance that must be paid periodically on credit card or telephone bills	Trivnet PaymentOne
Stored value payment systems	Enables consumers to make instant payments to merchants based on value stored in a digital account	Ecount American Express Blue smart card
Digital cash	Digital currency that can be used for micropayments or larger purchases	eCoin.net
Peer-to-peer payment systems	Sends money using the Web to individuals or vendors who are not set up to accept credit card payments	PayPal Yahoo PayDirect
Digital checking	Electronic check with a secure digital signature	Western Union MoneyZap ECheck
Electronic billing presentment and payment systems	Supports electronic payment for online and physical store purchases of goods or services after the purchase has taken place	CheckFree Yahoo Bill Pay, MSN Bill Pay

The process of paying for products and services purchased on the Internet is complex and merits additional discussion. We discuss electronic commerce security in detail in Chapter 10.

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Window on Technology

ETHICS IN AN INFORMATION SOCIETY

Ethics is a concern of humans who have freedom of choice. Ethics is about individual choice: When faced with alternative courses of action, what is the correct moral choice? What are the main features of ethical choice?

Basic Concepts: Responsibility, Accountability, and Liability

Ethical choices are decisions made by individuals who are responsible for the consequences of their actions. Responsibility is a key element of ethical action. Responsibility means that you accept the potential costs, duties, and obligations for the decisions you make. Accountability is a feature of systems and social institutions: It means that mechanisms are in place to determine who took responsible action, who is responsible. Systems and institutions in which it is impossible to find out who took what action are inherently incapable of ethical analysis or ethical action. Liability extends the concept of responsibility further to the area of laws. Liability is 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. Due process is a related feature of law-governed societies and is a process in which laws are known and understood and there is an ability to appeal to higher authorities to ensure that the laws are applied correctly.

These basic concepts form the underpinning of an ethical analysis of information systems and those who manage them. First, as discussed in Chapter 3, information technologies are filtered through social institutions, organizations, and individuals. Systems do not have impacts by themselves. Whatever information system impacts exist are products of institutional, organizational, and individual actions and behaviors. Second, responsibility for the consequences of technology falls clearly on the institutions, organizations, and individual managers who choose to use the technology. Using information technology in a socially responsible manner means that you can and will be held accountable for the consequences of your actions. Third, in an ethical, political society, individuals and others can recover damages done to them through a set of laws characterized by due process.

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Ethical Analysis

When confronted with a situation that seems to present ethical issues, how

should you analyze it? The following five-step process should help.

1. *Identify and describe clearly the facts.* Find out who did what to whom, and where, when, and how. In many instances, you will be surprised at the errors in the initially reported facts, and often you will find that simply getting the facts straight helps define the solution. It also helps to get the opposing parties involved in an ethical dilemma to agree on the facts.

2. *Define the conflict or dilemma and identify the higher-order values involved.* Ethical, social, and political issues always reference higher values. The parties to a dispute all claim to be pursuing higher values (e.g., freedom, privacy, protection of property, and the free enterprise system). Typically, an ethical issue involves a dilemma: two diametrically opposed courses of action that support worthwhile values. For example, the chapter-ending case study illustrates two competing values: the need to protect citizens from terrorist acts and the need to protect individual privacy.

3. *Identify the stakeholders.* Every ethical, social, and political issue has stakeholders: players in the game who have an interest in the outcome, who have invested in the situation, and usually who have vocal opinions (Smith, 2003). Find out the identity of these groups and what they want. This will be useful later when designing a solution.

4. *Identify the options that you can reasonably take.* You may find that none of the options satisfy all the interests involved, but that some options do a better job than others. Sometimes arriving at a good or ethical solution may not always be a balancing of consequences to stakeholders.

5. *Identify the potential consequences of your options.* Some options may be ethically correct but disastrous from other points of view. Other options may work in one instance but not in other similar instances. Always ask yourself, “What if I choose this option consistently over time?”

CANDIDATE ETHICAL PRINCIPLES

Once your analysis is complete, what ethical principles or rules should you use to make a decision? What higher-order values should inform your judgment? Although you are the only one who can decide which among many ethical principles you will follow, and how you will prioritize them, it is helpful to consider some ethical principles with deep roots in many cultures that have survived throughout recorded history.

1. Do unto others as you would have them do unto you (the Golden Rule). Putting yourself into the place of others, and thinking of yourself as the object of the decision, can help you think about fairness in decision making.

2. If an action is not right for everyone to take, it is not right for anyone (Immanuel Kant's Categorical Imperative). Ask yourself, "If everyone did this, could the organization, or society, survive?"

3. If an action cannot be taken repeatedly, it is not right to take at all (Descartes' rule of change). This is the slippery-slope rule: An action may bring about a small change now that is acceptable, but if repeated would bring unacceptable changes in the long run. In the vernacular, it might be stated as "once started down a slippery path you may not be able to stop."

4. Take the action that achieves the higher or greater value (the Utilitarian Principle). This rule assumes you can prioritize values in a rank order and understand the consequences of various courses of action.

- Take the action that produces the least harm, or the least potential cost (Risk Aversion Principle). Some actions have extremely high failure costs of very low probability (e.g., building a nuclear generating facility in an urban area) or extremely high failure costs of moderate probability (speeding and automobile accidents). Avoid these high-failure-cost actions, paying greater attention obviously to high-failure-cost potential of moderate to high probability.
- Assume that virtually all tangible and intangible objects are owned by someone else unless there is a specific declaration otherwise. (This is the ethical "no free lunch" rule.) If something someone else has created is useful to you, it has value, and you should assume the creator wants compensation for this work.

Although these ethical rules cannot always be guides to action, actions that do not easily pass these rules deserve some very close attention and a great deal of caution. The appearance of unethical behavior may do as much harm to you and your company as actual unethical behavior.

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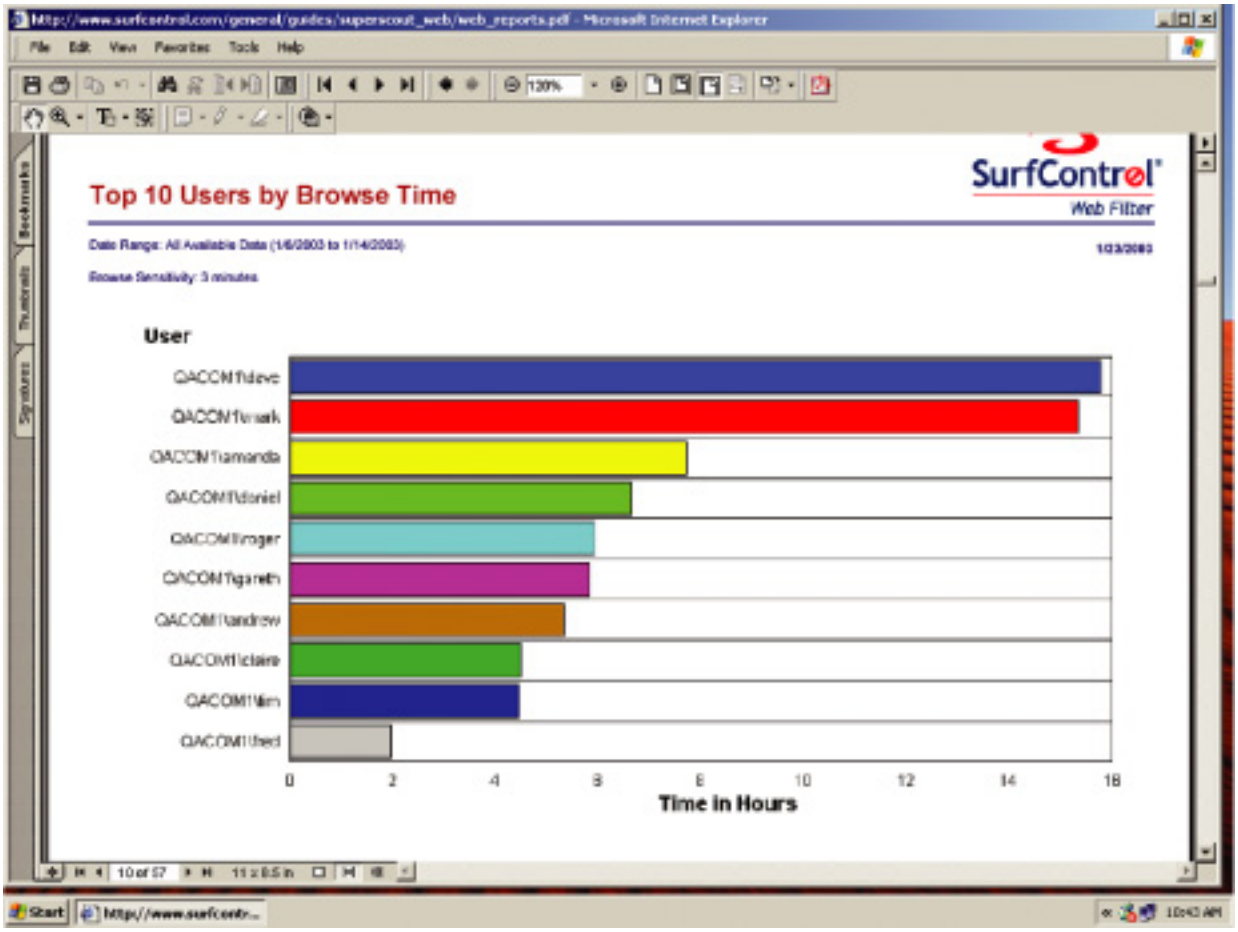
Professional Codes of Conduct

When groups of people claim to be professionals, they take on special rights and obligations because of their special claims to knowledge, wisdom, and respect. Professional codes of conduct are promulgated by associations of professionals such as the American Medical Association (AMA), the American Bar Association (ABA), the Association of Information Technology Professionals (AITP), and the Association of Computing Machinery (ACM). These professional groups take responsibility for the partial regulation of their professions by

determining entrance qualifications and competence. Codes of ethics are promises by professions to regulate themselves in the general interest of society. For example, avoiding harm to others, honoring property rights (including intellectual property), and respecting privacy are among the General Moral Imperatives of the ACM's Code of Ethics and Professional Conduct (ACM, 1993).



SurfControl offers tools for tracking Web and e-mail activity and for filtering unauthorized e-mail and Web site content. The benefits of monitoring employee e-mail and Internet use should be balanced with the need to respect employee privacy.

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Some Real-World Ethical Dilemmas

Information systems have created new ethical dilemmas in which one set of interests is pitted against another. For example, many of the large telephone companies in the United States are using information technology to reduce the sizes of their workforces. Voice recognition software reduces the need for human operators by enabling computers to recognize a customer's responses to a series of computerized questions. Many companies monitor what their

employees are doing on the Internet to prevent them from wasting company resources on nonbusiness activities (see the Chapter 8 Window on Management).

In each instance, you can find competing values at work, with groups lined on either side of a debate. A company may argue, for example, that it has a right to use information systems to increase productivity and reduce the size of its workforce to lower costs and stay in business. Employees displaced by information systems may argue that employers have some responsibility for their welfare. Business owners might feel obligated to monitor employee e-mail and Internet use to minimize drains on productivity (Jackson, Dawson, and Wilson, 2003; Urbaczewski and Jessup, 2002). Employees might believe they should be able to use the Internet for short personal tasks in place of the telephone. A close analysis of the facts can sometimes produce compromised solutions that give each side “half a loaf.” Try to apply some of the principles of ethical analysis described to each of these cases. What is the right thing to do?

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