PART FOUR

Building and Managing Systems

Chapter 13
Building Information Systems

Chapter 14
Managing Projects

Chapter 15
Managing Global Systems

Part Four focuses on building and managing systems in organizations. This part answers questions such as: What activities are required to build a new information system? What alternative approaches are available for building system solutions? How should information systems projects be managed to ensure that new systems provide genuine business benefits and work successfully in the organization? What issues must be addressed when building and managing global systems?

Building Information Systems

CHAPTER 13

LEARNING OBJECTIVES

After reading this chapter, you will be able to answer the following questions:

1. How does building new systems produce organizational change?
2. What are the core activities in the systems development process?
3. What are the principal methodologies for modeling and designing systems?
4. What are alternative methods for building information systems?
5. What are new approaches for system building in the digital firm era?

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CHAPTER CASES

New Systems Help Work Flow More Smoothly at Moen

Burton Snowboards Speeds Ahead with Nimble Business Processes

What Does It Take to Go Mobile?

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VIDEO CASES

IBM: Business Process Management in a SaaS Environment

IBM Helps the City of Madrid with Real-Time BPM Software

Instructional Videos:

BPM Business Process Management

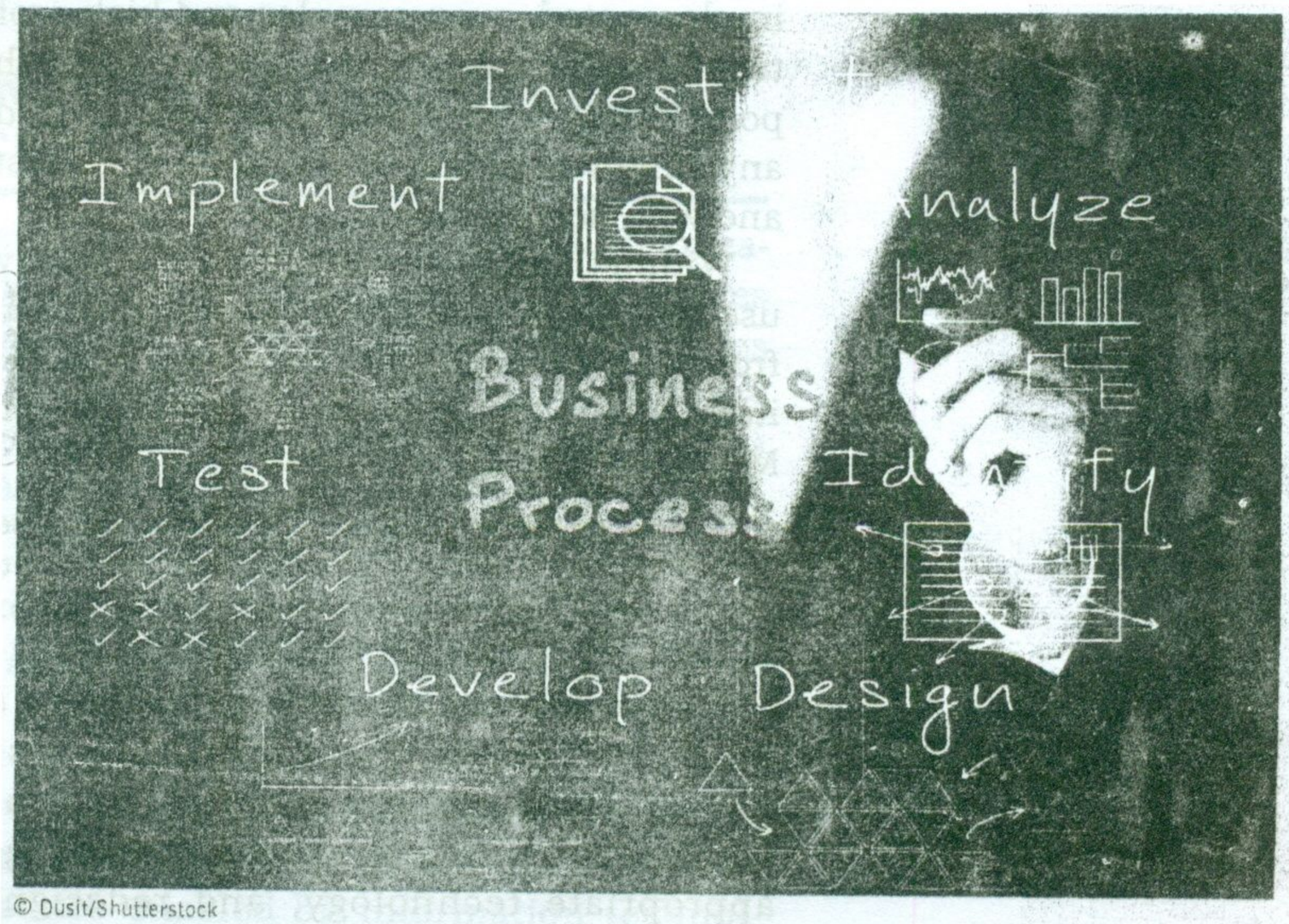
Workflow Management Visualized

NEW SYSTEMS HELP WORK FLOW MORE SMOOTHLY AT MOEN

Does your kitchen sink have a single-handle faucet or two faucets? If it's one with a single handle, it was invented in 1939 by Al Moen, founder of Moen, Incorporated, the number one faucet brand in North America. Based in North Olmsted, Ohio, Moen manufactures and sells a wide range of kitchen and bath products, including sinks, showerheads, and numerous accessories. New products are constantly being launched, and each requires numerous capital expense requests throughout the product development process.

Moen has three manufacturing facilities in the U.S. and one in China, as well as two distribution facilities in the U.S., one in China, and one in Canada and Mexico. The company had implemented a single instance of the SAP enterprise resource planning (ERP) system for nearly every line of its business worldwide, including supply chain, sales, service, and manufacturing. As a result, many of Moen's automated business processes were streamlined and efficient. Until recently, the process for initiating a capital expense request was one of the exceptions.

Moen's process to initiate a capital expense request (CER) was heavily manual. First, a user submitted a paper form that was routed manually through the corporate office from inbox to inbox to obtain the proper supporting documentation and approvals. The exact route differed, depending on factors such as type and amount of funds requested, department of origin, and level of approval needed. This process was very inefficient and uncertain. Among Moen's 300 employees involved in the capital expense request process, only a few outside of the finance department understood where and how the request



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was being routed. Finance would know if required approvals were insufficient, but getting to that department involved a great deal of guesswork from people who weren't sure of exactly where a form needed to go. Manually-routed documents could be easily lost or misplaced, leaving the other people along the approval chain completely unaware of the request. Making matters worse, CERs originating in Moen's Chinese manufacturing facility had to be mailed to the corporate office, increasing chances of getting lost. The recipient of these overseas requests couldn't just walk down the hallway to ask the sender a question.

Moen needed a solution that automated business form development and routing and that could easily integrate with its global SAP ERP system and support yearly upgrades to the SAP software. There were other requirements: The system had to be easy to use, with business users capable of automating select processes with a minimum of IT support. The solution also had to easily integrate with Microsoft SharePoint, which was supporting other internal Moen processes. And management did not want to limit the solution to CERs; it wanted the selected tool to automate other processes as well.

With assistance from Clear Process Solutions as consultants, Moen selected Winshuttle workflow software in November 2013. Winshuttle enables users to build and adapt Excel and SharePoint-based interactive forms and workflows for SAP without costly custom development and without compromising on security or control. The software integrates easily with both SharePoint and SAP, and can be tailored to Moen's processes. It is able to provide complete visibility into exactly where a request is located within the routing process.

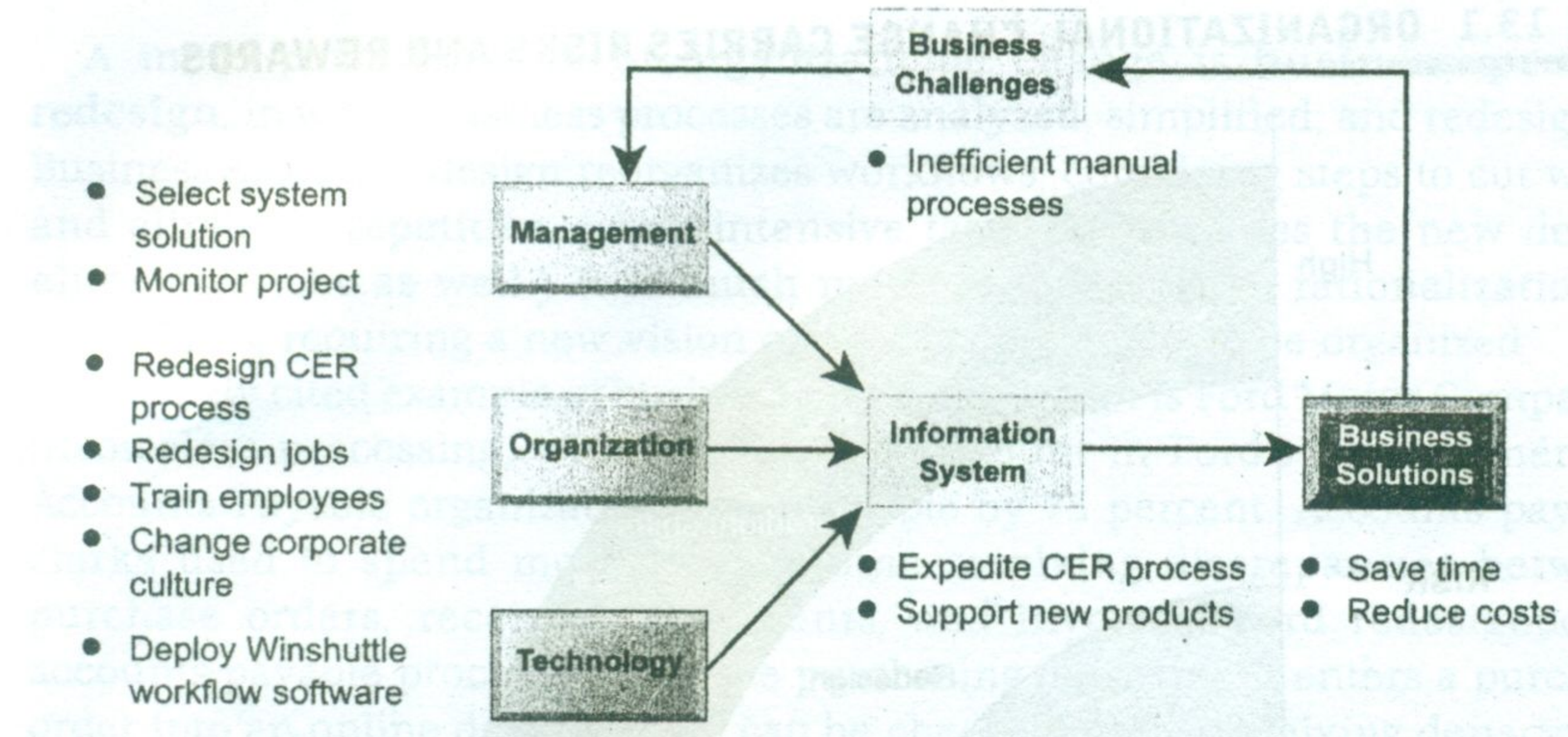
It took five months to implement Winshuttle. During that time, users were given training classes on how to build a workflow using the software. Gina Carlson, Moen's Director of Asia Pacific Customer Relationship and Financial Systems, also instituted a formal communication plan with additional training documents, Webinars, and IT town halls.

Before automation, the CER process took anywhere from four to ten business days, depending on the number of approvals required. After Winshuttle was implemented, even complex and high-profile CERs can be processed in one to two business days. Moen is able to see the status of a particular CER at any point in the processing cycle. Carlson and her colleagues are able to know at any time where a specific funding request is in the pipeline, who has seen it, and who needs to approve it.

Within the first month after the system went live, almost 70 Moen employees used the new automated CER process. With management anticipating savings from automating CER of two hours per person, the project is expected to pay for itself within three months. The days of tracking down paper-based forms at Moen are coming to an end.

Sources: Ken Murphy, "Capital Request Processes Now Flow as Smoothly as Water from a New Faucet," SAP Insider Profiles, July-September 2014; www.moen.com, accessed September 8, 2014; and www.winshuttle.com, accessed September 8, 2014.

The experience of Moen illustrates some of the steps required to design and build new information systems. Building a new system for processing capital expense requests entailed analyzing the organization's problems with existing systems, assessing information requirements, selecting appropriate technology, and redesigning business processes and jobs. Management had to oversee the systems-building effort and evaluate benefits and costs. The new information system represented a process of planned organizational change.



The chapter-opening case calls attention to important points raised by this case and this chapter. Moen's process for handling capital expense requests was hampered by outdated and inefficient manual processes, which raised costs, slowed down work, and limited the company's ability to develop new products.

Management decided to redesign and automate this process using new workflow software that enables users to create interactive forms and workflows for SAP without costly custom development. The solution encompassed not just the application of new technology, but changes to corporate culture, business processes, and job functions. Moen's pace of work and approvals for new capital expenditures have become much faster.

Here are some questions to think about: Why was Winshuttle software a good choice for Moen? How much did the new system change the way Moen ran its business?

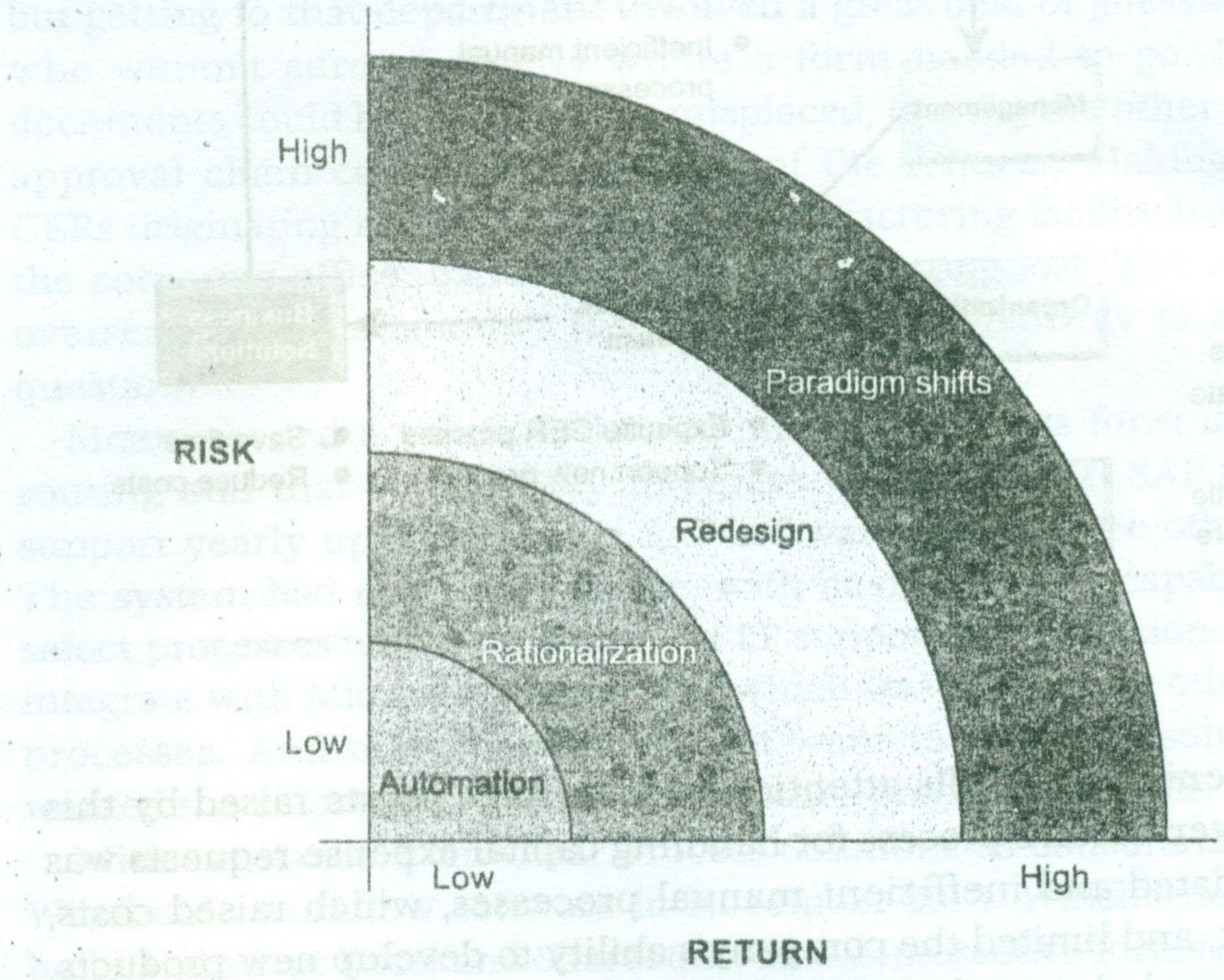
13.1 How does building new systems produce organizational change?

Building a new information system is one kind of planned organizational change. The introduction of a new information system involves much more than new hardware and software. It also includes changes in jobs, skills, management, and organization. When we design a new information system, we are redesigning the organization. System builders must understand how a system will affect specific business processes and the organization as a whole.

SYSTEMS DEVELOPMENT AND ORGANIZATIONAL CHANGE

Information technology can promote various degrees of organizational change, ranging from incremental to far-reaching. Figure 13.1 shows four kinds of structural organizational change that are enabled by information technology: (1) automation, (2) rationalization, (3) business process redesign, and (4) paradigm shifts. Each carries different risks and rewards.

FIGURE 13.1 ORGANIZATIONAL CHANGE CARRIES RISKS AND REWARDS



The most common forms of organizational change are automation and rationalization. These relatively slow-moving and slow-changing strategies present modest returns but little risk. Faster and more comprehensive change—such as redesign and paradigm shifts—carries high rewards but offers substantial chances of failure.

The most common form of IT-enabled organizational change is **automation**. The first applications of information technology involved assisting employees with performing their tasks more efficiently and effectively. Calculating paychecks and payroll registers, giving bank tellers instant access to customer deposit records, and developing a nationwide reservation network for airline ticket agents are all examples of early automation.

A deeper form of organizational change—one that follows quickly from early automation—is **rationalization of procedures**. Automation frequently reveals new bottlenecks in production and makes the existing arrangement of procedures and structures painfully cumbersome. Rationalization of procedures is the streamlining of standard operating procedures. For example, Moen's new system for capital expense requests is effective not only because it uses computer technology but also because the company simplified its business processes for this function. Fewer manual steps are required.

Rationalization of procedures is often found in programs for making a series of continuous quality improvements in products, services, and operations, such as total quality management (TQM) and six sigma. **Total quality management (TQM)** makes achieving quality an end in itself and the responsibility of all people and functions within an organization. TQM derives from concepts developed by American quality experts such as W. Edwards Deming and Joseph Juran, but it was popularized by the Japanese. **Six sigma** is a specific measure of quality, representing 3.4 defects per million opportunities. Most companies cannot achieve this level of quality, but use six sigma as a goal for driving ongoing quality improvement programs.

A more powerful type of organizational change is **business process redesign**, in which business processes are analyzed, simplified, and redesigned. Business process redesign reorganizes workflows, combining steps to cut waste and eliminate repetitive, paper-intensive tasks. (Sometimes the new design eliminates jobs as well.) It is much more ambitious than rationalization of procedures, requiring a new vision of how the process is to be organized.

A widely cited example of business process redesign is Ford Motor Company's invoiceless processing, which reduced headcount in Ford's North American Accounts Payable organization of 500 people by 75 percent. Accounts payable clerks used to spend most of their time resolving discrepancies between purchase orders, receiving documents, and invoices. Ford redesigned its accounts payable process so that the purchasing department enters a purchase order into an online database that can be checked by the receiving department when the ordered items arrive. If the received goods match the purchase order, the system automatically generates a check for accounts payable to send to the vendor. There is no need for vendors to send invoices.

Rationalizing procedures and redesigning business processes are limited to specific parts of a business. New information systems can ultimately affect the design of the entire organization by transforming how the organization carries out its business or even the nature of the business. For instance, the long-haul trucking and transportation firm Schneider National used new information systems to change its business model. Schneider created a new business managing logistics for other companies. This more radical form of business change is called a **paradigm shift**. A paradigm shift involves rethinking the nature of the business and the nature of the organization.

Paradigm shifts and business process redesign often fail because extensive organizational change is so difficult to orchestrate (see Chapter 14). Why, then, do so many corporations contemplate such radical change? Because the rewards are equally high (see Figure 13.1). In many instances, firms seeking paradigm shifts and pursuing reengineering strategies achieve stunning, order-of-magnitude increases in their returns on investment (or productivity). Some of these success stories, and some failure stories, are included throughout this book.

BUSINESS PROCESS REDESIGN

Like Moen, described in the chapter-opening case, many businesses today are trying to use information technology to improve their business processes. Some of these systems entail incremental process change, but others require more far-reaching redesign of business processes. To deal with these changes, organizations are turning to business process management. **Business process management (BPM)** provides a variety of tools and methodologies to analyze existing processes, design new processes, and optimize those processes. BPM is never concluded because process improvement requires continual change. Companies practicing business process management go through the following steps:

1. **Identify processes for change:** One of the most important strategic decisions that a firm can make is not deciding how to use computers to improve business processes, but understanding what business processes need improvement. When systems are used to strengthen the wrong business model or business processes, the business can become more efficient at doing what it should not do. As a result, the firm becomes vulnerable to competitors who may have discovered the right business

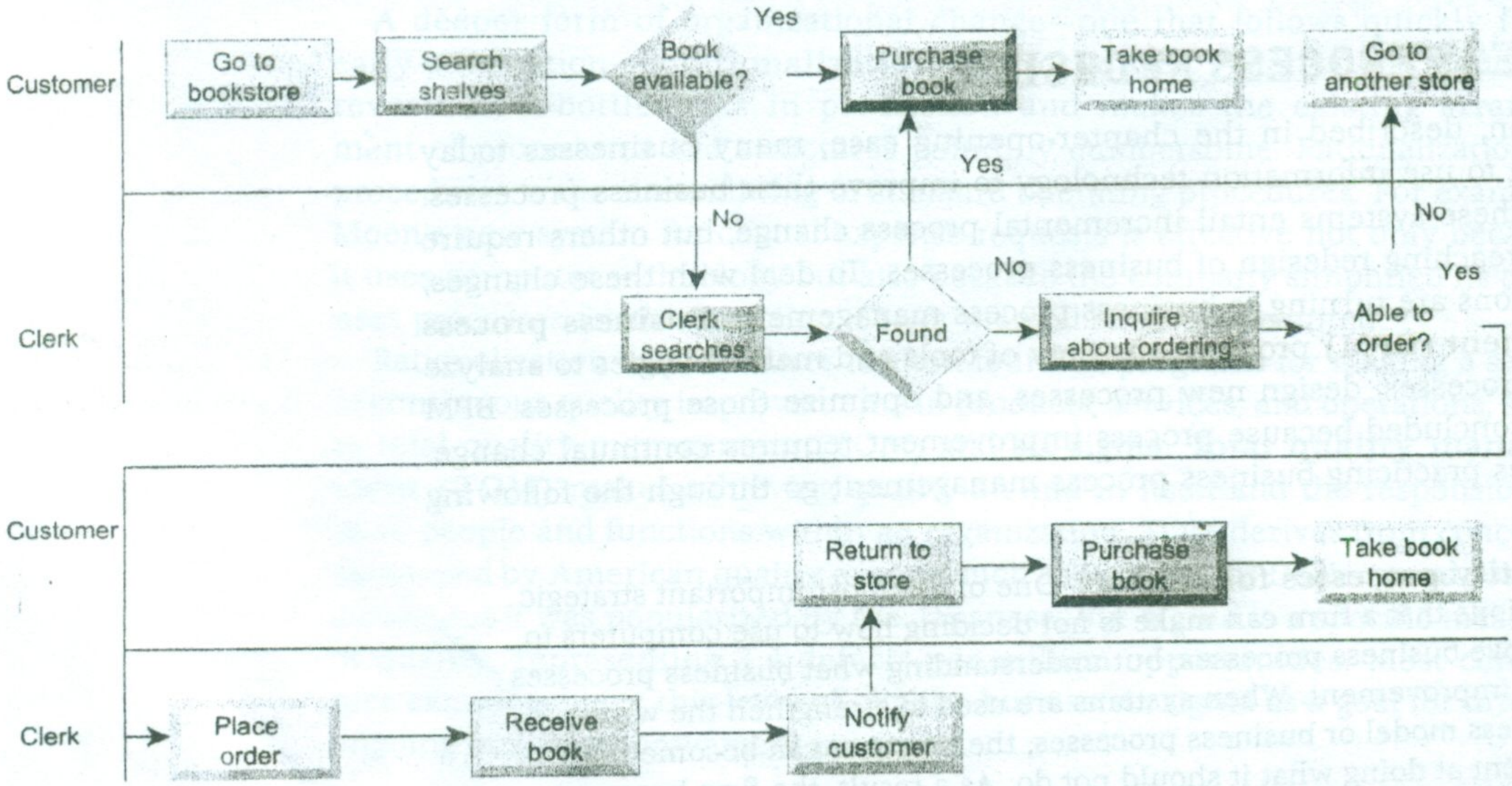
model. Considerable time and cost may also be spent improving business processes that have little impact on overall firm performance and revenue. Managers need to determine what business processes are the most important and how improving these processes will help business performance.

2. **Analyze existing processes:** Existing business processes should be modeled and documented, noting inputs, outputs, resources, and the sequence of activities. The process design team identifies redundant steps, paper-intensive tasks, bottlenecks, and other inefficiencies.

Figure 13.2 illustrates the "as-is" process for purchasing a book from a physical bookstore. Consider what happens when a customer visits a physical bookstore and searches its shelves for a book. If he or she finds the book, that person takes it to the checkout counter and pays for it via credit card, cash, or check. If the customer is unable to locate the book, he or she must ask a bookstore clerk to search the shelves or check the bookstore's inventory records to see if it is in stock. If the clerk finds the book, the customer purchases it and leaves. If the book is not available locally, the clerk inquires about ordering it for the customer, from the bookstore's warehouse or from the book's distributor or publisher. Once the ordered book arrives at the bookstore, a bookstore employee telephones the customer with this information. The customer would have to go to the bookstore again to pick up the book and pay for it. If the bookstore is unable to order the book for the customer, the customer would have to try another bookstore. You can see that this process has many steps and might require the customer to make multiple trips to the bookstore.

3. **Design the new process:** Once the existing process is mapped and measured in terms of time and cost, the process design team will try to improve the process by designing a new one. A new streamlined "to-be" process will be documented and modeled for comparison with the old process.

FIGURE 13.2 AS-IS BUSINESS PROCESS FOR PURCHASING A BOOK FROM A PHYSICAL BOOKSTORE



Purchasing a book from a physical bookstore requires many steps to be performed by both the seller and the customer.

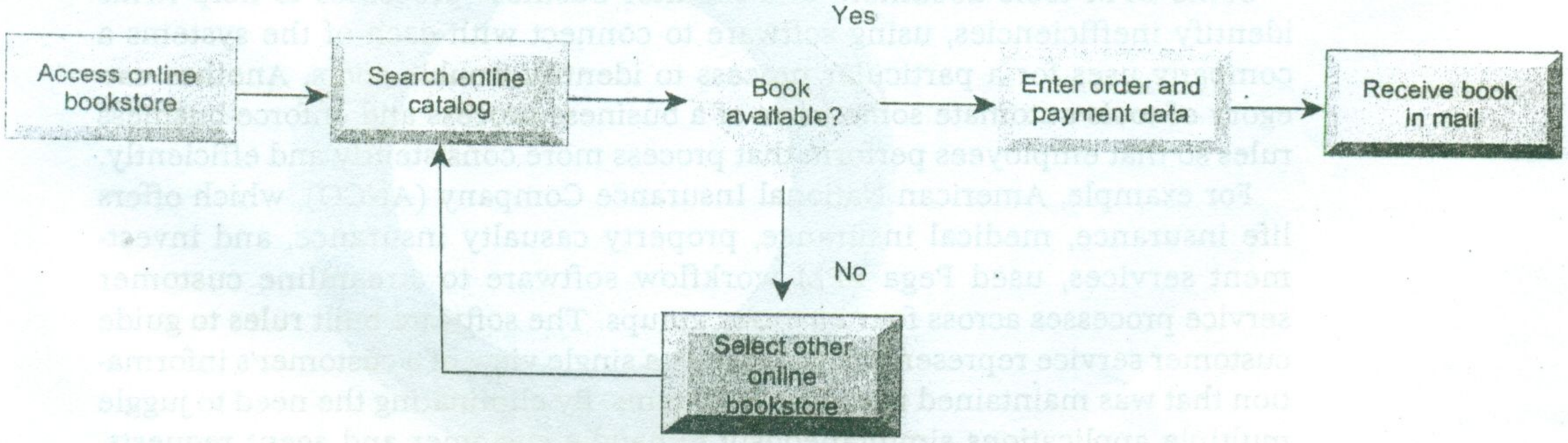
Figure 13.3 illustrates how the book-purchasing process can be redesigned by taking advantage of the Internet. The customer accesses an online bookstore over the Internet from his or her computer. He or she searches the bookstore's online catalog for the book he or she wants. If the book is available, the customer orders the book online, supplying credit card and shipping address information, and the book is delivered to the customer's home. If the online bookstore does not carry the book, the customer selects another online bookstore and searches for the book again. This process has far fewer steps than that for purchasing the book in a physical bookstore, requires much less effort on the part of the customer, and requires less sales staff for customer service. The new process is therefore much more efficient and time-saving.

The new process design needs to be justified by showing how much it reduces time and cost or enhances customer service and value. Management first measures the time and cost of the existing process as a baseline. In our example, the time required for purchasing a book from a physical bookstore might range from 15 minutes (if the customer immediately finds what he or she wants) to 30 minutes if the book is in stock but has to be located by sales staff. If the book has to be ordered from another source, the process might take one or two weeks and another trip to the bookstore for the customer. If the customer lives far away from the bookstore, the time to travel to the bookstore would have to be factored in. The bookstore will have to pay the costs for maintaining a physical store and keeping the book in stock, for sales staff on site, and for shipment costs if the book has to be obtained from another location.

The new process for purchasing a book online might only take several minutes, although the customer might have to wait several days or a week to receive the book in the mail and will have to pay a shipping charge. But the customer saves time and money by not having to travel to the bookstore or make additional visits to pick up the book. Booksellers' costs are lower because they do not have to pay for a physical store location or for local inventory.

4. **Implement the new process:** Once the new process has been thoroughly modeled and analyzed, it must be translated into a new set of procedures and work rules. New information systems or enhancements to existing systems

FIGURE 13.3 REDESIGNED PROCESS FOR PURCHASING A BOOK ONLINE



Using Internet technology makes it possible to redesign the process for purchasing a book so that it requires fewer steps and consumes fewer resources.

may have to be implemented to support the redesigned process. The new process and supporting systems are rolled out into the business organization. As the business starts using this process, problems are uncovered and addressed. Employees working with the process may recommend improvements.

5. **Continuous measurement:** Once a process has been implemented and optimized, it needs to be continually measured. Why? Processes may deteriorate over time as employees fall back on old methods, or they may lose their effectiveness if the business experiences other changes.

Although many business process improvements are incremental and ongoing, there are occasions when more radical change must take place. Our example of a physical bookstore redesigning the book-purchasing process so that it can be carried out online is an example of this type of radical, far-reaching change. When properly implemented, business process redesign produces dramatic gains in productivity and efficiency, and may even change the way the business is run. In some instances, it drives a "paradigm shift" that transforms the nature of the business itself.

This actually happened in book retailing when Amazon challenged traditional physical bookstores with its online retail model. By radically rethinking the way a book can be purchased and sold, Amazon and other online bookstores have achieved remarkable efficiencies, cost reductions, and a whole new way of doing business.

BPM poses challenges. Executives report that the largest single barrier to successful business process change is organizational culture. Employees do not like unfamiliar routines and often try to resist change. This is especially true of projects where organizational changes are very ambitious and far-reaching. Managing change is neither simple nor intuitive, and companies committed to extensive process improvement need a good change management strategy (see Chapter 14).

Tools for Business Process Management

Over 100 software firms provide tools for various aspects of BPM, including IBM, Oracle, and TIBCO. These tools help businesses identify and document processes requiring improvement, create models of improved processes, capture and enforce business rules for performing processes, and integrate existing systems to support new or redesigned processes. BPM software tools also provide analytics for verifying that process performance has been improved and for measuring the impact of process changes on key business performance indicators.

Some BPM tools document and monitor business processes to help firms identify inefficiencies, using software to connect with each of the systems a company uses for a particular process to identify trouble spots. Another category of tools automate some parts of a business process and enforce business rules so that employees perform that process more consistently and efficiently.

For example, American National Insurance Company (ANCO), which offers life insurance, medical insurance, property casualty insurance, and investment services, used Pega BPM workflow software to streamline customer service processes across four business groups. The software built rules to guide customer service representatives through a single view of a customer's information that was maintained in multiple systems. By eliminating the need to juggle multiple applications simultaneously to handle customer and agent requests, the improved process increased customer service representative workload capacity by 192 percent.

A third category of tools helps businesses integrate their existing systems to support process improvements. They automatically manage processes across the business, extract data from various sources and databases, and generate transactions in multiple related systems (see the Interactive Session on Organizations).

13.2 WHAT ARE THE CORE ACTIVITIES IN THE SYSTEMS DEVELOPMENT PROCESS?

New information systems are an outgrowth of a process of organizational problem solving. A new information system is built as a solution to some type of problem or set of problems the organization perceives it is facing. The problem may be one in which managers and employees realize that the organization is not performing as well as expected, or that the organization should take advantage of new opportunities to perform more successfully.

The activities that go into producing an information system solution to an organizational problem or opportunity are called **systems development**. Systems development is a structured kind of problem solved with distinct activities. These activities consist of systems analysis, systems design, programming, testing, conversion, and production and maintenance.

Figure 13.4 illustrates the systems development process. The systems development activities depicted usually take place in sequential order. But some of the activities may need to be repeated or some may take place simultaneously, depending on the approach to system building that is being employed (see Section 13.4).

SYSTEMS ANALYSIS

Systems analysis is the analysis of a problem that a firm tries to solve with an information system. It consists of defining the problem, identifying its causes,

FIGURE 13.4 THE SYSTEMS DEVELOPMENT PROCESS



Building a system can be broken down into six core activities.

INTERACTIVE SESSION: ORGANIZATIONS

BURTON SNOWBOARDS SPEEDS AHEAD WITH NIMBLE BUSINESS PROCESSES

When we hear "snowboarding", we tend to think of snow-covered slopes, acrobatic jumps, and high-flying entertainment. We don't usually think of improving business process efficiency. But snowboarding is business for Burton Snowboards, an industry pioneer and market leader. Founded in 1977 by Jake Burton Carpenter and headquartered in Burlington, Vermont, Burton designs, manufactures, and markets equipment, clothing, and related accessories for snowboarders. Today, Burton is a global enterprise that serves customers in 27 countries and has offices in Japan, Austria, and throughout the United States.

At its peak, Burton controlled over 40 percent of the U.S. snowboarding market, and it remains the market leader amidst a growing number of competitors. Now, as Burton continues to expand into a global company, it has a new set of problems: improving its systems for inventory, supply chain, purchasing, and customer service.

Stocking and managing inventory is a difficult problem for Burton, whose inventory changes dramatically depend on product line updates and the time of the year. Burton takes feedback from its customers very seriously, and will move quickly to meet their needs. For instance, if a rider tests a jacket and recommends repositioning a zipper, Burton's production line must be able to make this modification quickly and easily. Being dynamic and adaptable is a competitive necessity.

Burton has implemented and currently maintains SAP enterprise software, an Oracle database, a SUSE Linux enterprise server, and commodity hardware. That's a long way from a lone woodworking shop in Vermont. Before making these upgrades, Burton's information systems were a hodgepodge of inconsistently implemented and underutilized software. The company had to manually allocate products to customers and orders. In 1997, Burton first deployed SAP to begin upgrading its IT landscape, and the company has continued to use SAP since that time. But Burton needed to do more with its systems.

Two of Burton's IT goals, established by CIO Kevin Ubert, are to "strengthen the foundation," and keep their systems "simple, standard, [and] supportable." The foundation Ubert referred to is SAP enterprise resource planning (ERP) software. Rather than buying new software to solve IT problems, Burton decided that it would explore basic functionalities of SAP ERP software that it had not used yet. Often, Burton could resolve problems this way without adding new layers of complexity to its IT infrastructure, and the company gained proficiency with SAP enterprise software in the process. Burton aims for a standard, traditional version of software whenever possible, realizing that with more bells and whistles comes increased maintenance costs and steeper learning curves to understanding the software.

SAP analysts helped Burton identify the top five transactions that were the most critical to its business operations and that needed optimization from a systems standpoint. Burton had to identify unnecessarily complicated processes, backlogs, and design gaps in the flow of its business processes. For example, the available-to-promise process was taking hours to complete. (Available to promise, in response to customer order inquiries, reports on available quantities of a requested product and delivery due dates.) Burton wanted to speed up this process so that its dealers and retail customers would have more precise information about the availability of products not currently in stock. Completing this process now takes 20 minutes.

Other processes in need of improvement included the order-to-cash process (receiving and processing customer sales, including order entry, fulfillment, distribution, and payment); the handling of overdue purchase orders in the procure-to-pay process, which consists of all the steps from purchasing goods from a supplier to paying the supplier; and the electronic data interchange (EDI) inventory feed extract transaction. Burton has an assortment of warehouses that pass inventory data to one another automatically using EDI systems. Thousands of items are moving from warehouse to warehouse and thousands of transactions occur each day at each warehouse. Burton found that the process of reporting inventory was inefficient, and both suppliers and customers could not easily determine up-to-date information on which items were in stock at which warehouse.

SAP and Burton worked together to improve communication between warehouses and supply chain efficiency.

A management dashboard developed with the help of SAP shows how smoothly a critical process is running at a certain point in time. Information from the dashboard helps Burton's key users discover inconsistencies, gaps, or other areas that they should be monitoring more closely.

All of these process improvements proved especially valuable during what Burton calls its "reorder" season. Burton's dealers place orders to stock their stores well before winter sets in. As consumers start buying the merchandise, the dealers reorder with Burton to replenish their stock or to buy new products. Now they are able to see more timely product availability data, and receive orders more rapidly. In 2015, Burton is planning for the potential growth in global sales that would develop as a result of Beijing winning the rights to host the 2022 Winter Olympics. Burton believes that China might account for a full 10 percent of its sales by that time.

Sources: "Burton Sees Opportunity as Beijin Bids for Winter Olympic Games," Bloomberg News, January 12, 2015; Lauren Bonneau, "How Burton Snowboards Remains as Nimble as Its Riders," SAP InsiderPROFILES, April–June 2011; "The Burton Corporation Company Profile," Yahoo! Finance, accessed August 27, 2012; and www.burton.com, accessed August 27, 2012.

CASE STUDY QUESTIONS

1. Analyze Burton using the value chain and competitive forces models.
2. Why are the business processes described in this case such an important source of competitive advantage for Burton?
3. Explain exactly how these process improvements enhance Burton's operational performance and decision making.

specifying the solution, and identifying the information requirements that must be met by a system solution.

The systems analyst creates a road map of the existing organization and systems, identifying the primary owners and users of data along with existing hardware and software. The systems analyst then details the problems of existing systems. By examining documents, work papers, and procedures, observing system operations, and interviewing key users of the systems, the analyst can identify the problem areas and objectives a solution would achieve. Often, the solution requires building a new information system or improving an existing one.

The systems analysis also includes a **feasibility study** to determine whether that solution is feasible, or achievable, from a financial, technical, and organizational standpoint. The feasibility study determines whether the proposed system is expected to be a good investment, whether the technology needed for the system is available and can be handled by the firm's information systems specialists, and whether the organization can handle the changes introduced by the system.

Normally, the systems analysis process identifies several alternative solutions that the organization can pursue and assess the feasibility of each. A written systems proposal report describes the costs and benefits, and the advantages and disadvantages, of each alternative. It is up to management to determine which mix of costs, benefits, technical features, and organizational impacts represents the most desirable alternative.

Establishing Information Requirements

Perhaps the most challenging task of the systems analyst is to define the specific information requirements that must be met by the chosen system solution. At the most basic level, the **information requirements** of a new system involve identifying who needs what information, where, when, and how. Requirements analysis carefully defines the objectives of the new or modified system and develops a detailed description of the functions that the new system must perform. Faulty requirements analysis is a leading cause of systems failure and high systems development costs (see Chapter 14). A system designed around the wrong set of requirements will either have to be discarded because of poor performance or will need to undergo major modifications. Section 13.3 describes alternative approaches to eliciting requirements that help minimize this problem.

Some problems do not require an information system solution but instead need an adjustment in management, additional training, or refinement of existing organizational procedures. If the problem is information related, systems analysis still may be required to diagnose the problem and arrive at the proper solution.

SYSTEMS DESIGN

Systems analysis describes what a system should do to meet information requirements, and **systems design** shows how the system will fulfill this objective. The design of an information system is the overall plan or model for that system. Like the blueprint of a building or house, it consists of all the specifications that give the system its form and structure.

The systems designer details the system specifications that will deliver the functions identified during systems analysis. These specifications should address all of the managerial, organizational, and technological components of the system solution. Table 13.1 lists the types of specifications that would be produced during systems design.

Like houses or buildings, information systems may have many possible designs. Each design represents a unique blend of all technical and organizational components. What makes one design superior to others is the ease and efficiency with which it fulfills user requirements within a specific set of technical, organizational, financial, and time constraints.

The Role of End Users

User information requirements drive the entire system-building effort. Users must have sufficient control over the design process to ensure that the system reflects their business priorities and information needs, not the biases of the technical staff. Working on design increases users' understanding and acceptance of the system. As we describe in Chapter 14, insufficient user involvement in the design effort is a major cause of system failure. However, some systems require more user participation in design than others, and Section 13.3 shows how alternative systems development methods address the user participation issue.

TABLE 13.1 DESIGN SPECIFICATIONS

OUTPUT	PROCESSING	DOCUMENTATION
Medium	Computations	Operations documentation
Content	Program modules	Systems documentation
Timing	Required reports	User documentation
INPUT	Timing of outputs	CONVERSION
Origins	MANUAL PROCEDURES	Transfer files
Flow	What activities	Initiate new procedures
Data entry	Who performs them	Select testing method
USER INTERFACE	When	Cut over to new system
Simplicity	How	TRAINING
Efficiency	Where	Select training techniques
Logic	CONTROLS	Develop training modules
Feedback	Input controls (characters, limit, reasonableness)	Identify training facilities
Errors	Processing controls (consistency, record counts)	ORGANIZATIONAL CHANGES
DATABASE DESIGN	Output controls (totals, samples of output)	Task redesign
Logical data model	Procedural controls (passwords, special forms)	Job design
Volume and speed requirements	SECURITY	Process design
File organization and design	Access controls	Organization structure design
Record specifications	Catastrophe plans	Reporting relationships
	Audit trails	

COMPLETING THE SYSTEMS DEVELOPMENT PROCESS

The remaining steps in the systems development process translate the solution specifications established during systems analysis and design into a fully operational information system. These concluding steps consist of programming, testing, conversion, production, and maintenance.

Programming

During the **programming** stage, system specifications that were prepared during the design stage are translated into software program code. Today, many organizations no longer do their own programming for new systems. Instead, they purchase the software that meets the requirements for a new system from external sources such as software packages from a commercial software vendor, software services from an application service provider, or outsourcing firms that develop custom application software for their clients (see Section 13.3).

Testing

Exhaustive and thorough **testing** must be conducted to ascertain whether the system produces the right results. Testing answers the question, "Will the system produce the desired results under known conditions?" As Chapter 5 noted, some companies are starting to use cloud computing services for this work.

The amount of time needed to answer this question has been traditionally underrated in systems project planning (see Chapter 14). Testing is time-consuming: Test data must be carefully prepared, results reviewed, and corrections made in the system. In some instances, parts of the system may have to be redesigned. The risks resulting from glossing over this step are enormous.

Testing an information system can be broken down into three types of activities: unit testing, system testing, and acceptance testing. **Unit testing**, or program testing, consists of testing each program separately in the system. It is widely believed that the purpose of such testing is to guarantee that programs

are error-free, but this goal is realistically impossible. Testing should be viewed instead as a means of locating errors in programs, focusing on finding all the ways to make a program fail. Once they are pinpointed, problems can be corrected.

System testing tests the functioning of the information system as a whole. It tries to determine whether discrete modules will function together as planned and whether discrepancies exist between the way the system actually works and the way it was conceived. Among the areas examined are performance time, capacity for file storage and handling peak loads, recovery and restart capabilities, and manual procedures.

Acceptance testing provides the final certification that the system is ready to be used in a production setting. Systems tests are evaluated by users and reviewed by management. When all parties are satisfied that the new system meets their standards, the system is formally accepted for installation.

The systems development team works with users to devise a systematic test plan. The **test plan** includes all of the preparations for the series of tests we have just described.

Figure 13.5 shows an example of a test plan. The general condition being tested is a record change. The documentation consists of a series of test plan screens maintained on a database (perhaps a PC database) that is ideally suited to this kind of application.

Conversion is the process of changing from the old system to the new system. Four main conversion strategies can be employed: the parallel strategy, the direct cutover strategy, the pilot study strategy, and the phased approach strategy.

In a **parallel strategy,** both the old system and its potential replacement are run together for a time until everyone is assured that the new one functions correctly. This is the safest conversion approach because, in the event of errors or processing disruptions, the old system can still be used as a backup. However, this approach is very expensive, and additional staff or resources may be required to run the extra system.

The **direct cutover strategy** replaces the old system entirely with the new system on an appointed day. It is a very risky approach that can potentially be

FIGURE 13.5 **A SAMPLE TEST PLAN TO TEST A RECORD CHANGE**

Procedure	Address and Maintenance "Record Change Series"		Test Series 2		
	Prepared By:		Date:	Version:	
Test Ref.	Condition Tested	Special Requirements	Expected Results	Output On	Next Screen
2.0	Change records				
2.1	Change existing record	Key field	Not allowed		
2.2	Change nonexistent record	Other fields	"Invalid key" message		
2.3	Change deleted record	Deleted record must be available	"Deleted" message		
2.4	Make second record	Change 2.1 above	OK if valid	Transaction file	V45
2.5	Insert record		OK if valid	Transaction file	V45
2.6	Abort during change	Abort 2.5	No change	Transaction file	V45

When developing a test plan, it is imperative to include the various conditions to be tested, the requirements for each condition tested, and the expected results. Test plans require input from both end users and information systems specialists.

more costly than running two systems in parallel if serious problems with the new system are found. There is no other system to fall back on. Dislocations, disruptions, and the cost of corrections may be enormous.

The **pilot study strategy** introduces the new system to only a limited area of the organization, such as a single department or operating unit. When this pilot version is complete and working smoothly, it is installed throughout the rest of the organization, either simultaneously or in stages.

The **phased approach strategy** introduces the new system in stages, either by functions or by organizational units. If, for example, the system is introduced by function, a new payroll system might begin with hourly workers who are paid weekly, followed six months later by adding salaried employees (who are paid monthly) to the system. If the system is introduced by organizational unit, corporate headquarters might be converted first, followed by outlying operating units four months later.

Moving from an old system to a new one requires that end users be trained to use the new system. Detailed **documentation** showing how the system works from both a technical and end-user standpoint is finalized during conversion time for use in training and everyday operations. Lack of proper training and documentation contributes to system failure, so this portion of the systems development process is very important.

Production and Maintenance

After the new system is installed and conversion is complete, the system is said to be in **production**. During this stage, the system will be reviewed by both users and technical specialists to determine how well it has met its original objectives and to decide whether any revisions or modifications are in order. In some instances, a formal **post-implementation audit** document is prepared. After the system has been fine-tuned, it must be maintained while it is in production to correct errors, meet requirements, or improve processing efficiency. Changes in hardware, software, documentation, or procedures to a production system to correct errors, meet new requirements, or improve processing efficiency are termed **maintenance**.

Approximately 20 percent of the time devoted to maintenance is used for debugging or correcting emergency production problems. Another 20 percent is concerned with changes in data, files, reports, hardware, or system software. But 60 percent of all maintenance work consists of making user enhancements, improving documentation, and recoding system components for greater processing efficiency. The amount of work in the third category of maintenance problems could be reduced significantly through better systems analysis and design practices. Table 13.2 summarizes the systems development activities.

13.3 What are the principal methodologies for modeling and designing systems?

There are alternative methodologies for modeling and designing systems. Structured methodologies and object-oriented development are the most prominent.

Structured Methodologies

Structured methodologies have been used to document, analyze, and design information systems since the 1970s. **Structured** refers to the fact that

TABLE 13.2 SYSTEMS DEVELOPMENT

CORE ACTIVITY	DESCRIPTION
Systems analysis	Identify problem(s) Specify solutions Establish information requirements
Systems design	Create design specifications
Programming	Translate design specifications into program code
Testing	Perform unit testing Perform systems testing Perform acceptance testing
Conversion	Plan conversion Prepare documentation Train users and technical staff
Production and maintenance	Operate the system Evaluate the system Modify the system

the techniques are step by step, with each step building on the previous one. Structured methodologies are top-down, progressing from the highest, most abstract level to the lowest level of detail—from the general to the specific.

Structured development methods are process-oriented, focusing primarily on modeling the processes, or actions that capture, store, manipulate, and distribute data as the data flow through a system. These methods separate data from processes. A separate programming procedure must be written every time someone wants to take an action on a particular piece of data. The procedures act on data that the program passes to them.

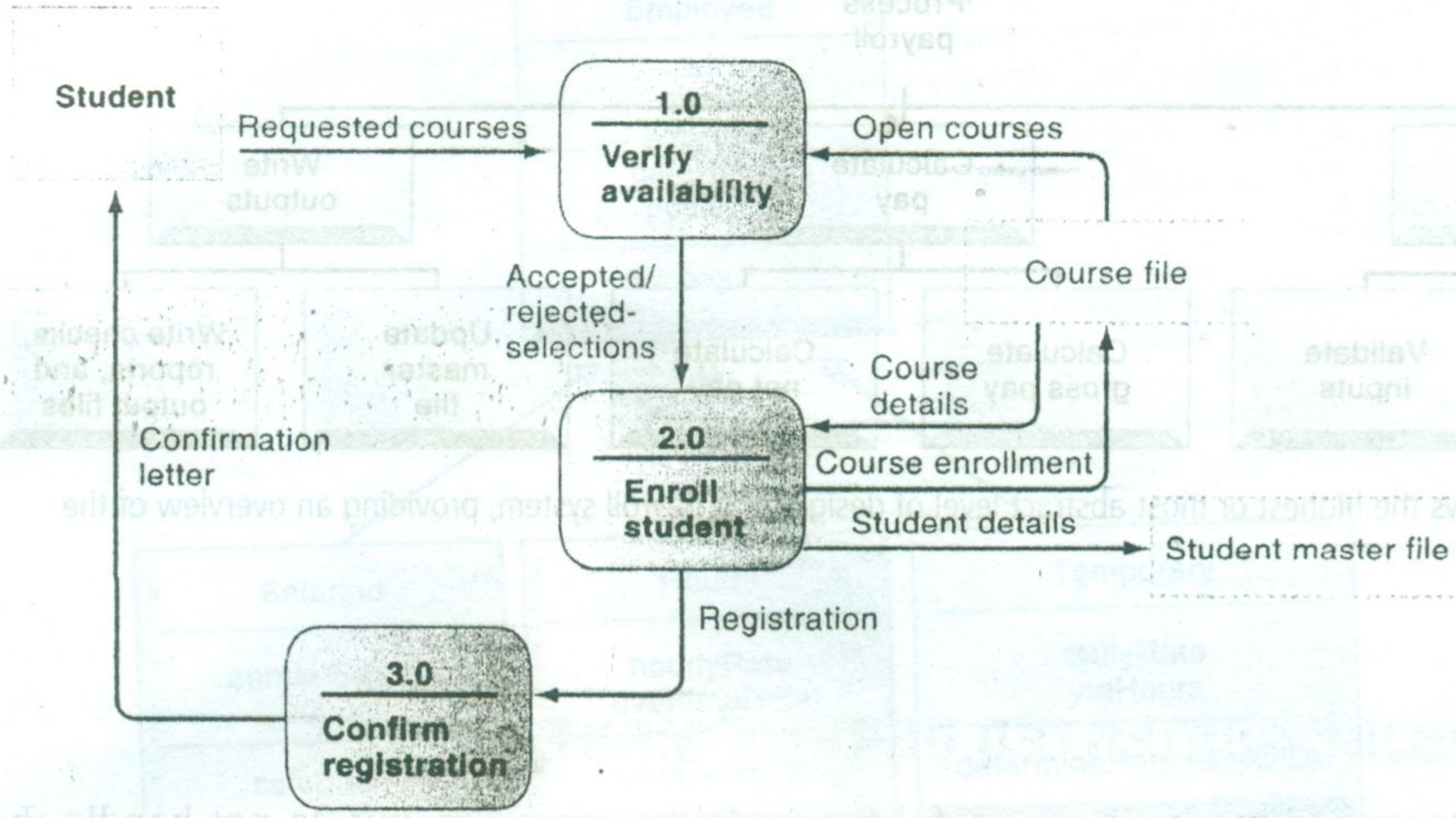
The primary tool for representing a system's component processes and the flow of data between them is the **data flow diagram (DFD)**. The data flow diagram offers a logical graphic model of information flow, partitioning a system into modules that show manageable levels of detail. It rigorously specifies the processes or transformations that occur within each module and the interfaces that exist between them.

Figure 13.6 shows a simple data flow diagram for a mail-in university course registration system. The rounded boxes represent processes, which portray the transformation of data. The square box represents an external entity, which is an originator or receiver of information located outside the boundaries of the system being modeled. The open rectangles represent data stores, which are either manual or automated inventories of data. The arrows represent data flows, which show the movement between processes, external entities, and data stores. They contain packets of data with the name or content of each data flow listed beside the arrow.

This data flow diagram shows that students submit registration forms with their name, identification number, and the numbers of the courses they wish to take. In process 1.0, the system verifies that each course selected is still open by referencing the university's course file. The file distinguishes courses that are open from those that have been canceled or filled. Process 1.0 then determines which of the student's selections can be accepted or rejected. Process 2.0 enrolls the student in the courses for which he or she has been accepted. It updates the university's course file with the student's name and identification

F-35/B

FIGURE 13.6 **DATA FLOW DIAGRAM FOR MAIL-IN UNIVERSITY REGISTRATION SYSTEM**



The system has three processes: Verify availability (1.0), Enroll student (2.0), and Confirm registration (3.0). The name and content of each of the data flows appear adjacent to each arrow. There is one external entity in this system: the student. There are two data stores: the student master file and the course file.

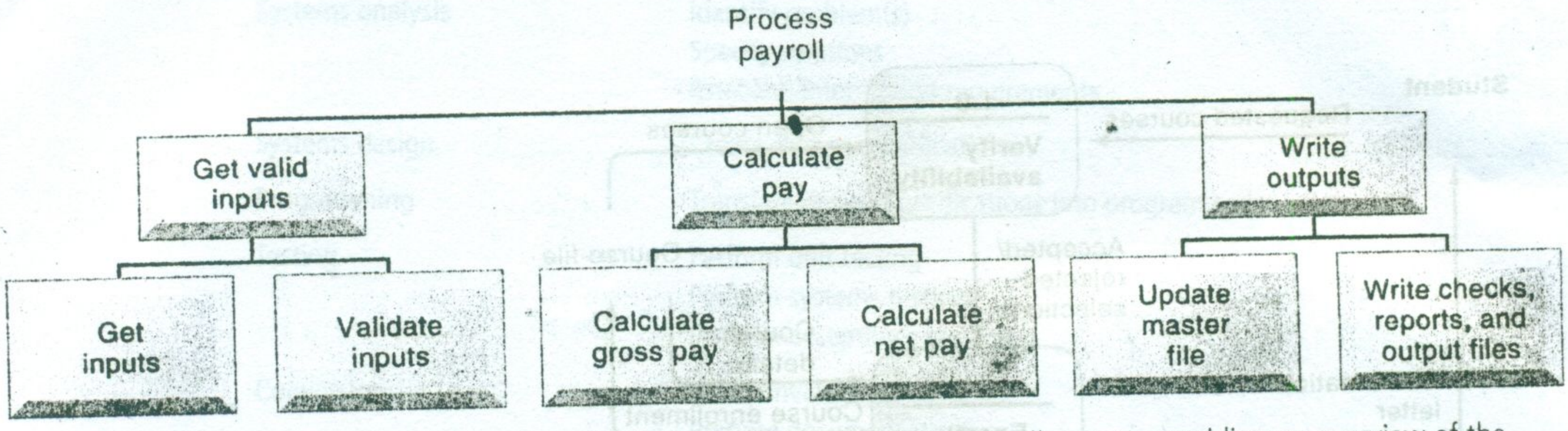
number and recalculates the class size. If maximum enrollment has been reached, the course number is flagged as closed. Process 2.0 also updates the university's student master file with information about new students or changes in address. Process 3.0 then sends each student applicant a confirmation of registration letter listing the courses for which he or she is registered and noting the course selections that could not be fulfilled.

The diagrams can be used to depict higher-level processes as well as lower-level details. Through leveled data flow diagrams, a complex process can be broken down into successive levels of detail. An entire system can be divided into subsystems with a high-level data flow diagram. Each subsystem, in turn, can be divided into additional subsystems with second-level data flow diagrams, and the lower-level subsystems can be broken down again until the lowest level of detail has been reached.

Another tool for structured analysis is a data dictionary, which contains information about individual pieces of data and data groupings within a system (see Chapter 6). The data dictionary defines the contents of data flows and data stores so that systems builders understand exactly what pieces of data they contain. **Process specifications** describe the transformation occurring within the lowest level of the data flow diagrams. They express the logic for each process.

In structured methodology, software design is modeled using hierarchical structure charts. The **structure chart** is a top-down chart, showing each level of design, its relationship to other levels, and its place in the overall design structure. The design first considers the main function of a program or system, then breaks this function into subfunctions, and decomposes each subfunction until the lowest level of detail has been reached. Figure 13.7 shows a high-level structure chart for a payroll system. If a design has too many levels to fit onto one structure chart, it can be broken down further on more detailed structure charts. A structure chart may document one program, one system (a set of programs), or part of one program.

FIGURE 13.7 HIGH-LEVEL STRUCTURE CHART FOR A PAYROLL SYSTEM



This structure chart shows the highest or most abstract level of design for a payroll system, providing an overview of the entire system.

OBJECT-ORIENTED DEVELOPMENT

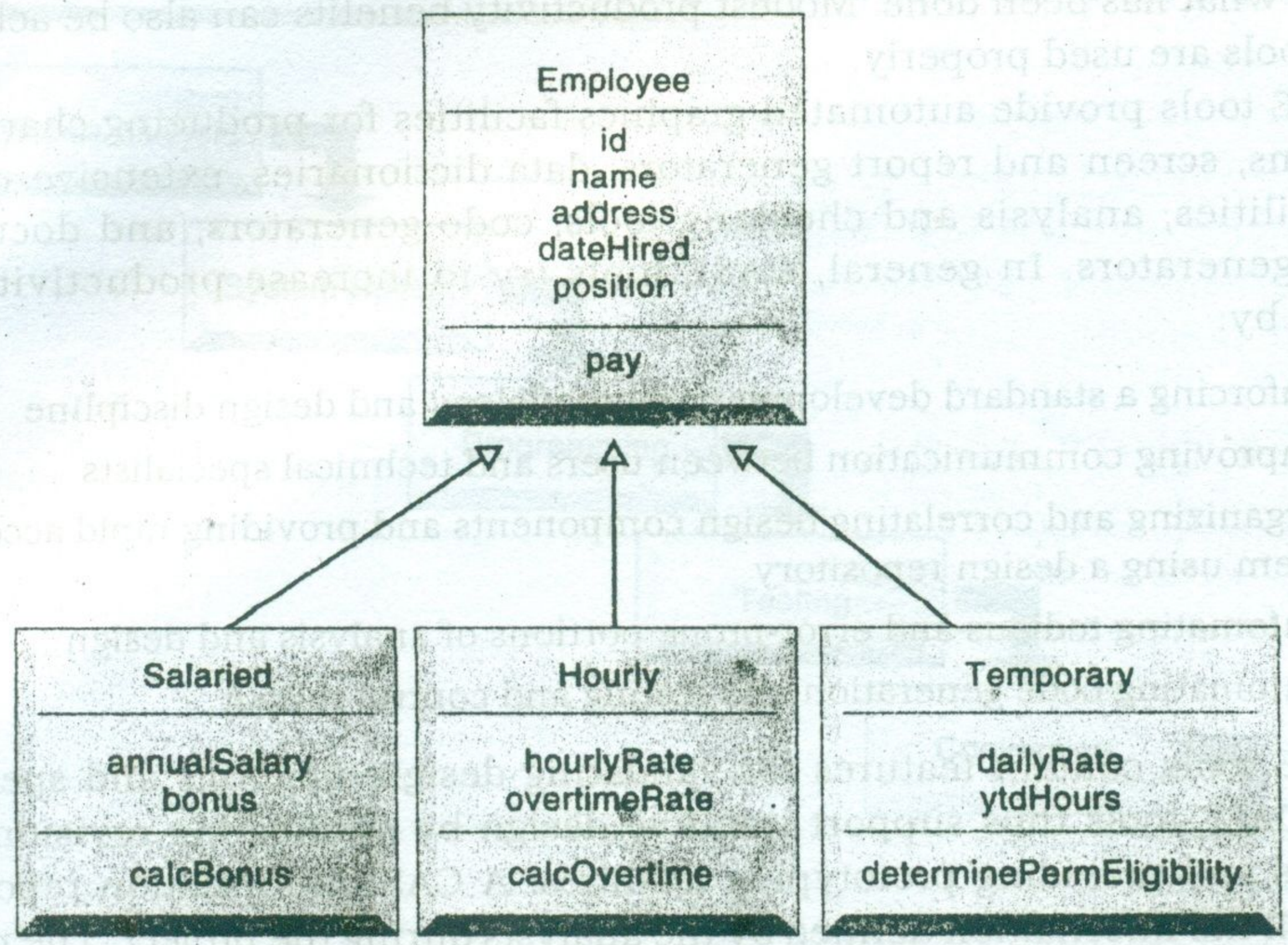
Structured methods are useful for modeling processes, but do not handle the modeling of data well. They also treat data and processes as logically separate entities, whereas in the real world such separation seems unnatural. Different modeling conventions are used for analysis (the data flow diagram) and for design (the structure chart).

Object-oriented development addresses these issues. Object-oriented development uses the **object** as the basic unit of systems analysis and design. An object combines data and the specific processes that operate on those data. Data encapsulated in an object can be accessed and modified only by the operations, or methods, associated with that object. Instead of passing data to procedures, programs send a message for an object to perform an operation that is already embedded in it. The system is modeled as a collection of objects and the relationships among them. Because processing logic resides within objects rather than in separate software programs, objects must collaborate with each other to make the system work.

Object-oriented modeling is based on the concepts of *class* and *inheritance*. Objects belonging to a certain class, or general categories of similar objects, have the features of that class. Classes of objects in turn can inherit all the structure and behaviors of a more general class and then add variables and behaviors unique to each object. New classes of objects are created by choosing an existing class and specifying how the new class differs from the existing class, instead of starting from scratch each time.

We can see how class and inheritance work in Figure 13.8, which illustrates the relationships among classes concerning employees and how they are paid. Employee is the common ancestor, or superclass, for the other three classes. Salaried, Hourly, and Temporary are subclasses of Employee. The class name is in the top compartment, the attributes for each class are in the middle portion of each box, and the list of operations is in the bottom portion of each box. The features that are shared by all employees (ID, name, address, date hired, position, and pay) are stored in the Employee superclass, whereas each subclass stores features that are specific to that particular type of employee. Specific to hourly employees, for example, are their hourly rates and overtime rates. A solid line from the subclass to the superclass is a generalization path showing that the subclasses Salaried, Hourly, and Temporary have common features that can be generalized into the superclass Employee.

FIGURE 13.8 **CLASS AND INHERITANCE**



This figure illustrates how classes inherit the common features of their superclass.

Object-oriented development is more iterative and incremental than traditional structured development. During analysis, systems builders document the functional requirements of the system, specifying its most important properties and what the proposed system must do. Interactions between the system and its users are analyzed to identify objects, which include both data and processes. The object-oriented design phase describes how the objects will behave and how they will interact with one another. Similar objects are grouped together to form a class, and classes are grouped into hierarchies in which a subclass inherits the attributes and methods from its superclass.

The information system is implemented by translating the design into program code, reusing classes that are already available in a library of reusable software objects, and adding new ones created during the object-oriented design phase. Implementation may also involve the creation of an object-oriented database. The resulting system must be thoroughly tested and evaluated.

Because objects are reusable, object-oriented development could potentially reduce the time and cost of writing software because organizations can reuse software objects that have already been created as building blocks for other applications. New systems can be created by using some existing objects, changing others, and adding a few new objects. Object-oriented frameworks have been developed to provide reusable, semicomplete applications that the organization can further customize into finished applications.

COMPUTER-AIDED SOFTWARE ENGINEERING

Computer-aided software engineering (CASE)—sometimes called *computer-aided systems engineering*--provides software tools to automate the methodologies we have just described to reduce the amount of repetitive work the developer needs to do. CASE tools also facilitate the creation of clear documentation and the coordination of team development efforts. Team

members can share their work easily by accessing each other's files to review or modify what has been done. Modest productivity benefits can also be achieved if the tools are used properly.

CASE tools provide automated graphics facilities for producing charts and diagrams, screen and report generators, data dictionaries, extensive reporting facilities, analysis and checking tools, code generators, and documentation generators. In general, CASE tools try to increase productivity and quality by:

- Enforcing a standard development methodology and design discipline
- Improving communication between users and technical specialists
- Organizing and correlating design components and providing rapid access to them using a design repository
- Automating tedious and error-prone portions of analysis and design
- Automating code generation and testing and control rollout

CASE tools contain features for validating design diagrams and specifications. CASE tools thus support iterative design by automating revisions and changes and providing prototyping facilities. A CASE information repository stores all the information defined by the analysts during the project. The repository includes data flow diagrams, structure charts, entity-relationship diagrams, data definitions, process specifications, screen and report formats, notes and comments, and test results.

To be used effectively, CASE tools require organizational discipline. Every member of a development project must adhere to a common set of naming conventions and standards as well as to a development methodology. The best CASE tools enforce common methods and standards, which may discourage their use in situations where organizational discipline is lacking.

13.4 WHAT ARE ALTERNATIVE METHODS FOR BUILDING INFORMATION SYSTEMS?

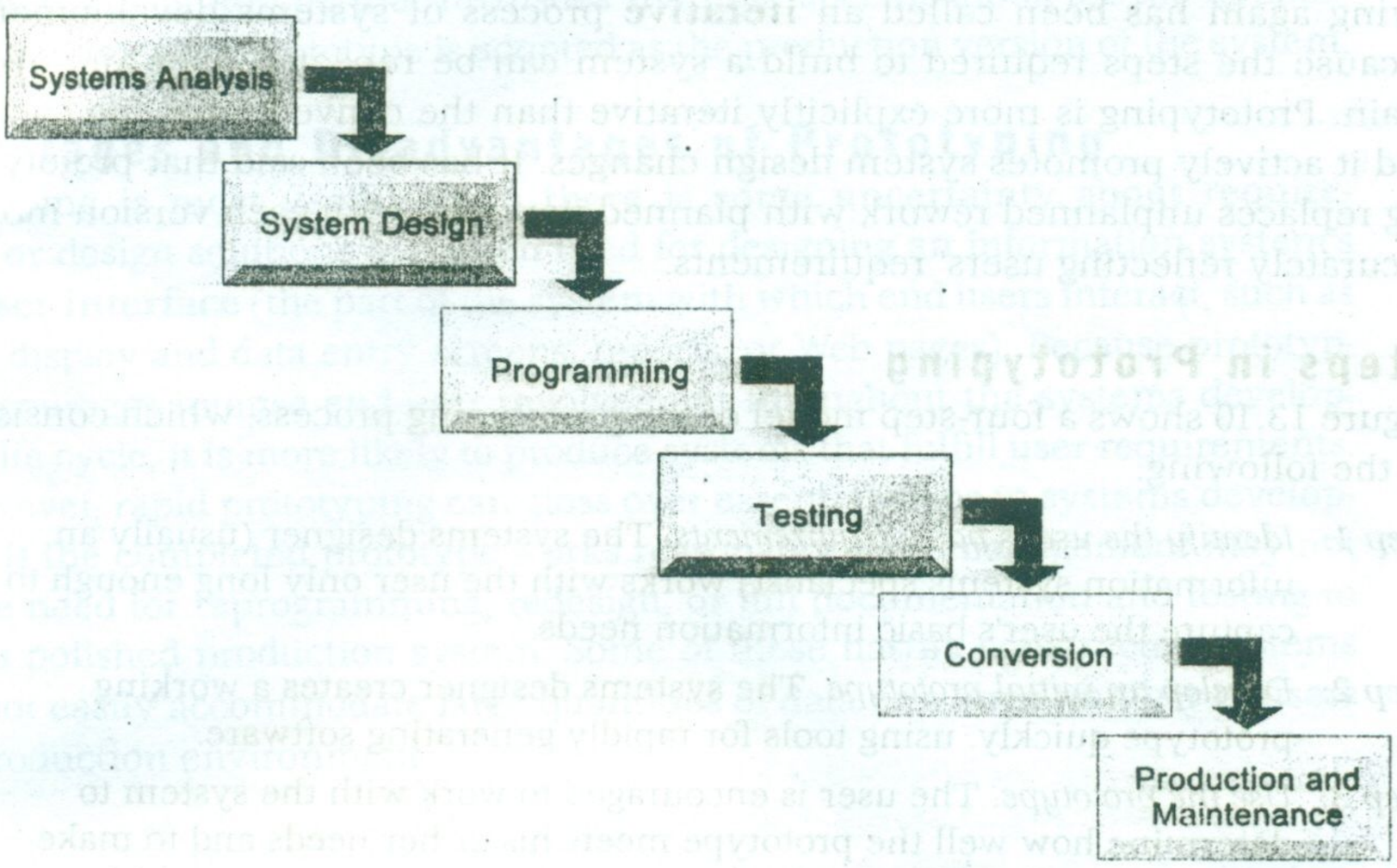
Systems differ in terms of their size and technological complexity and in terms of the organizational problems they are meant to solve. A number of systems-building approaches have been developed to deal with these differences. This section describes these alternative methods: the traditional systems life cycle, prototyping, application software packages, end-user development, and outsourcing.

TRADITIONAL SYSTEMS LIFE CYCLE

The **systems life cycle** is the oldest method for building information systems. The life cycle methodology is a phased approach to building a system, dividing systems development into formal stages, as illustrated in Figure 13.9. Systems development specialists have different opinions on how to partition the systems-building stages, but they roughly correspond to the stages of systems development we have just described.

The systems life cycle methodology maintains a formal division of labor between end users and information systems specialists. Technical specialists, such as systems analysts and programmers, are responsible for much of the systems analysis, design, and implementation work; end users are limited to

FIGURE 13.9 THE TRADITIONAL SYSTEMS DEVELOPMENT LIFE CYCLE



The systems development life cycle partitions systems development into formal stages, with each stage requiring completion before the next stage can begin.

providing information requirements and reviewing the technical staff's work. The life cycle also emphasizes formal specifications and paperwork, so many documents are generated during the course of a systems project.

The systems life cycle is still used for building large complex systems that require a rigorous and formal requirements analysis, predefined specifications, and tight controls over the system-building process. However, the systems life cycle approach can be costly, time-consuming, and inflexible. Although systems builders can go back and forth among stages in the life cycle, the systems life cycle is predominantly a "waterfall" approach in which tasks in one stage are completed before work for the next stage begins. Activities can be repeated, but volumes of new documents must be generated and steps retraced if requirements and specifications need to be revised. This encourages freezing of specifications relatively early in the development process. The life cycle approach is also not suitable for many small desktop systems, which tend to be less structured and more individualized.

PROTOTYPING

Prototyping consists of building an experimental system rapidly and inexpensively for end users to evaluate. By interacting with the prototype, users can get a better idea of their information requirements. The prototype endorsed by the users can be used as a template to create the final system.

The **prototype** is a working version of an information system or part of the system, but it is meant to be only a preliminary model. Once operational, the prototype will be further refined until it conforms precisely to users' requirements. Once the design has been finalized, the prototype can be converted to a polished production system.

The process of building a preliminary design, trying it out, refining it, and trying again has been called an **iterative** process of systems development because the steps required to build a system can be repeated over and over again. Prototyping is more explicitly iterative than the conventional life cycle, and it actively promotes system design changes. It has been said that prototyping replaces unplanned rework with planned iteration, with each version more accurately reflecting users' requirements.

Steps in Prototyping

Figure 13.10 shows a four-step model of the prototyping process, which consists of the following:

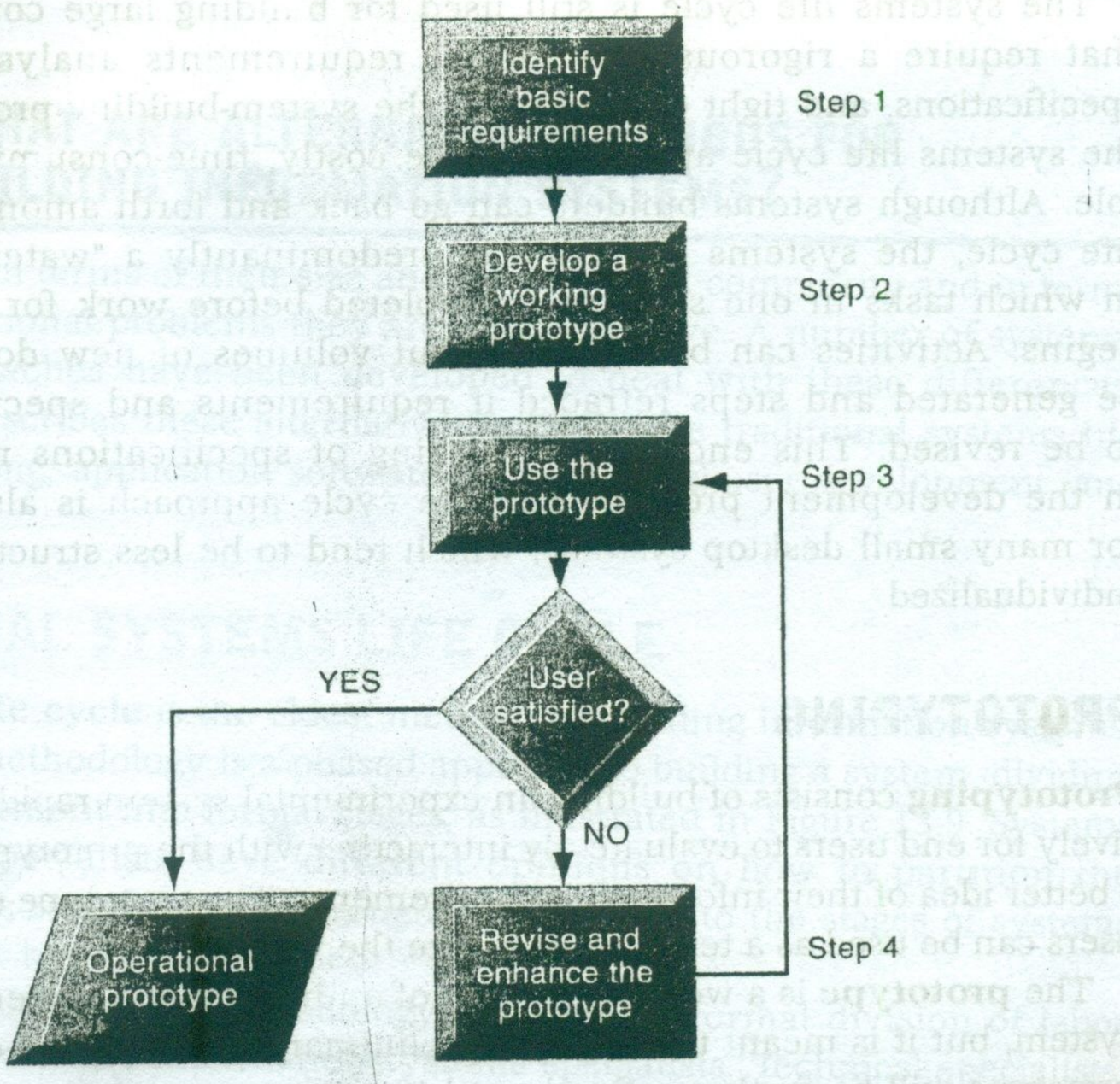
Step 1: *Identify the user's basic requirements.* The systems designer (usually an information systems specialist) works with the user only long enough to capture the user's basic information needs.

Step 2: *Develop an initial prototype.* The systems designer creates a working prototype quickly, using tools for rapidly generating software.

Step 3: *Use the prototype.* The user is encouraged to work with the system to determine how well the prototype meets his or her needs and to make suggestions for improving the prototype.

Step 4: *Revise and enhance the prototype.* The system builder notes all changes the user requests and refines the prototype accordingly. After the prototype has been revised, the cycle returns to Step 3. Steps 3 and 4 are repeated until the user is satisfied.

FIGURE 13.10 THE PROTOTYPING PROCESS



The process of developing a prototype can be broken down into four steps. Because a prototype can be developed quickly and inexpensively, systems builders can go through several iterations, repeating steps 3 and 4, to refine and enhance the prototype before arriving at the final operational one.

When no more iterations are required, the approved prototype then becomes an operational prototype that furnishes the final specifications for the application. Sometimes the prototype is adopted as the production version of the system.

Advantages and Disadvantages of Prototyping

Prototyping is most useful when there is some uncertainty about requirements or design solutions and often used for designing an information system's **end-user interface** (the part of the system with which end users interact, such as online display and data entry screens, reports, or Web pages). Because prototyping encourages intense end-user involvement throughout the systems development life cycle, it is more likely to produce systems that fulfill user requirements.

However, rapid prototyping can gloss over essential steps in systems development. If the completed prototype works reasonably well, management may not see the need for reprogramming, redesign, or full documentation and testing to build a polished production system. Some of these hastily constructed systems may not easily accommodate large quantities of data or a large number of users in a production environment.

END-USER DEVELOPMENT

End-user development allows end users, with little or no formal assistance from technical specialists, to create simple information systems, reducing the time and steps required to produce a finished application. Using user-friendly query languages and reporting, Web site development, graphics, and PC software tools, end users can access data, create reports, and develop simple applications on their own, with little or no help from professional systems analysts or programmers. A **query language** is a software tool that provides immediate online answers to questions that are not predefined, such as "Who are the highest-performing sales representatives?" Query languages are often tied to data management software (see Chapter 6).

For example, Neways Enterprise, a multinational firm which designs, manufactures, and sells personal care, household and nutritional products that are free of harmful ingredients, used Information Builders WEBFOCUS to create an online self-service reporting system for its thousands of independent distributors and its business analysts. The business analysts use the self-service reports to monitor finances, anticipate trends, and predict results based on current insights. Neways' globally dispersed independent distributors use the system to access real-time production data to support sales efforts and track qualification for monthly bonuses. The system's reporting tools let them decide how deeply they want to drill into the data (Information Builders, 2014).

On the whole, end-user-developed systems can be completed more rapidly than those developed through the conventional systems life cycle. Allowing users to specify their own business needs improves requirements gathering and often leads to a higher level of user involvement and satisfaction with the system. However, end-user software tools still cannot replace conventional tools for some business applications because they cannot easily handle the processing of large numbers of transactions or applications with extensive procedural logic and updating requirements.

End-user computing also poses organizational risks because it occurs outside of traditional mechanisms for information systems management and control. When systems are created rapidly, without a formal development methodology, testing and documentation may be inadequate. Control over data can be lost in systems outside the traditional information systems department. To help

organizations maximize the benefits of end-user applications development, management should control the development of end-user applications by requiring cost justification of end-user information system projects and by establishing hardware, software, and quality standards for user-developed applications.

APPLICATION SOFTWARE PACKAGES AND OUTSOURCING

Chapter 5 points out that much of today's software is not developed in-house but is purchased from external sources. Firms can rent the software from a software service provider, they can purchase a software package from a commercial vendor, or they can have a custom application developed by an outside outsourcing firm.

Application Software Packages

During the past several decades, many systems have been built on an application software package foundation. Many applications are common to all business organizations—for example, payroll, accounts receivable, general ledger, or inventory control. For such universal functions with standard processes that do not change a great deal over time, a generalized system will fulfill the requirements of many organizations.

If a software package can fulfill most of an organization's requirements, the company does not have to write its own software. The company can save time and money by using the prewritten, predesigned, pretested software programs from the package. Package vendors supply much of the ongoing maintenance and support for the system, including enhancements to keep the system in line with ongoing technical and business developments. When a package solution is pursued, end users will be responsible for supplying the business information requirements for the system and information systems specialists will provide technical requirements.

If an organization has unique requirements that the package does not address, many packages include capabilities for customization. **Customization** features allow a software package to be modified to meet an organization's unique requirements without destroying the integrity of the packaged software. If a great deal of customization is required, additional programming and customization work may become so expensive and time-consuming that they negate many of the advantages of software packages.

When a system is developed using an application software package, systems analysis will include a package evaluation effort, in which both end users and information systems specialists will participate. The most important evaluation criteria are the functions provided by the package, flexibility, user-friendliness, hardware and software resources, database requirements, installation and maintenance efforts, documentation, vendor quality, and cost. The package evaluation process often is based on a **Request for Proposal (RFP)**, which is a detailed list of questions submitted to packaged-software vendors.

When a software package is selected, the organization no longer has total control over the systems design process. Instead of tailoring the systems design specifications directly to user requirements, the design effort will consist of trying to mold user requirements to conform to the features of the package. If the organization's requirements conflict with the way the package works and the package cannot be customized, the organization will have to adapt to the package and change its procedures.

Outsourcing

If a firm does not want to use its internal resources to build or operate information systems, it can outsource the work to an external organization that specializes in providing these services. Cloud computing and software as a service (SaaS) providers, which we described in Chapter 5, are one form of outsourcing. Subscribing companies use the software and computer hardware provided by the service as the technical platform for their systems. In another form of outsourcing, a company could hire an external vendor to design and create the software for its system, but that company would operate the system on its own computers. The outsourcing vendor might be domestic or in another country.

Domestic outsourcing is driven primarily by the fact that outsourcing firms possess skills, resources, and assets that their clients do not have. Installing a new supply chain management system in a very large company might require hiring an additional 30 to 50 people with specific expertise in supply chain management software, licensed from a vendor. Rather than hire permanent new employees, most of whom would need extensive training in the software package, and then release them after the new system is built, it makes more sense, and is often less expensive, to outsource this work for a 12-month period.

In the case of **offshore outsourcing**, the decision tends to be much more cost-driven. A skilled programmer in India or Russia earns about USD $10,000–$20,000 per year, compared to about $60,000 per year for a comparable programmer in the United States. The Internet and low-cost communications technology have drastically reduced the expense and difficulty of coordinating the work of global teams in faraway locations. In addition to cost savings, many offshore outsourcing firms offer world-class technology assets and skills. Wage inflation outside the United States has recently eroded some of these advantages, and some jobs have moved back to the United States.

Nevertheless, there is a very strong chance that at some point in your career, you'll be working with offshore outsourcers or global teams. Your firm is most likely to benefit from outsourcing if it takes the time to evaluate all the risks and to make sure outsourcing is appropriate for its particular needs. Any company that outsources its applications must thoroughly understand the project, including its requirements, method of implementation, anticipated benefits, cost components, and metrics for measuring performance.

Many firms underestimate costs for identifying and evaluating vendors of information technology services, for transitioning to a new vendor, for improving internal software development methods to match those of outsourcing vendors, and for monitoring vendors to make sure they are fulfilling their contractual obligations. Companies will need to allocate resources for documenting requirements, sending out RFPs, handling travel expenses, negotiating contracts, and project management. Experts claim it takes from three months to a full year to fully transfer work to an offshore partner and make sure the vendor thoroughly understands your business.

Outsourcing offshore incurs additional costs for coping with cultural differences that drain productivity and dealing with human resources issues, such as terminating or relocating domestic employees. All of these hidden costs undercut some of the anticipated benefits from outsourcing. Firms should be especially cautious when using an outsourcer to develop or to operate applications that give it some type of competitive advantage.

General Motors Corporation (GM) had outsourced 90 percent of its IT services, including its data centers and application development. The company recently decided to bring 90 percent of its IT infrastructure in-house, with only 10 percent managed by outsourcers. Lowering costs is important, but GM's primary reason for cutting back outsourcing is to take back control of its information systems, which it believes were preventing the company from responding quickly to competitive opportunities. Bringing information systems in-house will make it easier for GM to cut its sprawling list of IT applications by at least 40 percent, move to a more standardized platform, complete innovative IT projects more quickly, and get a better grip on customer and production data, which had been housed in too many different systems. The automaker is consolidating 23 data centers worldwide into just two, both in Michigan, and running four software development centers (Murphy, 2012).

Figure 13.11 shows best- and worst-case scenarios for the total cost of an offshore outsourcing project. It shows how much hidden costs affect the total project cost. The best case reflects the lowest estimates for additional costs, and the worst case reflects the highest estimates for these costs. As you can see, hidden costs increase the total cost of an offshore outsourcing project by an extra 15 to 57 percent. Even with these extra costs, many firms will benefit from offshore outsourcing if they manage the work well. Under the worst-case scenario, a firm would still save about 15 percent.

13.5 WHAT ARE NEW APPROACHES FOR SYSTEM BUILDING IN THE DIGITAL FIRM ERA?

In the digital firm environment, organizations need to be able to add, change, and retire their technology capabilities very rapidly to respond to new opportunities, including the need to provide applications for mobile

FIGURE 13.11 TOTAL COST OF OFFSHORE OUTSOURCING

			$10,000,000	
	Best Case	Additional Cost ($)	Worst Case	Additional Cost ($)
1 Preparation	0%	20,000	2%	200,000
2 Transition costs	2%	200,000	3%	300,000
3 Layoffs & retention	3%	300,000	5%	500,000
4 Lost productivity/cultural issues	3%	300,000	27%	2,700,000
5 Inefficient processes	1%	100,000	10%	1,000,000
6 Managing the contract	6%	600,000	10%	1,000,000
Total additional costs		1,520,000		5,700,000
			Total Cost ($)	Additional Cost
Total cost of outsourcing (TCO) best case	10,000,000	1,520,000	11,520,000	15.2%
Total cost of outsourcing (TCO) worst case	10,000,000	5,700,000	15,700,000	57.0%

If a firm spends $10 million on offshore outsourcing contracts, that company will actually spend 15.2 percent in extra costs even under the best-case scenario. In the worst-case scenario, where there is a dramatic drop in productivity along with exceptionally high transition and layoff costs, a firm can expect to pay up to 57 percent in extra costs on top of the $10 million outlay for an offshore contract.

platforms. Companies are starting to use shorter, more informal development processes that provide fast solutions. In addition to using software packages and external service providers, businesses are relying more heavily on fast-cycle techniques such as rapid application development, joint application design, agile development, and reusable standardized software components that can be assembled into a complete set of services for e-commerce and e-business.

RAPID APPLICATION DEVELOPMENT (RAD)

Object-oriented software tools, reusable software, prototyping, and fourth-generation language tools are helping systems builders create working systems much more rapidly than they could using traditional systems-building methods and software tools. The term **rapid application development (RAD)** is used to describe this process of creating workable systems in a very short period of time. RAD can include the use of visual programming and other tools for building graphical user interfaces, iterative prototyping of key system elements, the automation of program code generation, and close teamwork among end users and information systems specialists. Simple systems often can be assembled from prebuilt components. The process does not have to be sequential, and key parts of development can occur simultaneously.

Sometimes a technique called **joint application design (JAD)** is used to accelerate the generation of information requirements and to develop the initial systems design. JAD brings end users and information systems specialists together in an interactive session to discuss the system's design. Properly prepared and facilitated, JAD sessions can significantly speed up the design phase and involve users at an intense level.

Agile development focuses on rapid delivery of working software by breaking a large project into a series of small subprojects that are completed in short periods of time using iteration and continuous feedback. Each mini-project is worked on by a team as if it were a complete project, including planning, requirements analysis, design, coding, testing, and documentation. Improvement or addition of new functionality takes place within the next iteration as developers clarify requirements. This helps to minimize the overall risk, and allows the project to adapt to changes more quickly. Agile methods emphasize face-to-face communication over written documents, encouraging people to collaborate and make decisions quickly and effectively.

COMPONENT-BASED DEVELOPMENT AND WEB SERVICES

We have already described some of the benefits of object-oriented development for building systems that can respond to rapidly changing business environments, including Web applications. To further expedite software creation, groups of objects have been assembled to provide software components for common functions such as a graphical user interface or online ordering capability that can be combined to create large-scale business applications. This approach to software development is called **component-based development**, and it enables a system to be built by assembling and integrating existing software components. Increasingly, these software components are coming from cloud services. Businesses are using component-based development to create their e-commerce applications by combining commercially available components for shopping carts, user authentication, search engines, and catalogs with pieces of software for their own unique business requirements.

Web Services and Service-Oriented Computing

Chapter 5 introduced *Web services* as loosely coupled, reusable software components delivered using Extensible Markup Language (XML) and other open protocols and standards that enable one application to communicate with another with no custom programming required to share data and services. In addition to supporting internal and external integration of systems, Web services can be used as tools for building new information system applications or enhancing existing systems. Because these software services use a universal set of standards, they promise to be less expensive and less difficult to weave together than proprietary components.

Web services can perform certain functions on their own, and they can also engage other Web services to complete more complex transactions, such as checking credit, procurement, or ordering products. By creating software components that can communicate and share data regardless of the operating system, programming language, or client device, Web services can provide significant cost savings in systems building while opening up new opportunities for collaboration with other companies.

MOBILE APPLICATION DEVELOPMENT: DESIGNING FOR A MULTI-SCREEN WORLD

Today, employees and customers expect, and even demand, to be able to use a mobile device of their choice to obtain information or perform a transaction anywhere and at any time. To meet these needs, companies will need to develop mobile Web sites, mobile apps, and native apps as well as traditional information systems. According to digital advertising agency Vertic, mobile app development projects will outnumber native PC projects by a 4-to-1 ratio by 2015 (Greengard, 2013).

Once an organization decides to develop mobile apps, it has to make some important choices, including the technology it will use to implement these apps (whether to write a native app or mobile Web app) and what to do about a mobile Web site. A **mobile Web site** is a version of a regular Web site that is scaled down in content and navigation for easy access and search on a small mobile screen. (Access Amazon's Web site from your computer and then from your smartphone to see the difference from a regular Web site.)

A **mobile Web app** is an Internet-enabled app with specific functionality for mobile devices. Users access mobile Web apps through their mobile device's Web browser. The Web app resides primarily on a server, is accessed via the Internet, and doesn't need to be installed on the device. The same application can be used by most devices that can surf the Web, regardless of their brand.

A **native app** is a standalone application designed to run on a specific platform and device. The native app is installed directly on a mobile device. Native apps can connect to the Internet to download and upload data, and they can also operate on these data even when not connected to the Internet. For example, an e-book reading app such as Kindle software can download a book from the Internet, disconnect from the Internet, and present the book for reading. Native mobile apps provide fast performance and a high degree of reliability. They are also able to take advantage of a mobile device's particular capabilities, such as its camera or touch features. However, native apps are expensive to develop because multiple versions of an app must be programmed for different mobile operating systems and hardware.

Developing applications for mobile platforms is quite different from development for PCs and their much larger screens. The reduced size of mobile devices makes using fingers and multi-touch gestures much easier than typing and using keyboards. Mobile apps need to be optimized for the specific tasks they are to perform; they should not try to carry out too many tasks; and they should be designed for usability. The user experience for mobile interaction is fundamentally different from using a desktop or laptop PC. Saving resources—bandwidth, screen space, memory, processing, data entry, and user gestures—is a top priority.

When a full Web site created for the desktop shrinks to the size of a smartphone screen, it is difficult for the user to navigate through the site. The user must continually zoom in and out and scroll to find relevant material. Therefore, companies need to design Web sites specifically for mobile interfaces and create multiple mobile sites to meet the needs of smartphones, tablets, and desktop browsers. This equates to at least three sites with separate content, maintenance, and costs. Currently, Web sites know what device you are using because your browser will send this information to the server when you log on. Based on this information, the server will deliver the appropriate screen.

One solution to the problem of having multiple Web sites is to use **responsive Web design**. Responsive Web design enables Web sites to automatically change layouts according to the visitor's screen resolution, whether on a desktop, laptop, tablet, or smartphone. Responsive design uses tools such as flexible grid-based layouts, flexible images, and media queries, to optimize the design for different viewing contexts. This eliminates the need for separate design and development work for each new device. HTML5, which we introduced in Chapter 5, is also used for mobile application development because it can support cross-platform mobile applications.

The Interactive Session on Technology describes how some companies have addressed the challenges of mobile development we have just identified.

INTERACTIVE BUSINESS TECHNOLOGY

WHAT DOES IT TAKE TO GO MOBILE?

"How should we go mobile?" Almost every company today is asking that question. In 2014, more people used their mobile phones than PCs to go online, and there is one mobile device for every person on earth in 2015. The number of Web searches performed on mobile devices has more than quadrupled since 2010. Customers expect, and even demand, to be able to use a mobile device of their choice to obtain information or perform a transaction anywhere and at any time. So if a company wants to stay connected to its customers, it needs some sort of mobile presence.

What do companies do, and where do they start? Developing mobile apps or a mobile Web site has some special challenges. The user experience on a mobile device is fundamentally different from that on a PC. There are special features on mobile devices such as location-based services that that give firms the potential to interact with customers in meaningful new ways. Firms need to be able to take advantage of those features while delivering an experience that is appropriate to a small screen. There are multiple mobile platforms to work with—iPhone, Android, Windows Phone, and possibly BlackBerry, and a firm may need a different version of an application to run on each of these. You can't just port a Web site or desktop application to a smartphone or tablet. It's a different systems development process.

It's important to understand how, why, and where customers use mobile devices and how these mobile experiences change business interactions and behavior. For example, do customers who use an app handle a greater number of transactions on their own and use the phone less? Do they spend more or less time researching products and shopping from a mobile device?

Deckers Outdoor Corporation, the parent company of brands such as UGG Australia, Teva, and Simple Shoes, spent considerable time studying its customers' mobile behavior. It looked at how customers use their mobile devices while shopping and researching brands to find out how consumers would connect with its brand through the mobile channel. When people use mobile devices, how do they research the products? What information do they want about brand? Are they looking for information about product features, product reviews, or retail store locations?

Decker's customer analysis showed that when consumers use mobile devices inside a Deckers store, what is most important is a seamless interaction. The customer wants to be able to look at a product on his or her mobile device and see the same information on that device as that person would obtain in the store, plus some additional information, such as consumer reviews.

A mobile strategy involves much more than selecting mobile devices, operating systems, and applications. It also involves changes to business processes, changing the way people work and the way a firm interacts with its customers. Mobile technology can streamline processes, make them more portable, and enhance them with capabilities such as touch interfaces, location and mapping features, alerts, texting, cameras, and video functionality. The technology can also create less efficient processes or fail to deliver benefits if the mobile application is not properly designed.

USAA, the giant financial services company serving members of the U.S. military and their families, is acutely aware of the need to ensure that mobile technology is aligned with its customer-facing business processes and leads to genuine improvements. The company is using mobile technology to refine its business processes and provide simpler and more powerful ways for customers to interact with the company.

USAA launched its Web site in 1997 and went mobile ten years later, with about 90 percent of its interactions with customers taking place on these two self-service channels. In 2011, USAA handled 183 million customer contacts through the mobile channel alone, and expects the mobile channel will be its primary point of contact with customers in the next two years. USAA has 100 dedicated mobile developers writing apps for devices using the iPhone, iPad, and Android operating systems, along with apps for the BlackBerry and Windows Phone 7.

USAA developed a smartphone accident report and claims app that enables customers to snap a photo and submit a claim directly from the site of an accident. The app is also able to send geographic information system (GIS) data to a towing service and display nearby car rental locations. Another mobile app supports photo deposits: a customer can capture an image of a check with

a smartphone and automatically submit it to the bank. The money is instantly deposited in the customer's account. This system eliminates the labor and expense of processing paper checks, as well as the time required to mail the check and wait three days for the deposit to clear. In 2011, USAA Federal Savings Bank processed $6.4 billion in deposits through this mobile app.

The mobile app also displays loan and credit card balances, shopping services, homeowners and auto insurance policy information, Home Circle and Auto Circle buying services, retirement products and information, ATM and taxi locators, and a communities feature that lets users see what others are posting about USAA on Twitter, Facebook, and YouTube.

A real estate company may want to display a completely different site to mobile users who are looking for house information after driving by a "For Sale" sign. The realtor may want to optimize the mobile interface to include specific listing and contact information to capture the lead immediately and keep the load time fast. If the mobile site is simply a more user-friendly version of the desktop site, the conversions may not be as high.

Ryland Homes, one of the top U.S. new home builders, has a conventional Web site, but it wanted to be able to engage customers using mobile technology as well. The company revamped its mobile Web site in March 2011 to increase sales leads by helping potential customers with mobile phones find its locations, look at its products, register with the company, and call directly. Ryland's development team made the site easier to read and capable of fitting on a smartphone or tablet screen without requiring users to pinch and zoom. It used jQuery Mobile software and responsive Web design to create variations of the site that were appropriate for different smartphone or tablet models employed by users. (The jQuery Mobile framework allows developers to design a single Web site or application that will work on all popular smartphone, tablet, and desktop platforms, eliminating the need to write unique apps for each mobile device or operating system.) Ryland focused on features such as location-based driving directions to nearby communities, clickable phone numbers, and brief online registrations to increase the chances of making a sale. The site shows nearby communities in order of distance, based on the location of the mobile device.

Sources: Samuel Greengard, "Mobility Transforms the Customer Relationship," *Bascline*, February 2012; William Atkinson, "How Deckers Used a Mobile Application to Build Customer Traffic," *CIO Insight*, November 9, 2011; "Going Mobile: A Portable Approach to Process Improvement," *Business Agility Insights*, June 2012; Google Inc., "Ryland Homes Opens Doors to Local Sales with Mobile Site for Home-Buyers," 2011.

1. What management, organization, and technology issues need to be addressed when building mobile applications?
2. How does user requirement definition for mobile applications differ from that in traditional systems analysis?
3. Describe the business processes changed by USAA's mobile applications before and after the applications were deployed.

Review Summary

1. ***How does building new systems produce organizational change?***

Building a new information system is a form of planned organizational change. Four kinds of technology-enabled change are (a) automation, (b) rationalization of procedures, (c) business process redesign, and (d) paradigm shift, with far-reaching changes carrying the greatest risks and rewards. Many organizations are using business process management to redesign work flows and business processes in the hope of achieving dramatic productivity breakthroughs. Business process management is also useful for promoting total quality management (TQM), six sigma, and other initiatives for incremental process improvement.

2. ***What are the core activities in the systems development process?***

The core activities in systems development are systems analysis, system design, programming, testing, conversion, production, and maintenance. Systems analysis is the study and analysis of problems of existing systems and the identification of requirements for their solutions. Systems design provides the specifications for an information system solution, showing how its technical and organizational components fit together.

3. ***What are the principal methodologies for modeling and designing systems?***

The two principal methodologies for modeling and designing information systems are structured methodologies and object-oriented development. Structured methodologies focus on modeling processes and data separately. The data flow diagram is the principal tool for structured analysis, and the structure chart is the principal tool for representing structured software design. Object-oriented development models a system as a collection of objects that combine processes and data. Object-oriented modeling is based on the concepts of class and inheritance.

4. ***What are the alternative methods for building information systems?***

The oldest method for building systems is the systems life cycle, which requires that information systems be developed in formal stages. The stages must proceed sequentially and have defined outputs; each requires formal approval before the next stage can commence. The systems life cycle is useful for large projects that need formal specifications and tight management control over each stage of systems building, but it is very rigid and costly.

Prototyping consists of building an experimental system rapidly and inexpensively for end users to interact with and evaluate. Prototyping encourages end-user involvement in systems development and iteration of design until specifications are captured accurately. The rapid creation of prototypes can result in systems that have not been completely tested or documented or that are technically inadequate for a production environment.

Using a software package reduces the amount of design, programming, testing, installation, and maintenance work required to build a system. Application software packages are helpful if a firm does not have the internal information systems staff or financial resources to custom develop a system. To meet an organization's unique requirements, packages may require extensive modifications that can substantially raise development costs.

End-user development is the development of information systems by end users, either alone or with minimal assistance from information systems specialists. End-user developed systems can be created rapidly and informally using user-friendly software tools. However, end-user development may create information systems that do not necessarily meet quality assurance standards and that are not easily controlled by traditional means.

Outsourcing consists of using an external vendor to build (or operate) a firm's information systems instead of the organization's internal information systems staff. Outsourcing can save application development costs or enable firms to develop applications without an internal information systems staff. However, firms risk losing control over their information systems and becoming too dependent on external vendors. Outsourcing also entails hidden costs, especially when the work is sent offshore.

5. ***What are new approaches for system building in the digital firm era?***

Companies are turning to rapid application design (RAD), joint application design (JAD), agile development, and reusable software components to accelerate the systems development process. RAD uses object-oriented software, visual programming, prototyping, and fourth-generation tools for very

rapid creation of systems. Agile development breaks a large project into a series of small subprojects that are completed in short periods of time using iteration and continuous feedback. Component-based development expedites application development by grouping objects into suites of software components that can be combined to create large-scale business applications. Web services provide a common set of standards that enable organizations to link their systems regardless of their technology platform through standard plug-and-play architecture. Mobile application development must pay attention to simplicity, usability, and the need to optimize tasks for tiny screens.

Key Terms

Acceptance testing, 546
Agile development, 559
Automation, 536
Business process management, 537
Business process redesign, 537
Component-based development, 559
Computer-aided software engineering (CASE), 551
Conversion, 546
Customization, 556
Data flow diagram (DFD), 548
Direct cutover strategy, 546
Documentation, 547
End-user development, 555
End-user interface, 555
Feasibility study, 543
Information requirements, 544
Iterative, 554
Joint application design (JAD), 559
Maintenance, 547
Mobile Web app, 560
Mobile Web site, 560
Native app, 560
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Offshore outsourcing, 557
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Test plan, 546
Testing, 545
Total quality management (TQM), 536
Unit testing, 545

MIS

Go to **mymislab.com** to complete the problems marked with this icon.

Review Questions

13-1 How does building new systems produce organizational change?

- Describe each of the four kinds of organizational change that can be promoted with information technology.
- Define business process redesign and compare it to other types of organizational change.

13-2 What are the core activities in the systems development process?

- Distinguish between systems analysis and systems design. Describe the activities for each.
- Define information requirements and explain why they are difficult to determine correctly.
- Explain why the testing stage of systems development is so important. Name and describe the three stages of testing for an information system.

- Describe the role of end users in building systems and why they are so important.

13-3 What are the principal methodologies for modeling and designing systems?

- Compare object-oriented and traditional structured approaches for modeling and designing systems.

13-4 What are alternative methods for building information systems?

- Define the traditional systems life cycle. Describe each of its steps and its advantages and disadvantages for systems building.
- Define information system prototyping. Describe its benefits and limitations. List and describe the steps in the prototyping process.
- Define an application software package. Explain the advantages and disadvantages of developing information systems based on software packages.
- Define end-user development and describe its advantages and disadvantages. Name some policies and procedures for managing end-user development.
- Describe the advantages and disadvantages of using outsourcing for building information systems.

13-5 What are new approaches for system building in the digital firm era?

- Define rapid application development (RAD) and agile development and explain how they can speed up system-building.
- Explain how component-based development and Web services help firms build and enhance their information systems.
- Explain why responsive Web design is important for the development of systems for use on mobile platforms.

Discussion Questions

13-6 Why is selecting a systems development approach an important business decision? Who should participate in the selection process?

13-7 Why are web services and service-oriented computing so important for reducing the costs of building new systems?

13-8 Why is it important to identify the information requirements of a new system prior to building the system?

Hands-On MIS Projects

The projects in this section give you hands-on experience analyzing business processes, designing and building a customer system for auto sales, and analyzing Web site information requirements.

Management Decision Problems

13-9 For an additional fee, a customer purchasing from the online appliance store Appliancesdirect.com in the U.K., such as a washing machine, can purchase a three-year service contract. The contract provides free repair service and parts for the specified appliance using an authorized service provider. When a person with a Appliancesdirect service contract needs to repair an appliance, such as a washing machine, he or she calls the company's Repairs & Parts department to schedule an appointment. The department makes the appointment and gives the caller the date and approximate time of the appointment. The repair technician arrives during the designated time framework and diagnoses the problem. If the problem is caused by a faulty part, the technician either replaces the part if he is carrying the part with him or orders the replacement part from Sears. If the part is not in stock. it will order the part and give the customer an approximate time when the part will arrive. The part is shipped directly to the customer. After the part has arrived, the customer must call Appliancesdirect to schedule a second appointment for a repair technician to replace the ordered part. This process is very lengthy. It may take two weeks to schedule the

first repair visit, another two weeks to order and receive the required part, and another week to schedule a second repair visit after the ordered part has been received.

- Diagram the existing process.
- What is the impact of the existing process on Appliancesdirect's operational efficiency and customer relationships?
- What changes could be made to make this process more efficient? How could information systems support these changes? Diagram the new, improved process.

13-10 Management at your agricultural chemicals corporation has been dissatisfied with production planning. Production plans are created using best guesses of demand for each product, which are based on how much of each product has been ordered in the past. If a customer places an unexpected order or requests a change to an existing order after it has been placed, there is no way to adjust production plans. The company may have to tell customers it can't fill their orders, or it may run up extra costs maintaining additional inventory to prevent stock-outs.

At the end of each month, orders are totaled and manually keyed into the company's production planning system. Data from the past month's production and inventory systems are manually entered into the firm's order management system. Analysts from the sales department and from the production department analyze the data from their respective systems to determine what the sales targets and production targets should be for the next month. These estimates are usually different. The analysts then get together at a high-level planning meeting to revise the production and sales targets to take into account senior management's goals for market share, revenues, and profits. The outcome of the meeting is a finalized production master schedule.

The entire production planning process takes 17 business days to complete. Nine of these days are required to enter and validate the data. The remaining days are spent developing and reconciling the production and sales targets and finalizing the production master schedule.

- Draw a diagram of the existing production planning process.
- Analyze the problems this process creates for the company.
- How could an enterprise system solve these problems? In what ways could it lower costs? Diagram what the production planning process might look like if the company implemented enterprise software.

Improving Decision Making: Using Database Software to Design a Customer System for Auto Sales

Software skills: Database design, querying, reporting, and forms
Business skills: Sales lead and customer analysis

13-11 This project requires you to perform a systems analysis and then design a system solution using database software.

Burrows Auto Dealers specializes in selling new vehicles from Toyota in Sheffield, England. The company advertises in local newspapers and is listed as an authorized dealer on the Toyota Web site and other major Web sites for auto buyers. The company benefits from a good local word-of-mouth reputation and name recognition.

Burrows does not believe it has enough information about its customers. It cannot easily determine which prospects have made auto purchases, nor can it identify which customer touch points have produced the greatest number of sales leads or actual sales so it can focus advertising and marketing more on the channels that generate the most revenue. Are purchasers discovering Burrows from newspaper ads, from word of mouth, or from the Web?

Prepare a systems analysis report detailing Burrows' problem and a system solution that can be implemented using PC database management software. Then use database software to develop a simple system solution.

Achieving Operational Excellence: Analyzing Web Site Design and Information Requirements

Software skills: Web browser software
Business skills: Information requirements analysis, Web site design

13-12 Visit the Web site of your choice and explore it thoroughly. Prepare a report analyzing the various functions provided by that Web site and its information requirements. Your report should answer these questions: What functions does the Web site perform? What data does it use? What are its inputs, outputs, and processes? What are some of its other design specifications? Does the Web site link to any internal systems or systems of other organizations? What value does this Web site provide the firm?

Collaboration and Teamwork Project

13-13 In MyMISLab, you will find a Collaboration and Teamwork Project dealing with the concepts in this chapter. You will be able to use Google Drive, Google Sites, Google Docs, Google+, or other open source collaboration tools to complete the assignment.

SourceGas Goes for Better Workforce Scheduling Systems

CASE STUDY

SourceGas is a utility headquartered in Golden, Colorado providing natural gas service to over 413,000 customers in Arkansas, Nebraska, Colorado, and Wyoming. The company has over 1,100 employees and operates nearly 18,000 miles of natural gas transmission and distribution pipeline covering a 332,437-square-mile area—about half the size of Alaska.

The number of work orders (authorizing specific work or repairs to be done) processed per mile traveled is a key performance indicator for utility companies, especially SourceGas. SourceGas's territory includes many large rural areas where re-routing work orders incurs very heavy fuel, maintenance, and other operational costs. The more work orders that can be processed per mile traveled, the lower the cost.

SourceGas's predecessor had installed a mobile information system in 2000 to dispatch approximately 500,000 work orders to approximately 500 field technicians equipped with mobile devices. However, this work order and dispatch system was starting to show its age, and the work order and dispatch processes required too much manual effort. All work was dispatched manually, and there were no systematized scheduling priorities, making it difficult for service technicians to consistently be assigned workloads that were aligned with business objectives.

SourceGas dispatchers were highly experienced and had the requisite knowledge to assign technicians with the appropriate set of skills to perform the work. However, to perform this process successfully, dispatchers had to commit to memory more than 225 different types of work that technicians performed in the field. SourceGas wound up spending a great deal of time and effort clarifying its scheduling policies.

SourceGas's work order process starts with a call from a customer to the SourceGas call center in Fayetteville, Arkansas. Under the company's old system, the company's SAP CRM software created a work order that was sent to the SourceGas dispatch center, where dispatchers assigned the work to technicians who received the assignments using Panasonic Toughbook mobile devices. Although the previous system integrated with SAP CRM software to enable SourceGas to track a work order from start to finish, the work order still had to be initiated manually by the dispatchers.

What's more, the outdated system could no longer be easily modified to keep up with new requirements. SourceGas serves both regulated and non-regulated markets in four states with

different business rules, so the system has to be able to accomodate rapid and constant change. Enhancements to the system were just too costly.

SourceGas needed a new system to automate its work order and scheduling processes that could be updated and changed much more easily. Management also wanted a system where SourceGas could make these changes using its own internal resources rather than external consultants, which the company had relied on heavily to make enhancements to its old system. The software for the legacy system had been custom-programmed by third-party vendors, making the system difficult to maintain and enhance.

In the summer of 2011, SourceGas initiated a requirements-gathering workshop with ClickSoftware, the external vendor the company had used in the past to make system enhancements. The objective was to establish system requirements and develop business rules to guide the work order and scheduling processes. SourceGas's biggest priorities were to 1) automate work scheduling; 2) maintain the company's existing timesheet process; and 3) ensure minimal change required for field technicians to use the new system.

For its solution, SourceGas chose SAP Workforce Scheduling & Optimization software package by ClickSoftware, which integrates with its existing SAP systems, including SAP ERP and SAP CRM. SAP Workforce Scheduling & Optimization by ClickSoftware is a real-time optimized scheduling solution for managing scheduling and dispatching, supporting mobile service operations, scheduling service appointments, and monitoring service operations. The software includes capabilities for demand forecasting to determine how much work is set to arrive, when, and where; deploying resources based on knowledge of worker skills, service commitments, location, and customer preferences; responding in real time to on-the-spot issues such as traffic and cancellations; and analyzing service performance by identifying problem areas and methods for improvement. Software users are able to meet anticipated workloads in a specific time frame with better capacity planning and resource allocation. SAP Workforce Scheduling & Optimization software integrates directly with all SAP applications.

An SAP NetWeaver Process Integration adapter automatically handles the messaging between the SAP Workforce Scheduling & Optimization and the SAP CRM system. Work orders are now automatically scheduled and dispatched using the company's business rules configured in the system, with exceptions flagged for dispatchers to handle.

The entire process of implementing the new system-requirements analysis, development, testing, and training, took a little over one year. SourceGas rolled out the system in phases, with its last division going live with the system in December 2012. In implementing the SAP software package, SourceGas faced some special challenges because it had to design the system and configure the software to account for all the special conditions of its unique service area and complex rules for types of work. Some of the questions that had to be addressed were: Are work order priorities the same in an urban area, such as Fayetteville, Arkansas, as they are in rural Wyoming? What constitutes an emergency work order?

The SourceGas system had to be designed to schedule and route all the field technician work according to these various rules and conditions. The design also had to make the system as familiar and easy to use for SourceGas mobile workers as possible, with the new mobile app user experience mirroring field workers' existing user experience as much as possible. This was especially critical for time reporting, which required some simplification while adhering nevertheless to company business rules for proper accounting.

SourceGas was able to enhance the software while maintaining the same user experience. To improve technician efficiency, the software was enhanced to tailor service order completion data sent back to SourceGas's ERP system for each type of service order rather than displaying all data fields on all orders. Another important enhancement was to add audio alerts for dispatchers and technicians' mobile devices to the SAP Workforce Scheduling & Optimization software so that emergency orders receive proper attention. An additional safety feature is the capability for technicians to set a timer to alert dispatch if they haven't returned to their vehicle by a specified time.

SourceGas used an iterative approach and agile development methodology and took user input and user training very seriously. The system project had a committee of super-user technicians as well as an operations team to make sure the system was built to the right specifications. Its technicians had provided important input during the requirements-gathering and design stages of system-building, and they began training on the new application in June 2012. SourceGas trained 20 percent of its workforce to obtain their feedback about the new system (to

make sure it met their expectations), and used the experience to create training materials for when the system went totally live. This approach helped ensure users would buy into the new system and that no business process was overlooked.

The testing process had end users on SourceGas's operations team perform all of the approximately 225 types of service orders handled by the company using the new application to make sure the system was able to handle every single business scenario. For example, to test the process of a technician closing out a work order for a meter exchange, the new system must be able to move data from a final reading of the old meter into SourceGas's SAP ERP system, and the system has to perform certain steps before the new meter is recognized and synchronized to a customer account.

What benefits have been produced by the new system? SourceGas's management has received positive feedback about the new system capabilities for automated scheduling, timesheet preparation as well as its improved usability compared to the previous system. Managers can more accurately gauge their workload in their divisions. SourceGas dispatchers can see their workloads more accurately and determine the appropriate resources. The company has already used the new system to complete 400,000 work orders and pay 900,000 timesheet records. However, management would like to see more manpower study reports before it can determine the extent of the new system's operational efficiencies and benefits.

One key benefit that is already apparent, however, is the company's ability to keep a lid on the costs of maintaining and updating the system because it is doing most of that work with in-house staff rather than turning to external vendors, as it had in the past. The SAP Workforce Scheduling and Optimization software package has made it possible for SourceGas to rapidly make changes in-house, which makes it easier for the company to respond to rapid changes in the utility industry.

SourceGas will be further enhancing its SAP Workforce Scheduling and Optimization software to focus more directly on serving customers. Potential changes to the system include allowing customers to place orders online, sending text messages to inform customers when technicians are on the way, and processing payment from customers directly in the field.

Sources: www.sourcegas.com, accessed June 30, 2014; Murphy, Ken "SourceGas Takes the Driver's Seat in Workforce Scheduling," SAP InsiderPROFILES, July 1, 2013; and "SourceGas Implements SAP Workforce Scheduling & Optimization," www.youtube.com, May 14, 2014.

CASE STUDY QUESTIONS

13-14 Analyze SourceGas's problems with its old system. What management, organization, and technology factors were responsible for these problems? What was the business impact of these problems?

13-15 What role did end users play in developing SourceGas's new work order and dispatch system? How did the project team make sure users were involved? What would have happened to the project if they had not done this?

13-16 What types of system-building methods and tools did SourceGas use for building its system?

13-17 Discuss the issue of software package customization at SourceGas.

13-18 What other steps did SourceGas take to make sure the new system was successful?

13-19 What were the benefits of the new system? How did it change the way SourceGas ran its business? How successful was this system solution?

MyMISLab

Go to mymislab.com for the following Assisted-graded writing questions:

13-20 Describe four system conversion strategies.

13-21 Describe the role of end users in developing systems using the traditional systems life cycle, prototyping, application software packages, and end-user development.

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Managing Projects

CHAPTER 14

LEARNING OBJECTIVES

After reading this chapter, you will be able to answer the following questions:

1. What are the objectives of project management and why is it so essential in developing information systems?
2. What methods can be used for selecting and evaluating information systems projects and aligning them with the firm's business goals?
3. How can firms assess the business value of information systems?
4. What are the principal risk factors in information systems projects, and how can they be managed?

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CHAPTER CASES

Nu Skin's New Human Resources System Project Puts People First

Westinghouse Electric Takes on the Risks of a "Big Bang" Project

Britain's National Health Service Jettisons Choose and Book System

A Shaky Start for Healthcare.gov

VIDEO CASES

Blue Cross Blue Shield: Smarter Computing Project

NASA Project Management Challenges

Instructional Videos:

Software Project Management, Part 1

Software Project Management, Part 2

Nu Skin Enterprises is an American direct-selling and multilevel marketing company which sells more than 200 anti-aging personal care and dietary supplements products through more than 830,000 independent distributors. Since its beginnings in 1984 in Provo, Utah, the company has expanded operations to 52 international markets. Annual revenues have topped 1 billion dollars.

Nu Skin's business model combines direct selling with multilevel marketing. Each distributor markets products directly to potential customers, and can also recruit and train customers to become distributors. Distributors are paid from the retail markup on products they are able to sell personally, as well as a percentage of the sales of distributors they have recruited. To be successful, Nu Skin obviously must pay close attention to how it manages people.

Although Nu Skin has nearly 6,000 employees in 28 different countries, until recently, it did not have a centralized human resources (HR) system to maintain employee data or to provide HR reporting to other parts of the business. Instead, it managed employees manually at the local level or allowed local operating units to use their own systems. In order to obtain employee information at the corporate level, Nu Skin had to contact the region and obtain the data manually. All of this was very time-consuming, and the company really needed more consistent and automated HR processes.

When Nu Skin's management decided to implement a centralized HR system, a cross-functional project team representing human resources and the information systems department conducted a thorough two-year analysis of information needs and searched for the right system. It recommended SAP



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ERP Human Capital Management (HCM), and started to implement the modules for personnel administration and organizational management.

Members of the project team were selected so that their HR expertise and experience would complement each other. Team members included several SAP business analysts, a programmer analyst, a technical business analyst, an HR information systems analyst, and a team of senior systems engineers. Vice President of Human Resources David Daines and IT Business Integration leaders Amy Camara and Jay Barney supported the team.

External consultants from Symphony Consulting were hired to assist the project team in identifying information requirements from various Nu Skin offices. Consultants were hired on the basis of skills and personality that would enhance the team, as well as the ability to perform on-site training. Nu Skin's users were in so many different geographic locations that it would be impossible for them to train in the new system off-site. The consultants were assigned to train employees on-site during the implementation.

Through every step of the project, the company was careful to put "people" before technology. What kind of people should be on the project team? What consultants should be employed? What are the business and culture requirements that have to be addressed?

The project team visited various Nu Skin sites in each of the company's markets to inquire about the data each collected, what systems and reports they used with the data, and what they wanted in the future. These face-to-face meetings sensitized the project team to the regional differences in information requirements and corporate culture. The meetings also gave end users a stronger sense of ownership in the project and the belief that the project team was dedicated to making the new system work for their benefit.

The project team used a phased implementation approach for each global region. In 2011, Nu Skin went live with the SAP ERP HCM global functionality. Benefits were immediate. In the past, if the finance department needed a report on the number of full-time employees in a specific market, the Nu Skin HR department had to request the information from the local operating unit, which could take weeks. A report about which employees transferred to another department or left the company had to be manually created by gathering the required data from the various regions and manually sending the report to the different departments. Now all of these reports are automatically generated and distributed by the system.

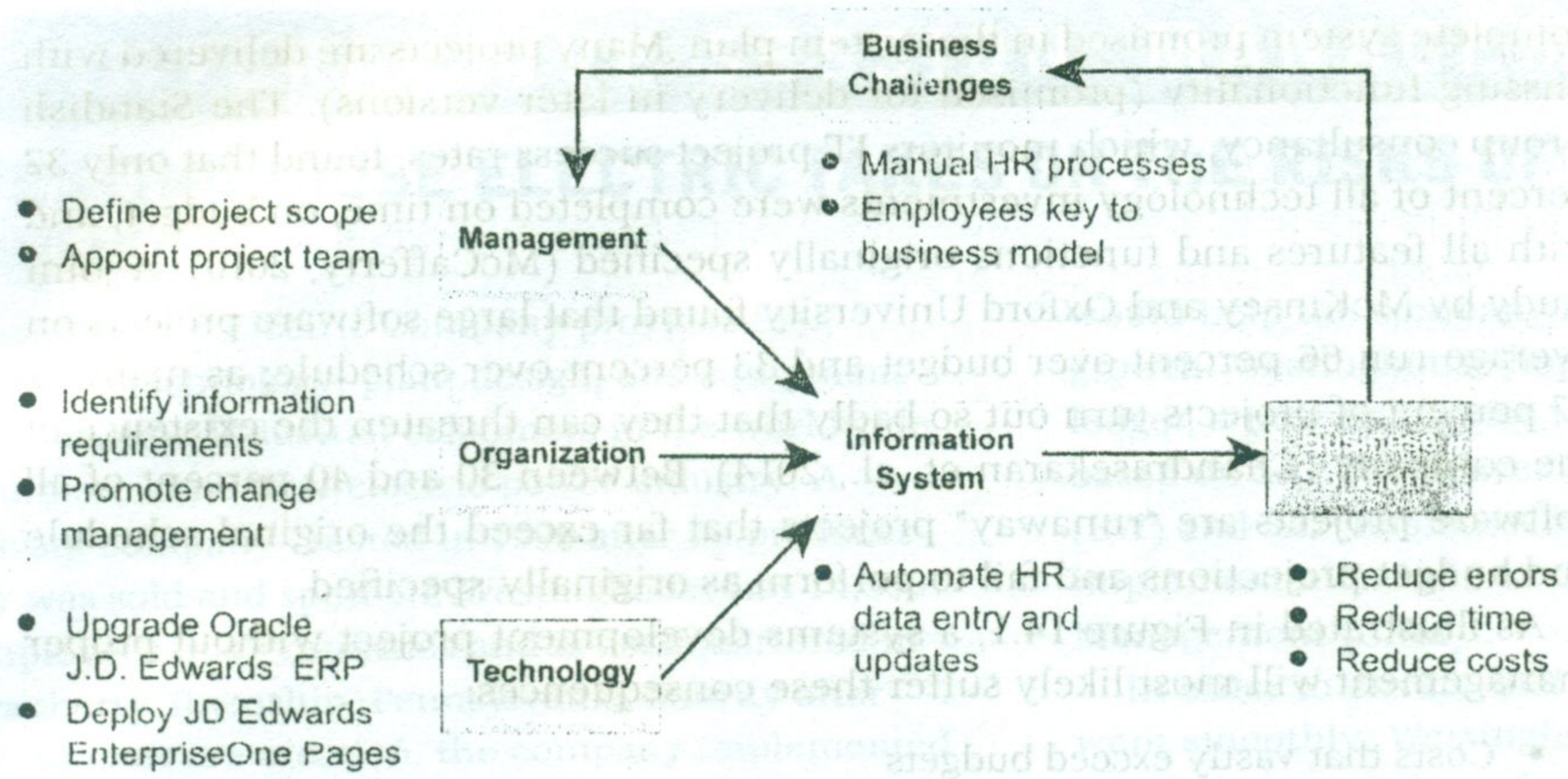
Sources: "Nu Skin Fights Aging Systems with New HR Software,"SAP Insider Profiles January 2012; "Nu Skin: Invigorating the Customer Interaction Experience," www.sap.com, accessed November 8, 2012; and www.nuskin.com, accessed November 8, 2012.



One of the principal challenges posed by information systems is ensuring they deliver genuine business benefits. There is a very high failure rate among information systems projects because organizations have incorrectly assessed their business value or because firms have failed to manage the organizational change surrounding the introduction of new technology.

Nu Skin's management realized this when it implemented its HR system. The new system involved an enterprise-wide change in HR business processes supported by new software. Nu Skin succeeded in this project because its management clearly understood that attention to organizational "people" issues was essential for success, especially in a multinational company with numerous regional and cultural differences.

The chapter-opening diagram calls attention to important points raised by this case and this chapter. Nu Skin desperately needed to automate its HR processes, which had been entirely manual and made operations highly



inefficient. Management wisely selected a project team whose members had both business and technical expertise. The team took great care and time to identify the right software solution and to elicit user information requirements. Staging the system implementation and conducting employee training at each location further contributed to success.

Here are some questions to think about: Why was it important to have representatives from both HR and IT on the project team? What were the risk factors in this project?

WHAT ARE THE OBJECTIVES OF PROJECT MANAGEMENT AND WHY IS IT SO ESSENTIAL IN DEVELOPING INFORMATION SYSTEMS?

There is a very high failure rate among information systems projects. In nearly every organization, information systems projects take much more time and money to implement than originally anticipated or the completed system does not work properly. When an information system does not meet expectations or costs too much to develop, companies may not realize any benefit from their information system investment, and the system may not be able to solve the problems for which it was intended. The development of a new system must be carefully managed and orchestrated, and the way a project is executed is likely to be the most important factor influencing its outcome. That's why it's essential to have some knowledge about managing information systems projects and the reasons why they succeed or fail.

RUNAWAY PROJECTS AND SYSTEM FAILURE

How badly are projects managed? On average, private sector projects are underestimated by one-half in terms of budget and time required to deliver the

complete system promised in the system plan. Many projects are delivered with missing functionality (promised for delivery in later versions). The Standish Group consultancy, which monitors IT project success rates, found that only 32 percent of all technology investments were completed on time, on budget, and with all features and functions originally specified (McCafferty, 2010). A joint study by McKinsey and Oxford University found that large software projects on average run 66 percent over budget and 33 percent over schedule; as many as 17 percent of projects turn out so badly that they can threaten the existence of the company (Chandrasekaran et. al., 2014). Between 30 and 40 percent of all software projects are "runaway" projects that far exceed the original schedule and budget projections and fail to perform as originally specified.

As illustrated in Figure 14.1, a systems development project without proper management will most likely suffer these consequences:

- Costs that vastly exceed budgets
- Unexpected time slippage
- Technical performance that is less than expected
- Failure to obtain anticipated benefits

The systems produced by failed information projects are often not used in the way they were intended, or they are not used at all. Users often have to develop parallel manual systems to make these systems work.

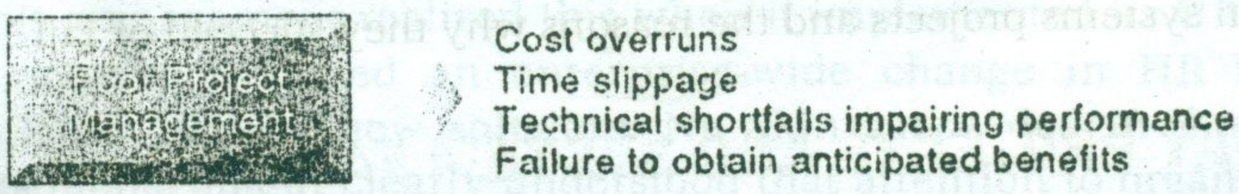
The actual design of the system may fail to capture essential business requirements or improve organizational performance. Information may not be provided quickly enough to be helpful, it may be in a format that is impossible to digest and use, or it may represent the wrong pieces of data.

The way in which nontechnical business users must interact with the system may be excessively complicated and discouraging. A system may be designed with a poor user interface. The **user interface** is the part of the system with which end users interact. For example, an online input form or data entry screen may be so poorly arranged that no one wants to submit data or request information. System outputs may be displayed in a format that is too difficult to comprehend.

Web sites may discourage visitors from exploring further if the Web pages are cluttered and poorly arranged, if users cannot easily find the information they are seeking, or if it takes too long to access and display the Web page on the user's computer.

Additionally, the data in the system may have a high level of inaccuracy or inconsistency. The information in certain fields may be erroneous or ambiguous, or it may not be organized properly for business purposes. Information required for a specific business function may be inaccessible because the data are incomplete.

FIGURE 14.1 CONSEQUENCES OF POOR PROJECT MANAGEMENT



Without proper management, a systems development project takes longer to complete and most often exceeds the allocated budget. The resulting information system most likely is technically inferior and may not be able to demonstrate any benefits to the organization.

INTERACTIVE SESSION: MANAGEMENT

WESTINGHOUSE ELECTRIC TAKES ON THE RISKS OF A "BIG BANG" PROJECT

Westinghouse Electric Company provides fuel, services, technology, plant design, and equipment to utility and industrial customers in the worldwide commercial nuclear electric power industry. A private company created in 1999 after its predecessor was sold and spun off, Westinghouse has 14,500 employees in 17 countries and is headquartered in Cranberry Township, Pennsylvania. Shortly after Westinghouse's creation, the company implemented a full suite of SAP software across the enterprise.

For the past 15 years, the nuclear energy industry was in a holding pattern, with steady business throughout but minimal growth. Westinghouse supplied nuclear equipment and services to plants all around the world, and the business was successful. The initial SAP installation served Westinghouse just fine for nearly an entire decade. From 2010 onward, the nuclear energy industry started to expand. Westinghouse began to experience growth in sales, and its legacy SAP installation was not equipped to handle the increased volume of business.

Westinghouse needed to update its older system to support new processes, configurations, and functionalities that related to the larger amount of business it was conducting. The company estimated that it would increase in size fourfold over the next few years. Westinghouse opted to launch a sweeping new program to update its IT. The program, called Synergy internally, consisted of 40 different projects, and updating the SAP system was one of the largest.

Rather than simply upgrade its existing systems, Westinghouse opted to "re-implement" those systems with much more current SAP technology. Westinghouse did this because its 10-year-old SAP ERP implementation was too outdated. It was easier for the company to simply replace the old SAP ERP systems with a completely new configuration. The division of the Synergy project dedicated to the SAP re-implementation was known as Cornerstone, aptly named because the new system would be the foundation for the company's future growth.

Westinghouse wanted to start with a clean-core SAP environment with a completely new reconfiguration. The company's goals were to convert all existing data that the company wanted to save, as well as add new functionalities that would help the company manage its imminent growth. Westinghouse hoped to add a new general ledger, a new enterprise reporting environment based on SAP NetWeaver Business Warehouse (BW) and SAP BusinessObjects solutions, and new implementations of SAP Customer Relationship Management (CRM).

In order to ensure that the re-implementation went smoothly, Westinghouse took many precautions to manage the risks involved in such a significant change. First, the company ensured that every element of the Cornerstone project was motivated by a particular business driver or goal. By associating goals with each element of the project, Westinghouse was able to more precisely control the implementation of the new system.

Once the elements of the new SAP system came into place, Westinghouse had to decide how to actually roll out the new system. It could have used a gradual, phased approach, adding new systems over a three-year period, but the company instead decided on what it called a "big-bang approach." Management decided that the company was growing too fast for a slow approach—it needed the new systems as soon as possible, and hoped to recoup the return on investment sooner rather than later. However, while the phased approach was more expensive, it was also much less risky. To manage the increased risk of the big-bang approach, the company brought in a change management consultant.

The consultant, John Flynn, helped Westinghouse with both the Synergy and Cornerstone projects, but focused on Cornerstone. Flynn performed a risk assessment study to identify business areas that were most likely to undergo significant change. He identified the Westinghouse supply chain as one of these, since the company's growth would add many new elements to the chain. Therefore, the change management team spent extra time with Westinghouse's supply chain staff members to help them understand the new project and its impact on their day-to-day routines.

Next, after mapping the risk associated with each element of the SAP re-implementation, Westinghouse had to finally switch, or cut over, to the new system. To handle that event, Flynn worked with business leaders to recruit coordinators for every site in the organization. Each site

coordinator had a list of responsibilities and a checklist to complete prior to the system going live to ensure each site was ready when the switch was flipped. Westinghouse dedicated extra staff to answer employee questions in the problem areas designated by Flynn. The company created an automatic call distribution system and e-mail system that routed users across all time zones to the employees most able to answer their questions. For example, Westinghouse expected that there would be many questions about passwords, access issues, time entry, and purchase requisition management after the new system went live, so the company provided extra staff to answer those and other frequently asked questions. This "temporary help desk" handled over 2,000 inquiries during the first three weeks of the implementation. The project team also set up a blog where users could share tips and solutions.

The cutover to the new SAP system went smoothly, and the company plans to use many of the techniques that it learned from the implementation in the future. It plans to use the blog as its primary communication method for support solutions and other Synergy projects, and future additions to the SAP suite will be much easier than the sweeping big-bang change.

Sources: David Hannon, "Westinghouse Electric Company Sees Global Standard Processes as the Foundation for Future Business Success," SAP InsiderPROFILES, January–March 2012 and www.westinghousenuclear.com, accessed April 23, 2012.

CASE STUDY QUESTIONS

1. Identify and discuss the risks in Westinghouse Electric's Cornerstone project.
2. Why was change management so important for this project and this company?
3. What management, organization, and technology issues had to be addressed by the Westinghouse project team?
4. Should other companies use a "big-bang" implementation strategy? Why or why not? Explain your answer.

The Interactive Session on Organizations illustrates some of the problems we have just described. As you read this case, try to determine why this system was discarded and the role of project management in the outcome.

PROJECT MANAGEMENT OBJECTIVES

A **project** is a planned series of related activities for achieving a specific business objective. Information systems projects include the development of new information systems, enhancement of existing systems, or upgrade or replacement of the firm's information technology (IT) infrastructure.

Project management refers to the application of knowledge, skills, tools, and techniques to achieve specific targets within specified budget and time constraints. Project management activities include planning the work, assessing risk, estimating resources required to accomplish the work, organizing the work, acquiring human and material resources, assigning tasks, directing activities, controlling project execution, reporting progress, and analyzing the results. As in other areas of business, project management for information systems must deal with five major variables: scope, time, cost, quality, and risk.

Scope defines what work is or is not included in a project. For example, the scope of a project for a new order processing system might be to include new modules for inputting orders and transmitting them to production and accounting but not any changes to related accounts receivable, manufacturing, distribution, or inventory control systems. Project management defines all the work

INTERACTIVE SESSION: ORGANIZATIONS

BRITAIN'S NATIONAL HEALTH SERVICE JETTISONS CHOOSE AND BOOK SYSTEM

When senior cardiologist Duncan Dymond complained in 2010 that patients were arriving at his hospital at incorrect times and, far worse, in need of a different specialist, it was neither the beginning nor the end of problems with the Choose and Book system. Installed in 2004 as part of a £200 million IT modernization of Great Britain's National Health Service (NHS), the patient booking system was supposed to enable patients to select a hospital for an outpatient appointment from a range of options, primarily with the help and direction of their general practitioner (GP). A letter with a referral number and a secure code was then generated so that the patient could either go online or call a central booking service to confirm the appointment. Initial contact could also occur directly via the national appointments line or at the HealthSpace Web site. The goals were threefold: to speed up the referral process, eliminate costly paperwork, and encourage patient participation so as to stem losses of up to £225 million annually from 1.6 million patient no-shows.

Implementation was sluggish and plagued with glitches. One early problem was that many hospital Patient Administration Systems (PAS) and GP clinical computer systems were not compatible. Choose and Book served as the go-between between the two systems, thus, both had to be compliant. The objective to book 90 percent of all referrals by December 2006 was never met. Four years later, even though Choose and Book had been installed in 94 percent of all GP surgeries, it was used to book just 54 percent of appointments. Even a three year £100 million incentive program to encourage physician adoption failed to sway doctors who had witnessed patients unnecessarily travelling to distant hospitals and referral letters rebuffed when patients sought confirmation.

Designers also focused on building provider choice into the service. This turned out to be a solution in search of a problem. According to the NHS Alliance, a coalition of health care providers, managers, and patients dedicated to improving care and providing a voice to patients, the ability to choose physicians and facilities from a wide range of options was never a chief concern. Instead, patients were looking for swift referrals to their local hospital. In rural areas, choice was considerably limited anyway, and older patients, in particular, simply found the array of choices confusing, difficult to navigate, and time-consuming to select.

Although many doctors were fans, system misfires created a significant population of disgruntled caregivers who refused to use Choose and Book. Glitches included appointment letters gone astray, last-minute cancellations, costs incurred for phone calls to the booking line in some locations, and treatment delays due to lack of visit categorization—either urgent or routine—not incorporated because cases requiring immediate treatment bypassed the queuing system.

By 2014, Choose and Book's cost had ballooned to £356 million. Still, out of a total public investment of £12.7 billion for the National Programme for IT (NPfIT), it was considered to be one of its few successes, providing reliable, secure, and certain referrals for more than half of first-time outpatients and used—at least to some degree—by over 90 percent of providers. But when a study by the Public Accounts Committee (PAC) reported that use by both doctors and patients had dropped and that waiting times for elective care had shown no improvement, Choose and Book's days were numbered. The system had never been able to function optimally because not all available outpatient appointments were listed. Members of Parliament (MPs) were fatigued by nearly a decade of patchwork fixes and frustrated that projected annual savings of up to £51 million had never materialized.

The discreet replacement of Choose and Book by a new system of unstipulated—and perhaps greater—cost underscores both the mission and the challenges of NHS. Launched in 1948, the comprehensive health system is funded by tax dollars (£108.9 billion in 2012/13) and administered by the Department of Health (DH). All British citizens are afforded care from their first newborn exam to their end-of-life care, with many services free of charge. NHS England covers 53 million citizens. Another 10.2 million people are covered by NHS divisions in Northern Ireland, Wales, and Scotland. All told, the four divisions of the NHS employ approximately 1.7 million people, making it the fourth largest employer in the world. This includes GPs, nurses, ambulance personnel, and hospital and community health service (HCHS) medical and dental staff.

The most pressing and urgent challenge faced by NHS England is the often lengthy waiting time to receive care, which can sometimes yield dire consequences. Healthcare for all, regardless of wealth, is a core value of British society. A 2013, Commonwealth Fund study of national healthcare systems ranked NHS first for quality of care, safety, coordination of care, patient-centered care, and cost. On timeliness of care, the UK ranked third.

With timeliness of care the overriding goal, NHS England launched the e-Referral Service at the end of 2014. Director of Strategic Systems and Technology, Beverley Bryant, expects significantly reduced paperwork and fewer data errors, along with an accelerated referral process, as patients monitor and manage their own hospital appointments. Several ideas to encourage adoption are being explored including making physician participation mandatory and developing an incentive program that incorporates penalties as well as rewards. The goal is to improve upon or eliminate the flaws of Choose and Book—for example, moving away from the hybrid electronic/paper environment that has proved burdensome for hospitals. The switch to all-digital will occur by 2019.

The new system uses an open platform and a set of application programming interfaces (APIs) both of which provide more flexibility to integrate with other systems than the restrictive proprietary system employed by Choose and Book. What's more, these changes should reduce operating costs. After a decade of technological advances, updates would have been necessary even had Choose and Book been a resounding success. The new e-Referrals system must trump Choose and Book's record of booking 40,000 referrals every day, ensure that all appointment slots are available, and shuttle citizens to their appointments at a quicker pace, all while ensuring that existing health care inequalities are not exacerbated.

Sources: Warwick Ashford, "NHS to scrap £356m o\Outpatient Booking System," ComputerWeekly.com, May 12, 2014; Toby Helm and Dennis Campbell, "NHS Hit by New Tech Failure as It Scraps Patient Booking System," *The Observer*, May 10, 2014; "About the National Health Service (NHS)," nhs.uk/NHSEngl and, accessed August 10, 2014; Caroline Baldwin, "New NHS e-Referral Service to Use Agile and Open Technologies," ComputerWeekly.com, May 13, 2014;"NHS e-Referral Service Vision," systems.hscic.gov.uk, accessed August 10, 2014; "NHS to Stop Choose and Book Outpatient Appointments System and Replace It with New IT System," UK News, May 11, 2014; and "Mark Gould, "Claims that NHS Choose and Book System. Puts Choice Before Quality," *The Guardian*, March 23, 2010.

1. Clarify and describe the problems of the NHS Choose and Book System. What management, organization, and technology factors were responsible for those problems?
2. To what extent was Choose and Book a failure? Explain your answer.
3. What was the economic and social impact of Choose and Book?
4. Describe the steps that should have been taken to make Choose and Book more successful.

required to complete a project successfully, and should ensure that the scope of a project does not expand beyond what was originally intended.

Time is the amount of time required to complete the project. Project management typically establishes the amount of time required to complete major components of a project. Each of these components is further broken down into activities and tasks. Project management tries to determine the time required to complete each task and establish a schedule for completing the work.

Cost is based on the time to complete a project multiplied by the cost of human resources required to complete the project. Information systems project costs also include the cost of hardware, software, and work space. Project management develops a budget for the project and monitors ongoing project expenses.

Quality is an indicator of how well the end result of a project satisfies the objectives specified by management. The quality of information systems projects usually boils down to improved organizational performance and

decision making. Quality also considers the accuracy and timeliness of information produced by the new system and ease of use.

Risk refers to potential problems that would threaten the success of a project. These potential problems might prevent a project from achieving its objectives by increasing time and cost, lowering the quality of project outputs, or preventing the project from being completed altogether. Section 14.4 describes the most important risk factors for information systems.

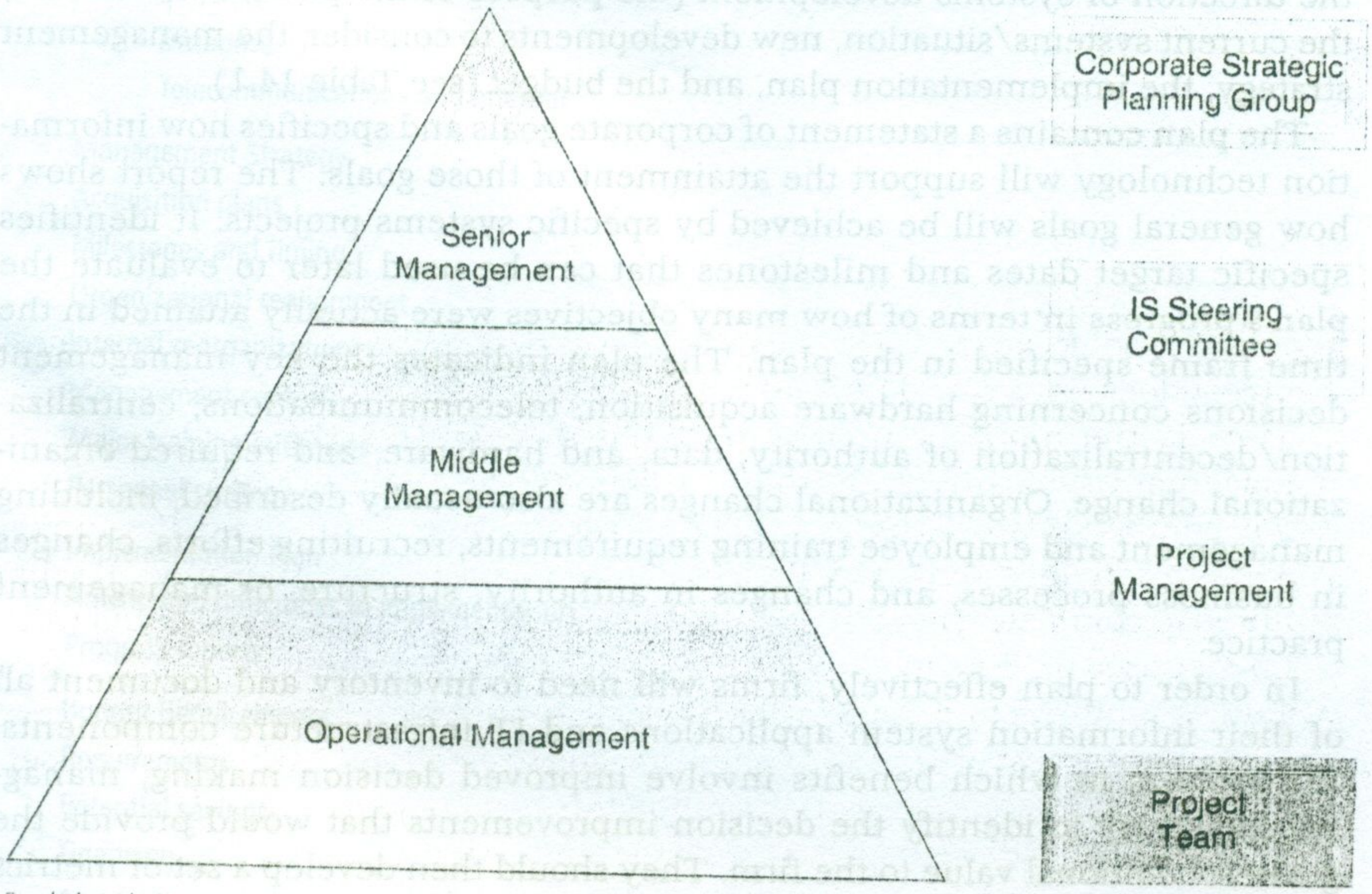
14.2 WHAT METHODS CAN BE USED FOR SELECTING AND EVALUATING INFORMATION SYSTEMS PROJECTS AND ALIGNING THEM WITH THE FIRM'S BUSINESS GOALS?

Companies typically are presented with many different projects for solving problems and improving performance. There are far more ideas for systems projects than there are resources. Firms will need to select from this group the projects that promise the greatest benefit to the business. Obviously, the firm's overall business strategy should drive project selection. How should managers choose among all the options?

MANAGEMENT STRUCTURE FOR SYSTEMS PROJECTS

Figure 14.2 shows the elements of a management structure for information systems projects in a large corporation. It helps ensure that the most important projects are given priority.

FIGURE 14.2 MANAGEMENT CONTROL OF SYSTEMS PROJECTS



Each level of management in the hierarchy is responsible for specific aspects of systems projects, and this structure helps give priority to the most important systems projects for the organization.

At the apex of this structure is the corporate strategic planning group and the information system steering committee. The corporate strategic planning group is responsible for developing the firm's strategic plan, which may require the development of new systems. Often, this group will have developed objective measures of firm performance (called "key performance indicators," introduced in Chapter 12) and choose to support IT projects which can make a substantial improvement in one or several key performance indicators. These performance indicators are reviewed and discussed by the firm's board of directors.

The information systems steering committee is the senior management group with responsibility for systems development and operation. It is composed of department heads from both end-user and information systems areas. The steering committee reviews and approves plans for systems in all divisions, seeks to coordinate and integrate systems, and occasionally becomes involved in selecting specific information systems projects. This group also has a keen awareness of the key performance indicators decided on by higher level managers and the board of directors.

The project team is supervised by a project management group composed of information systems managers and end-user managers responsible for overseeing several specific information systems projects. The project team is directly responsible for the individual systems project. It consists of systems analysts, specialists from the relevant end-user business areas, application programmers, and perhaps database specialists. The mix of skills and the size of the project team depend on the specific nature of the system solution.

LINKING SYSTEMS PROJECTS TO THE BUSINESS PLAN

In order to identify the information systems projects that will deliver the most business value, organizations need to develop an **information systems plan** that supports their overall business plan and in which strategic systems are incorporated into top-level planning. The plan serves as a road map indicating the direction of systems development (the purpose of the plan), the rationale, the current systems/situation, new developments to consider, the management strategy, the implementation plan, and the budget (see Table 14.1).

The plan contains a statement of corporate goals and specifies how information technology will support the attainment of those goals. The report shows how general goals will be achieved by specific systems projects. It identifies specific target dates and milestones that can be used later to evaluate the plan's progress in terms of how many objectives were actually attained in the time frame specified in the plan. The plan indicates the key management decisions concerning hardware acquisition; telecommunications; centralization/decentralization of authority, data, and hardware; and required organizational change. Organizational changes are also usually described, including management and employee training requirements, recruiting efforts, changes in business processes, and changes in authority, structure, or management practice.

In order to plan effectively, firms will need to inventory and document all of their information system applications and IT infrastructure components. For projects in which benefits involve improved decision making, managers should try to identify the decision improvements that would provide the greatest additional value to the firm. They should then develop a set of metrics to quantify the value of more timely and precise information on the outcome of the decision. (See Chapter 12 for more detail on this topic.)

TABLE 14.1 INFORMATION SYSTEMS PLAN

1. Purpose of the Plan
   - Overview of plan contents
   - Current business organization and future organization
   - Key business processes
   - Management strategy
2. Strategic Business Plan Rationale
   - Current situation
   - Current business organization
   - Changing environments
   - Major goals of the business plan
   - Firm's strategic plan
3. Current Systems
   - Major systems supporting business functions and processes
   - Current infrastructure capabilities
     - Hardware
     - Software
     - Database
     - Telecommunications and Internet
   - Difficulties meeting business requirements
   - Anticipated future demands
4. New Developments
   - New system projects
     - Project descriptions
     - Business rationale
     - Applications' role in strategy
   - New infrastructure capabilities required
     - Hardware
     - Software
     - Database
     - Telecommunications and Internet
5. Management Strategy
   - Acquisition plans
   - Milestones and timing
   - Organizational realignment
   - Internal reorganization
   - Management controls
   - Major training initiatives
   - Personnel strategy
6. Implementation Plan
   - Anticipated difficulties in implementation
   - Progress reports
7. Budget Requirements
   - Requirements
   - Potential savings
   - Financing
   - Acquisition cycle

INFORMATION REQUIREMENTS AND KEY PERFORMANCE INDICATORS

To develop an effective information systems plan, the organization must have a clear understanding of both its long- and short-term information requirements. A strategic approach to information requirements, strategic analysis, or critical success factors argues that an organization's information requirements are determined by a small number of **key performance indicators (KPIs)** of managers. KPIs are shaped by the industry, the firm, the manager, and the broader environment. For instance, KPIs for an automobile firm might be unit production costs, labor costs, factory productivity, re-work and error rate, customer brand recognition surveys, J.D. Power quality rankings, employee job satisfaction ratings, and health costs. New information systems should focus on providing information that helps the firm meet these goals implied by key performance indicators.

PORTFOLIO ANALYSIS

Once strategic analyses have determined the overall direction of systems development, **portfolio analysis** can be used to evaluate alternative system projects. Portfolio analysis inventories all of the organization's information systems projects and assets, including infrastructure, outsourcing contracts, and licenses. This portfolio of information systems investments can be described as having a certain profile of risk and benefit to the firm (see Figure 14.3) similar to a financial portfolio.

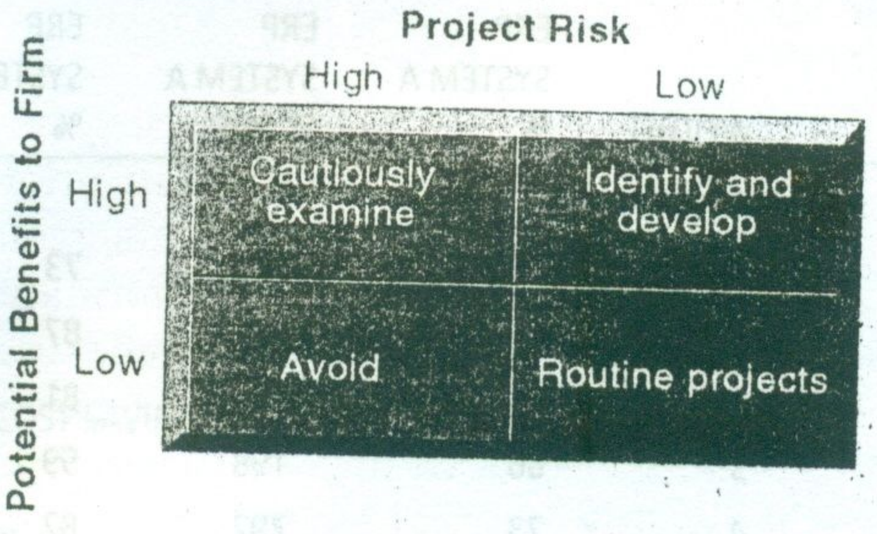
Each information systems project carries its own set of risks and benefits. (Section 14.4 describes the factors that increase the risks of systems projects.) Firms would try to improve the return on their portfolios of IT assets by balancing the risk and return from their systems investments. Although there is no ideal profile for all firms, information-intensive industries (e.g., finance) should have a few high-risk, high-benefit projects to ensure that they stay current with technology. Firms in non-information-intensive industries should focus on high-benefit, low-risk projects.

Most desirable, of course, are systems with high benefit and low risk. These promise early returns and low risks. Second, high-benefit, high-risk systems should be examined; low-benefit, high-risk systems should be totally avoided; and low-benefit, low-risk systems should be reexamined for the possibility of rebuilding and replacing them with more desirable systems having higher benefits. By using portfolio analysis, management can determine the optimal mix of investment risk and reward for their firms, balancing riskier high-reward projects with safer lower-reward ones. Firms where portfolio analysis is aligned with business strategy have been found to have a superior return on their IT assets, better alignment of IT investments with business objectives, and better organization-wide coordination of IT investments (Jeffrey and Leliveld, 2004).

SCORING MODELS

A **scoring model** is useful for selecting projects where many criteria must be considered. It assigns weights to various features of a system and then calculates the weighted totals. Using Table 14.2, the firm must decide among two alternative enterprise resource planning (ERP) systems. The first column lists the criteria that decision makers will use to evaluate the systems. These criteria are usually the result of lengthy discussions among the decision-making

FIGURE 14.3 **A SYSTEM PORTFOLIO**



Companies should examine their portfolio of projects in terms of potential benefits and likely risks. Certain kinds of projects should be avoided altogether and others developed rapidly. There is no ideal mix. Companies in different industries have different profiles.

group. Often the most important outcome of a scoring model is not the score but agreement on the criteria used to judge a system.

Table 14.2 shows that this particular company attaches the most importance to capabilities for sales order processing, inventory management, and warehousing. The second column in Table 14.2 lists the weights that decision makers attached to the decision criteria. Columns 3 and 5 show the percentage of requirements for each function that each alternative ERP system can provide. Each vendor's score can be calculated by multiplying the percentage of requirements met for each function by the weight attached to that function. ERP System B has the highest total score.

As with all "objective" techniques, there are many qualitative judgments involved in using the scoring model. This model requires experts who understand the issues and the technology. It is appropriate to cycle through the scoring model several times, changing the criteria and weights, to see how sensitive the outcome is to reasonable changes in criteria. Scoring models are used most commonly to confirm, to rationalize, and to support decisions, rather than as the final arbiters of system selection.

14.3 HOW CAN FIRMS ASSESS THE BUSINESS VALUE OF INFORMATION SYSTEMS?

Even if a system project supports a firm's strategic goals and meets user information requirements, it needs to be a good investment for the firm. The value of systems from a financial perspective essentially revolves around the issue of return on invested capital. Does a particular information system investment produce sufficient returns to justify its costs?

INFORMATION SYSTEM COSTS AND BENEFITS

Table 14.3 lists some of the more common costs and benefits of systems. **Tangible benefits** can be quantified and assigned a monetary value. **Intangible benefits**, such as more efficient customer service or enhanced decision making, cannot be immediately quantified but may lead to quantifiable gains in the long run. Transaction and clerical systems that displace labor and save space always

TABLE 14.2 EXAMPLE OF A SCORING MODEL FOR AN ERP SYSTEM

CRITERIA	WEIGHT	ERP SYSTEM A %	ERP SYSTEM A SCORE	ERP SYSTEM B %	ERP SYSTEM B SCORE
1.0 Order Processing					
1.1 Online order entry	4	67	268	73	292
1.2 Online pricing	4	81	324	87	348
1.3 Inventory check	4	72	288	81	324
1.4 Customer credit check	3	66	198	59	177
1.5 Invoicing	4	73	292	82	328
Total Order Processing			1,370		1,469
2.0 Inventory Management					
2.1 Production forecasting	3	72	216	76	228
2.2 Production planning	4	79	316	81	324
2.3 Inventory control	4	68	272	80	320
2.4 Reports	3	71	213	69	207
Total Inventory Management			1,017		1,079
3.0 Warehousing					
3.1 Receiving	2	71	142	75	150
3.2 Picking/packing	3	77	231	82	246
3.3 Shipping	4	92	368	89	356
Total Warehousing			741		752
Grand Total			3,128		3,300

produce more measurable, tangible benefits than management information systems, decision-support systems, and computer-supported collaborative work systems (see Chapters 2 and 11).

Chapter 5 introduced the concept of total cost of ownership (TCO), which is designed to identify and measure the components of information technology expenditures beyond the initial cost of purchasing and installing hardware and software. However, TCO analysis provides only part of the information needed to evaluate an information technology investment because it does not typically deal with benefits, cost categories such as complexity costs, and "soft" and strategic factors discussed later in this section.

Capital Budgeting for Information Systems

To determine the benefits of a particular project, you'll need to calculate all of its costs and all of its benefits. Obviously, a project where costs exceed benefits should be rejected. But even if the benefits outweigh the costs, additional financial analysis is required to determine whether the project represents a good return on the firm's invested capital. **Capital budgeting** models are one of several techniques used to measure the value of investing in long-term capital investment projects.

TABLE 14.3 COSTS AND BENEFITS OF INFORMATION SYSTEMS

COSTS
Hardware
Telecommunications
Software
Services
Personnel
TANGIBLE BENEFITS (COST SAVINGS)
Increased productivity
Lower operational costs
Reduced workforce
Lower computer expenses
Lower outside vendor costs
Lower clerical and professional costs
Reduced rate of growth in expenses
Reduced facility costs
INTANGIBLE BENEFITS
Improved asset utilization
Improved resource control
Improved organizational planning
Increased organizational flexibility
More timely information
More information
Increased organizational learning
Legal requirements attained
Enhanced employee goodwill
Increased job satisfaction
Improved decision making
Improved operations
Higher client satisfaction
Better corporate image

Capital budgeting methods rely on measures of cash flows into and out of the firm; capital projects generate those cash flows. The investment cost for information systems projects is an immediate cash outflow caused by expenditures for hardware, software, and labor. In subsequent years, the investment may cause additional cash outflows that will be balanced by cash inflows resulting from the investment. Cash inflows take the form of increased sales of more products (for reasons such as new products, higher quality, or increasing market share) or reduced costs in production and operations. The difference between cash outflows and cash inflows is used for calculating the financial worth of an investment. Once the cash flows have been established, several alternative methods are available for comparing different projects and deciding about the investment.

The principal capital budgeting models for evaluating IT projects are: the payback method, the accounting rate of return on investment (ROI), net

present value, and the internal rate of return (IRR). You can find out more about how these capital budgeting models are used to justify information system investments in the Learning Tracks for this chapter.

REAL OPTIONS PRICING MODELS

Some information systems projects are highly uncertain, especially investments in IT infrastructure. Their future revenue streams are unclear and their up-front costs are high. Suppose, for instance, that a firm is considering a $20 million investment to upgrade its IT infrastructure—its hardware, software, data management tools, and networking technology. If this upgraded infrastructure were available, the organization would have the technology capabilities to respond more easily to future problems and opportunities. Although the costs of this investment can be calculated, not all of the benefits of making this investment can be established in advance. But if the firm waits a few years until the revenue potential becomes more obvious, it might be too late to make the infrastructure investment. In such cases, managers might benefit from using real options pricing models to evaluate information technology investments.

Real options pricing models (ROPMs) use the concept of options valuation borrowed from the financial industry. An *option* is essentially the right, but not the obligation, to act at some future date. A typical *call option*, for instance, is a financial option in which a person buys the right (but not the obligation) to purchase an underlying asset (usually a stock) at a fixed price (strike price) on or before a given date.

For instance, let's assume that on September 19, 2014, you could purchase a call option for $31.00 that would give you the right to buy a share of Procter & Gamble (P&G) common stock for $50 per share on a certain date. Options expire over time, and this call option has an expiration date of January 15, 2016. If the price of P&G common stock does not rise above $50 per share by the stock market close on January 15, 2016, you would not exercise the option, and the value of the option would fall to zero on the strike date. If, however, the price of P&G stock rose to, say, $100 per share, you could purchase the stock for the strike price of $50 and retain the profit of $50 per share minus the cost on the option. (Because the option is sold as a 100-share contract, the cost of the contract would be 100 × $31.00 before commissions, or $3100, and you would be purchasing and obtaining a profit from 100 shares of Procter & Gamble.) The stock option enables the owner to benefit from the upside potential of an opportunity while limiting the downside risk.

ROPMs value information systems projects similar to stock options, where an initial expenditure on technology creates the opportunity to obtain the benefits associated with further development and deployment of the technology as long as management has the freedom to cancel, defer, restart, or expand the project. ROPMs give managers the flexibility to stage their IT investment or test the waters with small pilot projects or prototypes to gain more knowledge about the risks of a project before investing in the entire implementation. The disadvantages of this model are primarily in estimating all the key variables affecting option value, including anticipated cash flows from the underlying asset and changes in the cost of implementation. Models for determining option value of information technology platforms are being developed (Fichman, 2004; McGrath and MacMillan, 2000).

The traditional focus on the financial and technical aspects of an information system tends to overlook the social and organizational dimensions of information systems that may affect the true costs and benefits of the investment. Many companies' information systems investment decisions do not adequately consider costs from organizational disruptions created by a new system, such as the cost to train end users, the impact that users' learning curves for a new system have on productivity, or the time managers need to spend overseeing new system-related changes. Benefits, such as more timely decisions from a new system or enhanced employee learning and expertise, may also be overlooked in a traditional financial analysis (Ryan, Harrison, and Schkade, 2002).



WHAT ARE THE PRINCIPAL RISK FACTORS IN INFORMATION SYSTEMS PROJECTS, AND HOW CAN THEY BE MANAGED?

We have already introduced the topic of information system risks and risk assessment in Chapter 8. In this chapter, we describe the specific risks to information systems projects and show what can be done to manage them effectively.

DIMENSIONS OF PROJECT RISK

Systems differ dramatically in their size, scope, level of complexity, and organizational and technical components. Some systems development projects are more likely to create the problems we have described earlier or to suffer delays because they carry a much higher level of risk than others. The level of project risk is influenced by project size, project structure, and the level of technical expertise of the information systems staff and project team.

- *Project size*. The larger the project—as indicated by the dollars spent, the size of the implementation staff, the time allocated for implementation, and the number of organizational units affected--the greater the risk. Very large-scale systems projects have a failure rate that is 50 to 75 percent higher than that for other projects because such projects are complex and difficult to control. The organizational complexity of the system—how many units and groups use it and how much it influences business processes—contribute to the complexity of large-scale systems projects just as much as technical characteristics, such as the number of lines of program code, length of project, and budget. In addition, there are few reliable techniques for estimating the time and cost to develop large-scale information systems.
- *Project structure*. Some projects are more highly structured than others. Their requirements are clear and straightforward so outputs and processes can be easily defined. Users know exactly what they want and what the system should do; there is almost no possibility of the users changing their minds. Such projects run a much lower risk than those with relatively undefined, fluid, and constantly changing requirements; with outputs that cannot be fixed easily because they are subject to users' changing ideas; or with users who cannot agree on what they want.
- *Experience with technology*. The project risk rises if the project team and the information system staff lack the required technical expertise. If the team

is unfamiliar with the hardware, system software, application software, or database management system proposed for the project, it is highly likely that the project will experience technical problems or take more time to complete because of the need to master new skills.

Although the difficulty of the technology is one risk factor in information systems projects, the other factors are primarily organizational, dealing with the complexity of information requirements, the scope of the project, and how many parts of the organization will be affected by a new information system.

CHANGE MANAGEMENT AND THE CONCEPT OF IMPLEMENTATION

The introduction or alteration of an information system has a powerful behavioral and organizational impact. Changes in the way that information is defined, accessed, and used to manage the organization's resources often lead to new distributions of authority and power. This internal organizational change breeds resistance and opposition and can lead to the demise of an otherwise good system.

A very large percentage of information systems projects stumble because the process of organizational change surrounding system building was not properly addressed. Successful system building requires careful **change management**.

The Concept of Implementation

To manage the organizational change surrounding the introduction of a new information system effectively, you must examine the process of implementation. **Implementation** refers to all organizational activities working toward the adoption, management, and routinization of an innovation, such as a new formation system. In the implementation process, the systems analyst is a **change agent**. The analyst not only develops technical solutions but also redefines the configurations, interactions, job activities, and power relationships of various organizational groups. The analyst is the catalyst for the entire change process and is responsible for ensuring that all parties involved accept the changes created by a new system. The change agent communicates with users, mediates between competing interest groups, and ensures that the organizational adjustment to such changes is complete.

The Role of End Users

System implementation generally benefits from high levels of user involvement and management support. User participation in the design and operation of information systems has several positive results. First, if users are heavily involved in systems design, they have more opportunities to mold the system according to their priorities and business requirements, and more opportunities to control the outcome. Second, they are more likely to react positively to the completed system because they have been active participants in the change process. Incorporating user knowledge and expertise leads to better solutions.

The relationship between users and information systems specialists has traditionally been a problem area for information systems implementation efforts. Users and information systems specialists tend to have different backgrounds, interests, and priorities. This is referred to as the **user-designer communications gap**. These differences lead to divergent organizational loyalties, approaches to problem solving, and vocabularies.

Information systems specialists, for example, often have a highly technical, or machine, orientation to problem solving. They look for elegant and sophisticated technical solutions in which hardware and software efficiency is optimized at the expense of ease of use or organizational effectiveness. Users prefer systems that are oriented toward solving business problems or facilitating organizational tasks. Often the orientations of both groups are so at odds that they appear to speak in different tongues.

These differences are illustrated in Table 14.4, which depicts the typical concerns of end users and technical specialists (information systems designers) regarding the development of a new information system. Communication problems between end users and designers are a major reason why user requirements are not properly incorporated into information systems and why users are driven out of the implementation process.

Systems development projects run a very high risk of failure when there is a pronounced gap between users and technical specialists and when these groups continue to pursue different goals. Under such conditions, users are often driven away from the project. Because they cannot comprehend what the technicians are saying, users conclude that the entire project is best left in the hands of the information specialists alone.

Management Support and Commitment

If an information systems project has the backing and commitment of management at various levels, it is more likely to be perceived positively by both users and the technical information services staff. Both groups will believe that their participation in the development process will receive higher-level attention and priority. They will be recognized and rewarded for the time and effort they devote to implementation. Management backing also ensures that a systems project receives sufficient funding and resources to be successful. Furthermore, to be enforced effectively, all the changes in work habits and procedures and any organizational realignments associated with a new system depend on management backing. If a manager considers a new system a priority, the system will more likely be treated that way by his or her subordinates.

Change Management Challenges for Business Process Reengineering, Enterprise Applications, and Mergers and Acquisitions

Given the challenges of innovation and implementation, it is not surprising to find a very high failure rate among enterprise application and business process

TABLE 14.4 THE USER DESIGNER COMMUNICATIONS GAP

USER CONCERNS	DESIGNER CONCERNS
Will the system deliver the information we need for our work?	What demands will this system put on our servers?
Can we access the data on our iPhones, BlackBerrys, tablets, and PCs?	What kind of programming demands will this place on our group?
What new procedures do we need to enter data into the system?	Where will the data be stored? What's the most efficient way to store them?
How will the operation of the system change employees' daily routines?	What technologies should we use to secure the data?

reengineering (BPR) projects, which typically require extensive organizational change and which may require replacing old technologies and legacy systems that are deeply rooted in many interrelated business processes. A number of studies have indicated that 70 percent of all business process reengineering projects fail to deliver promised benefits. Likewise, a high percentage of enterprise applications fail to be fully implemented or to meet the goals of their users even after three years of work.

Many enterprise application and reengineering projects have been undermined by poor implementation and change management practices that failed to address employees' concerns about change. Dealing with fear and anxiety throughout the organization, overcoming resistance by key managers, and changing job functions, career paths, and recruitment practices have posed greater threats to reengineering than the difficulties companies faced visualizing and designing breakthrough changes to business processes. All of the enterprise applications require tighter coordination among different functional groups as well as extensive business process change (see Chapter 9).

Projects related to mergers and acquisitions have a similar failure rate. Mergers and acquisitions are deeply affected by the organizational characteristics of the merging companies as well as by their IT infrastructures. Combining the information systems of two different companies usually requires considerable organizational change and complex systems projects to manage. If the integration is not properly managed, firms can emerge with a tangled hodgepodge of inherited legacy systems built by aggregating the systems of one firm after another. Without a successful systems integration, the benefits anticipated from the merger cannot be realized, or, worse, the merged entity cannot execute its business processes effectively.

CONTROLLING RISK FACTORS

Various project management, requirements gathering, and planning methodologies have been developed for specific categories of implementation problems. Strategies have also been devised for ensuring that users play appropriate roles throughout the implementation period and for managing the organizational change process. Not all aspects of the implementation process can be easily controlled or planned. However, anticipating potential implementation problems and applying appropriate corrective strategies can increase the chances for system success.

The first step in managing project risk involves identifying the nature and level of risk confronting the project (Schmidt et al., 2001). Implementers can then handle each project with the tools and risk management approaches geared to its level of risk (Iversen, Mathiassen, and Nielsen, 2004; Barki, Rivard, and Talbot, 2001; McFarlan, 1981).

Managing Technical Complexity

Projects with challenging and complex technology for users to master benefit from **internal integration tools**. The success of such projects depends on how well their technical complexity can be managed. Project leaders need both heavy technical and administrative experience. They must be able to anticipate problems and develop smooth working relationships among a predominantly technical team. The team should be under the leadership of a manager with a strong technical and project management background, and team members should be highly experienced. Team meetings should take place frequently.

Essential technical skills or expertise not available internally should be secured from outside the organization.

Formal Planning and Control Tools

Large projects benefit from appropriate use of **formal planning tools** and **formal control tools** for documenting and monitoring project plans. The two most commonly used methods for documenting project plans are Gantt charts and PERT charts. A **Gantt chart** lists project activities and their corresponding start and completion dates. The Gantt chart visually represents the timing and duration of different tasks in a development project as well as their human resource requirements (see Figure 14.4). It shows each task as a horizontal bar whose length is proportional to the time required to complete it.

Although Gantt charts show when project activities begin and end, they don't depict task dependencies, how one task is affected if another is behind schedule, or how tasks should be ordered. That is where **PERT charts** are useful. PERT stands for Program Evaluation and Review Technique, a methodology developed by the U.S. Navy during the 1950s to manage the Polaris submarine missile program. A PERT chart graphically depicts project tasks and their interrelationships. The PERT chart lists the specific activities that make up a project and the activities that must be completed before a specific activity can start, as illustrated in Figure 14.5.

The PERT chart portrays a project as a network diagram consisting of numbered nodes (either circles or rectangles) representing project tasks. Each node is numbered and shows the task, its duration, the starting date, and the completion date. The direction of the arrows on the lines indicates the sequence of tasks and shows which activities must be completed before the commencement of another activity. In Figure 14.5, the tasks in nodes 2, 3, and 4 are not dependent on each other and can be undertaken simultaneously, but each is dependent on completion of the first task. PERT charts for complex projects can be difficult to interpret, and project managers often use both techniques.

These project management techniques can help managers identify bottlenecks and determine the impact that problems will have on project completion times. They can also help systems developers partition projects into smaller, more manageable segments with defined, measurable business results. Standard control techniques can successfully chart the progress of the project against budgets and target dates, so deviations from the plan can be spotted.

Increasing User Involvement and Overcoming User Resistance

Projects with relatively little structure and many undefined requirements must involve users fully at all stages. Users must be mobilized to support one of many possible design options and to remain committed to a single design. **External integration tools** consist of ways to link the work of the implementation team to users at all organizational levels. For instance, users can become active members of the project team, take on leadership roles, and take charge of installation and training. The implementation team can demonstrate its responsiveness to users, promptly answering questions, incorporating user feedback, and showing their willingness to help.

Participation in implementation activities may not be enough to overcome the problem of user resistance to organizational change. Different users may be affected by the system in different ways. Whereas some users may welcome

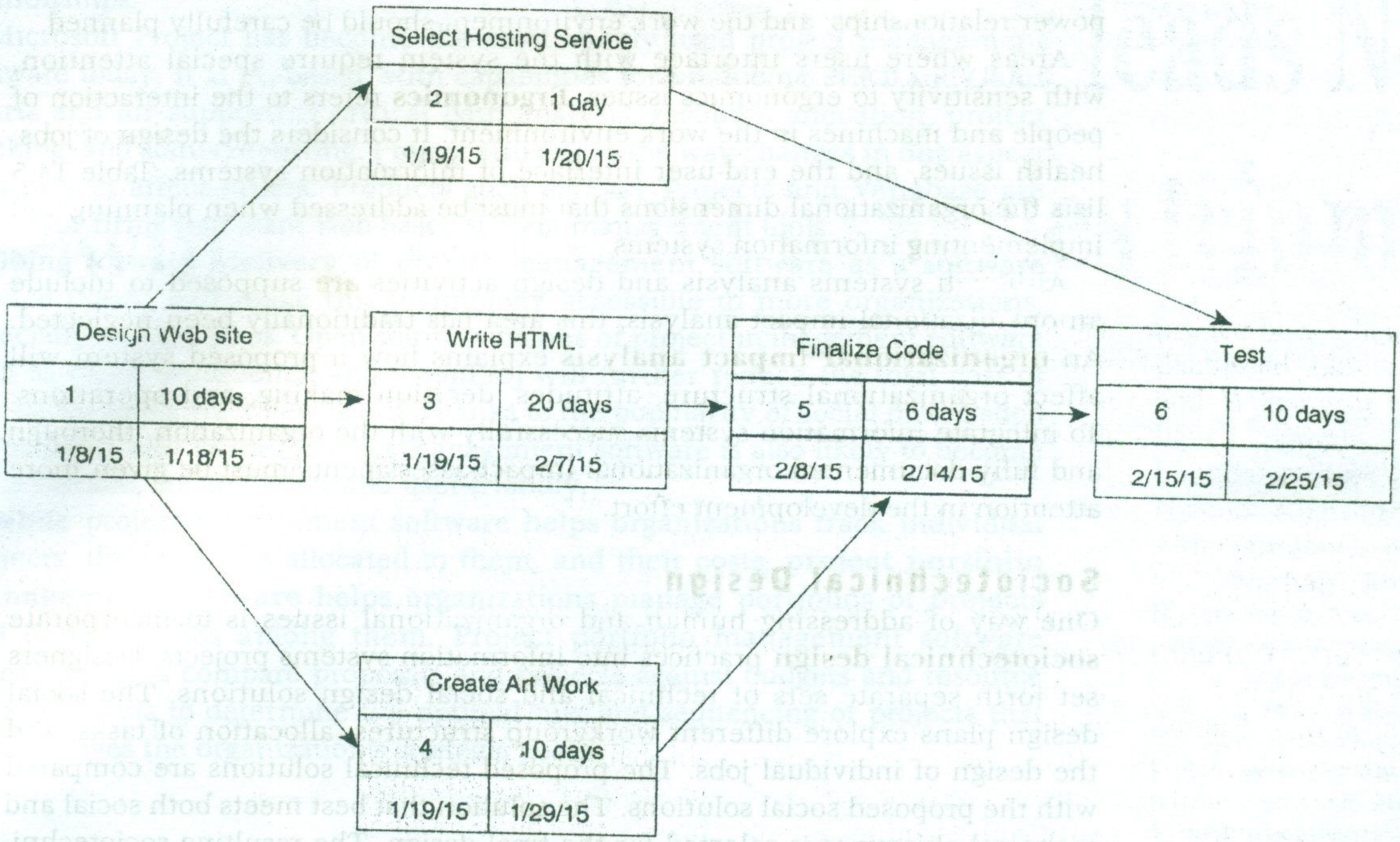
FIGURE 14.4 **A GANTT CHART**

HRIS COMBINED PLAN–HR	Da	Who	2014 Oct	Nov	Dec	2015 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2016 Jan	Feb	Mar
DATA ADMINISTRATION SECURITY																				
QMF security review/setup	20	EF TP																		
Security orientation	2	EF JA																		
QMF security maintenance	35	TP GL																		
Data entry sec. profiles	4	EF TP																		
Data entry sec. views est.	12	EF TP																		
Data entry security profiles	65	EF TP																		
DATA DICTIONARY																				
Orientation sessions	1	EF *																		
Data dictionary design	32	EFWV																		
DD prod. coordn-query	20	GL																		
DD prod. coordn-live	40	EF GL																		
Data dictionary cleanup	35	EF GL																		
Data dictionary maint.	35	EF GL																		
PROCEDURES REVISION																				
DESIGN PREP																				
Work flows (old)	10	PK JL																		
Payroll data flows	31	JL PK																		
HRIS P/R model	11	PK JL																		
P/R interface orient. mtg.	6	PK JL																		
P/R interface coordn. 1	15	PK																		
P/R interface coordn. 2	8	PK																		
Benefits interfaces (old)	5	JL																		
Benefits interfaces (new flow)	8	JL																		
Benefits communication strategy	3	PK JL																		
New work flow model	15	PK JL																		
Posn. data entry flows	14	WV JL																		

RESOURCE SUMMARY																					
Edith Farrell	5.0	EF	2	21	24	24	23	22	22	27	34	34	29	26	28	19	14				
Woody Vinton	5.0	WV	5	17	20	19	12	10	14	10	2							4	3		
Charles Pierce	5.0	CP		5	11	20	13	9	10	7	6	8	4	4	4	4	4				
Ted Leurs	5.0	TL		12	17	17	19	17	14	12	15	16	2	1	1	1	1				
Toni Cox	5.0	TC	1	11	10	11	11	12	19	19	21	21	21	17	17	12	9				
Patricia Knopp	5.0	PC	7	23	30	34	27	25	15	24	25	16	11	13	17	10	3	3	2		
Jane Lawton	5.0	JL	1	9	16	21	19	21	21	20	17	15	14	12	14	8	5				
David Holloway	5.0	DH	4	4	5	5	5	2	7	5	4	16	2								
Diane O'Neill	5.0	DO	6	14	17	16	13	11	9	4											
Joan Albert	5.0	JA	5	6			7	6	2	1				5	5	1					
Marie Marcus	5.0	MM	15	7	2	1	1														
Don Stevens	5.0	DS	4	4	5	4	5	1													
Casual	5.0	CASL		3	4	3			4	7	9	5	3	2							
Kathy Mendez	5.0	KM		1	5	16	20	19	22	19	20	18	20	11	2						
Anna Borden	5.0	AB					9	10	16	15	11	12	19	10	7	1					
Gail Loring	5.0	GL		3	6	5	9	10	17	18	17	10	13	10	10	7	17				
UNASSIGNED	0.0	X										9			236	225	230	14	13		
Co-op	5.0	CO		6	4				2	3	4	4	2	4	16			216	178		
Casual	5.0	CAUL								3	3	3									
TOTAL DAYS			49	147	176	196	194	174	193	195	190	181	140	125	358	288	284	237	196	12	

The Gantt chart in this figure shows the task, person-days, and initials of each responsible person, as well as the start and finish dates for each task. The resource summary provides a good manager with the total person-days for each month and for each person working on the project to manage the project successfully. The project described here is a data administration project.

FIGURE 14.5 **A PERT CHART**



This is a simplified PERT chart for creating a small Web site. It shows the ordering of project tasks and the relationship of a task with preceding and succeeding tasks.

a new system because it brings changes they perceive as beneficial to them, others may resist these changes because they believe the shifts are detrimental to their interests.

If the use of a system is voluntary, users may choose to avoid it; if use is mandatory, resistance will take the form of increased error rates, disruptions, turnover, and even sabotage. Therefore, the implementation strategy must not only encourage user participation and involvement, but it must also address the issue of counterimplementation. **Counterimplementation** is a deliberate strategy to thwart the implementation of an information system or an innovation in an organization.

Strategies to overcome user resistance include user participation (to elicit commitment as well as to improve design), user education and training, management edicts and policies, and better incentives for users who cooperate. The new system can be made more user friendly by improving the end-user interface. Users will be more cooperative if organizational problems are solved prior to introducing the new system.

DESIGNING FOR THE ORGANIZATION

Because the purpose of a new system is to improve the organization's performance, information systems projects must explicitly address the ways in which the organization will change when the new system is installed, including installation of intranets, extranets, and Web applications. In addition to

procedural changes, transformations in job functions, organizational structure, power relationships, and the work environment should be carefully planned.

Areas where users interface with the system require special attention, with sensitivity to ergonomics issues. **Ergonomics** refers to the interaction of people and machines in the work environment. It considers the design of jobs, health issues, and the end-user interface of information systems. Table 14.5 lists the organizational dimensions that must be addressed when planning and implementing information systems.

Although systems analysis and design activities are supposed to include an organizational impact analysis, this area has traditionally been neglected. An **organizational impact analysis** explains how a proposed system will affect organizational structure, attitudes, decision making, and operations. To integrate information systems successfully with the organization, thorough and fully documented organizational impact assessments must be given more attention in the development effort.

Sociotechnical Design

One way of addressing human and organizational issues is to incorporate **sociotechnical design** practices into information systems projects. Designers set forth separate sets of technical and social design solutions. The social design plans explore different workgroup structures, allocation of tasks, and the design of individual jobs. The proposed technical solutions are compared with the proposed social solutions. The solution that best meets both social and technical objectives is selected for the final design. The resulting sociotechnical design is expected to produce an information system that blends technical efficiency with sensitivity to organizational and human needs, leading to higher job satisfaction and productivity.

PROJECT MANAGEMENT SOFTWARE TOOLS

Commercial software tools that automate many aspects of project management facilitate the project management process. Project management software typically features capabilities for defining and ordering tasks, assigning resources to tasks, establishing starting and ending dates to tasks, tracking progress, and facilitating modifications to tasks and resources. Many automate the creation of Gantt and PERT charts.

Some of these tools are large sophisticated programs for managing very large projects, dispersed work groups, and enterprise functions. These high-end

TABLE 14.5 ORGANIZATIONAL FACTORS IN SYSTEMS PLANNING AND IMPLEMENTATION

Employee participation and involvement
Job design
Standards and performance monitoring
Ergonomics (including equipment, user interfaces, and the work environment)
Employee grievance resolution procedures
Health and safety
Government regulatory compliance

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tools can manage very large numbers of tasks and activities and complex relationships.

Microsoft Project has become the most widely used project management software today. It is PC-based, with capabilities for producing PERT and Gantt charts and for supporting critical path analysis, resource allocation, project tracking, and status reporting. Project also tracks the way changes in one aspect of a project affect others. Products such as Easy Projects and Vertabase are useful for firms that want Web-based project management tools.

Going forward, delivery of project management software as a software service (SaaS) will make this technology accessible to more organizations, especially smaller ones. Open source versions of project management software such as Open Workbench and OpenProj will further reduce the total cost of ownership and attract new users. Thanks to the popularity of social media such as Facebook and Twitter, project management software is also likely to become more flexible, collaborative, and user-friendly.

While project management software helps organizations track individual projects, the resources allocated to them, and their costs, **project portfolio management software** helps organizations manage portfolios of projects and dependencies among them. Project portfolio management software helps managers compare proposals and projects against budgets and resource capacity levels to determine the optimal mix and sequencing of projects that best achieves the organization's strategic goals.

Review Summary

1. *What are the objectives of project management and why is it so essential in developing information systems?*

   Good project management is essential for ensuring that systems are delivered on time, on budget, and provide genuine business benefits. Project management activities include planning the work, assessing the risk, estimating and acquiring resources required to accomplish the work, organizing the work, directing execution, and analyzing the results. Project management must deal with five major variables: scope, time, cost, quality, and risk.

2. *What methods can be used for selecting and evaluating information systems projects and aligning them with the firm's business goals?*

   Organizations need an information systems plan that describes how information technology supports the attainment of their business goals and documents all their system applications and IT infrastructure components. Large corporations will have a management structure to ensure the most important systems projects receive priority. Key performance indicators, portfolio analysis, and scoring models can be used to identify and evaluate alternative information systems projects.

3. *How can firms assess the business value of information systems projects?*

   To determine whether an information systems project is a good investment, one must calculate its costs and benefits. Tangible benefits are quantifiable, and intangible benefits that cannot be immediately quantified may provide quantifiable benefits in the future. Benefits that exceed costs should be analyzed using capital budgeting methods to make sure a project represents a good return on the firm's invested capital. Real options pricing models, which apply the same techniques for valuing financial options to systems investments, can be useful when considering highly uncertain IT investments.

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4. ***What are the principal risk factors in information systems projects, and how can they be managed?***

The level of risk in a systems development project is determined by (1) project size, (2) project structure, and (3) experience with technology. IS projects are more likely to fail when there is insufficient or improper user participation in the systems development process, lack of management support, and poor management of the implementation process. There is a very high failure rate among projects involving business process reengineering, enterprise applications, and mergers and acquisitions because they require extensive organizational change.

Implementation refers to the entire process of organizational change surrounding the introduction of a new information system. User support and involvement and management support and control of the implementation process are essential, as are mechanisms for dealing with the level of risk in each new systems project. Project risk factors can be brought under some control by a contingency approach to project management. The risk level of each project determines the appropriate mix of external integration tools, internal integration tools, formal planning tools, and formal control tools to be applied.

Key Terms

Capital budgeting, 586
Change agent, 590
Change management, 590
Counterimplementation, 595
Ergonomics, 596
External integration tools, 593
Formal control tools, 593
Formal planning tools, 593
Gantt chart, 593
Implementation, 590
Information systems plan, 582
Intangible benefits, 585
Internal integration tools, 592
Organizational impact analysis, 596
PERT chart, 593
Portfolio analysis, 584
Project, 578
Project management, 578
Project portfolio management, 597
Real options pricing models (ROPMs), 588
Scope, 578
Scoring model, 584
Sociotechnical design, 596
Tangible benefits, 585
User-designer communications gap, 590
User interface, 576

MyMISLab

Go to **mymislab.com** to complete the problems marked with this icon ✪.

Review Questions

14-1 What are the objectives of project management and why is it so essential in developing information systems?

- Describe information system problems resulting from poor project management.
- Define and describe runaway systems projects and evidence of systems failure. What are the likely consequences for the business firm.

14-2 What methods can be used for selecting and evaluating information systems projects and aligning them with the firm's business goals?

- Name and describe the groups responsible for the management of information systems projects.
- Describe the purpose of an information systems plan and list the major categories in the plan.
- Explain how key performance indicators, portfolio analysis, and scoring models can be used to select information systems projects.
- Explain why it is important to link systems projects to the overall business plan.

14-3 How can firms assess the business value of information systems projects?

- List and describe the major costs and benefits of information systems.
- Distinguish between tangible and intangible benefits.

- Describe the limitations of financial models for selecting which systems to build.

14-4 What are the principal risk factors in information systems projects, and how can they be managed?

- Identify and describe each of the principal risk factors in information systems projects.
- Explain why builders of new information systems need to address implementation and change management.
- Explain why eliciting support of management and end users is so essential for successful implementation of information systems projects.
- Explain why there is such a high failure rate for implementations involving enterprise applications, business process reengineering, and mergers and acquisitions.
- Identify and describe the strategies for controlling project risk.
- Identify the organizational considerations that should be addressed by project planning and implementation.
- Explain how sociotechnical design practices can mitigate human and organizational issues that arise when building information systems.

Discussion Questions

14-5 Why does portfolio analysis help managers decide which systems to build?

14-6 It has been said that most systems fail because systems builders ignore organizational behavior problems. Why might this be so?

14-7 Why is project size a major factor in project risk?

Hands-On MIS Projects

The projects in this section give you hands-on experience evaluating information systems projects, using spreadsheet software to perform capital budgeting analyses for new information systems investments, and using Web tools to analyze the financing for a new home.

Management Decision Problems

14-8 The U.S. Census launched an IT project to arm its census takers in the field with high-tech handheld devices that would save taxpayer money by directly beaming population data to headquarters from census takers in the field. Census officials signed a $600 million contract with Harris Corporation in 2006 to build 500,000 devices, but still weren't sure which features they wanted included in the units. Census officials did not specify the testing process to measure the performance of the handheld devices. As the project progressed, 400 change requests to project requirements were added. Two years and hundreds of millions of taxpayer dollars later, the handhelds were far too slow and unreliable to be used for the 2010 U.S. census. What could Census Bureau management and the Harris Corporation have done to prevent this outcome?

14-9 Caterpillar is the world's leading maker of earth-moving machinery and supplier of agricultural equipment. Caterpillar wants to end its support for its Dealer Business System (DBS), which it licenses to its dealers to help them run their businesses. The software in this system is becoming outdated, and senior management wants to transfer support for the hosted version of the software to Accenture Consultants so it can concentrate on its core business. Caterpillar never required its dealers to use DBS, but the system had become a de facto standard for doing business with the company. The majority of the 50 Cat dealers in North America use some version of DBS, as do about half of the 200 or so Cat dealers in the rest of the world. Before Caterpillar turns the product over to Accenture, what factors and issues should it consider? What questions should it ask? What questions should its dealers ask?

Improving Decision Making: Using Spreadsheet Software for Capital Budgeting for a New CAD System

Software skills: Spreadsheet formulas and functions
Business skills: Capital budgeting

14-10 This project provides you with an opportunity to use spreadsheet software to use the capital budgeting models discussed in this chapter to analyze the return on an investment for a new computer-aided design (CAD) system.

Your company would like to invest in a new computer-aided design (CAD) system that requires purchasing hardware, software, and networking technology, as well as expenditures for installation, training, and support. MyMISLab contains tables showing each cost component for the new system as well as annual maintenance costs over a five-year period, along with a Learning Track on capital budgeting models. You believe the new system will reduce the amount of labor required to generate designs and design specifications, thereby increasing your firm's annual cash flow.

- Using the data provided in these tables, create a worksheet that calculates the costs and benefits of the investment over a five-year period and analyzes the investment using the four capital budgeting models presented in this chapter's Learning Track.
- Is this investment worthwhile? Why or why not?

Improving Decision Making: Using Web Tools for Buying and Financing a Home

Software skills: Internet-based software
Business skills: Financial planning

14-11 This project will develop your skills using Web-based software for searching for a home and calculating mortgage financing for that home.

You would like to purchase a home in Fort Collins, Colorado. Ideally, it should be a single-family house with at least three bedrooms and one bathroom that costs between $150,000 and $225,000 and finance it with a 30-year fixed rate mortgage. You can afford a down payment that is 20 percent of the value of the house. Before you purchase a house, you would like to find out what homes are available in your price range, find a mortgage, and determine the amount of your monthly payment. Use the Yahoo! Homes site to help you with the following tasks:

- Locate homes in Fort Collins, Colorado, that meet your specifications.
- Find a mortgage for 80 percent of the list price of the home. Compare rates from at least three sites (use search engines to find sites other than Yahoo).
- After selecting a mortgage, calculate your closing costs and the monthly payment.

When you are finished, evaluate the whole process. For example, assess the ease of use of the site and your ability to find information about houses and mortgages, the accuracy of the information you found, and the breadth of choice of homes and mortgages.

Collaboration and Teamwork Project

14-12 In MyMISLab, you will find a Collaboration and Teamwork Project dealing with the concepts in this chapter. You will be able to use Google Drive, Google Sites, Google Docs, Google+, or other open source collaboration tools to complete the assignment.

A Shaky Start for Healthcare.gov

CASE STUDY

The administration of President Barack Obama has made Patient Protection and Affordable Care Act, often called "Obamacare", its chief domestic accomplishment and the centerpiece of Obama's legacy. Essential to Obama's health care reform plan is Healthcare.gov, a health insurance exchange Web site that facilitates the sale of private health insurance plans to U.S. residents, assists people eligible to sign up for Medicaid, and has a separate marketplace for small businesses.

The site allows users to compare prices on health insurance plans in their states, to enroll in a plan they choose, and to find out if they qualify for government health care subsidies. Users must sign up and create their own specific account first, providing some personal information, in order to receive detailed information about available health care plans in their area.

Healthcare.gov was launched on October 1, 2013, as promised, but visitors quickly encountered numerous technical problems. Software that assigned digital identities to enrollees and ensured that they saw only their own personal data was overwhelmed. Customers encountered cryptic error messages and could not log in to create accounts. There was insufficient computing capacity in the Herndon, Virginia, data center housing the system for the site. Many users received quotes that were incorrect because the feature used prices based on just two age groups. It was estimated that only 1 percent of interested consumers were able to enroll through the site for the first week of operations, and many applications sent to insurers contained erroneous information. Thousands of enrollees for HealthCare.gov—at least one in five at the height of the problems—received inaccurate assignments to Medicaid or to private health plans. Some people were wrongly denied coverage.

Insurers received enrollment files from the federal exchange that were incomplete or inaccurate—as many as one in ten. The information includes who is enrolling and what subsidies they may receive. Some insurers reported being deluged with phone calls from people who believe they have signed up for a particular health plan, only to find that the company has no record of the enrollment. Enrollment problems with insurers persisted into November.

U.S. chief technology officer Todd Park stated on October 6 that Healthcare.gov's glitches were caused by an unexpectedly high volume of users. About 50,000–60,000 had been expected, but the site had to handle 250,000 simultaneous users. Over 8.1 million people visited Healthcare.gov between October 1 and October, 2013.

White House officials later admitted that Healthcare.gov's problems were not just caused by high traffic volume but also by software and system design issues. Stress tests performed by contractors a day before the launch date revealed the site slowed substantially with only 1,100 simultaneous users, far fewer than the 50,000–60,000 that were anticipated. Technical experts found out that the site was riddled with hardware and software defects, amounting to more than 600 items that needed to be fixed.

A major contributor to these problems was the part of the system's design that requires users to create individual accounts before shopping for health insurance. This means that before users can shop for coverage, they must input personal data that are exchanged among separate computer systems built or run by multiple vendors, including CGI Group, developer of healthcare.gov, Quality Software Services, and credit-checker Experian PLC. If any part of this web of systems fails to work properly, users will be blocked from entering the exchange marketplace. A bottleneck had been created where these systems interacted with a software component called Oracle Identity Manager supplied by Oracle Corporation that was embedded in the government's identity-checking system. Quality Software Services had subcontracted with Oracle for this part of the system. This problem might have been averted if the system allowed users to browse plans without first going through the complex registration process.

Problems persisted into the third week of operations, including pull-down menus that only worked intermittently and excruciatingly long wait times. For some weeks in October, the site was down 60 percent of the time.

What happened to Healthcare.gov is another example of IT project management gone awry, which often happens with large technology projects, especially those for the U.S. federal government. There was no single leader overseeing the

Healthcare.gov implementation. The U.S. Centers for Medicare and Medicaid Services (CMS) coordinated the development effort. However, CMS had a siloed management structure, and no single unit was designated to take charge of the entire project.

CMS parceled out the work for building and implementing the Healthcare.gov system to a number of different outside contractors. The front end of the Web site (including the user interface) was developed by the startup Development Seed. The back end (where all the heavy-duty processing of enrollment data and transactions with insurers takes place) was contracted to CGI Federal, a subsidiary of the Canadian multinational CGI Group, which received $231 million for the project. CGI then subcontracted much of its work to other companies. This is common in large government projects. Functions relating to digital identity authentication were contracted to Experian, the global information services company noted for its credit-checking expertise.

CMS set deadlines for the contractors, who were expected to attend meetings to hammer out the details of the specifications for the Web site. But the computer specialists skipped some of those sessions. Relations between CMS and its primary contractor CGI Federal had deteriorated in the months prior to the Healthcare.gov launch. Contractors for different parts of the system barely communicated with each other.

Some IT experts also criticized CMS's decision to use database software from a company called MarkLogic, which handles data management differently from more mainstream database management systems from companies such as IBM and Oracle. Work proceeded more slowly because so few people were familiar with MarkLogic, and MarkLogic continued to perform below expectations after the Healthcare.gov Web site was launched.

The Web site had not been thoroughly tested before it went live, so a number of software and hardware defects had not been detected. Testing of the system by insurers had been scheduled for July but didn't begin until the third week in September. CMS was responsible for testing the system during the final weeks, not its software developers. Usually software developers handle the portion of the testing for identifying remaining problems before users see the final product.

Fixing the account creation software exposed other problems. As few as 500 users could cripple the system.

Technology experts also faulted Healthcare.gov's developers for trying to go live with all parts of a large and very complex system all at once. It would have been better to roll out system functions gradually. CGI believed that a full-function Healthcare.gov with all the anticipated bells and whistles was an unrealistic target. Given the time required to complete and test the software, it was impossible to launch a full-function exchange by Oct. 1. But government officials insisted that Oct. 1 was not negotiable and had become impatient with CGI's pattern of excuses for missed deadlines. The Obama administration kept on modifying regulations and policies until the summer of 2013, which meant that contractors had to deal with changing requirements.

The Healthcare.gov enrollment system is very complex. It connects to other federal computer networks, including SSA, IRS, VA, Office of Personnel Management, and the Peace Corps. It has to verify a considerable amount of personal information, including income and immigration status.

Vital components were never secured. There was insufficient access to a data center to prevent the Web site from crashing. No backup system for a Web site crash was created. The interaction between the data center where the information is stored and the system was so poorly configured that it had to be redesigned.

CMS had several warnings between March and July that the project was going off-track, but didn't seek deep White House involvement or change the leadership structure, according to officials, congressional aides and e-mails from the period. An administration report noted that inadequate management oversight and coordination among technical teams prevented real-time decision making and efficient responses to address the issues with the site. The House Energy and Commerce Committee, which had been investigating Healthcare.gov, found no evidence of extensive communication between CMS and the White House even in July, when CMS technology official Henry Chao expressed serious concern about the project.

In March, a White House Web site that tracks the status of major government technology projects labeled the project high risk. Officials attributed the downgrade to a lag in submitting information, and the project's status was upgraded the following month. The consulting firm McKinsey & Co. detailed the project's potential risks in a presentation between March 28 and April 8 to the top CMS official, Marilyn Tavenner, to Health and Human Services Secretary Kathleen Sebelius, and to White House Chief Technology Officer Todd Park.

The McKinsey report anticipated many of the site's pitfalls and urged the administration to name a single project leader to streamline decision-making. It also emphasized the importance of White House support for CMS to meet the Oct. 1 launch date. But according to documents from the period and officials, the White House's minimal involvement in the project's details didn't change after the McKinsey report.

By July, CMS officials were growing alarmed about the project's status, including a shortage of staff to address the ever-mounting list of problems. They brought more personnel on board while bickering with contractors over the distribution of resources. But the depth of the website's difficulties still didn't become apparent until weeks after the Oct. 1 launch.

The White House assembled experts from government and industry who worked frantically to fix the system. The Obama administration appointed contractor Quality Software Services Inc. (QSSI) to coordinate the work involved in fixing the Web site. QSSI had worked earlier on the Web site's back-end. Former deputy director of the Office of Management and Budget Jeffrey Zients was appointed to act as the adviser to CMS. In January 2014, Accenture replaced CGI Group as the Web site's lead contractor.

Work on fixing the Web site continued through October and November 2013, and the Web site appeared to be working more smoothly. For the vast majority of users, Healthcare.gov was working more than 90 percent of the time. Response time (the time required for a Web page to load) was reduced from 8 seconds to less than one. The incidence of error messages preventing people from using the site went from 6 percent down to .75 percent. But on November 13, the Obama administration revealed that less than 27,000 people had signed up for private health insurance using Healthcare.gov. Only 137,000 people had done so by November 30. These enrollment numbers were well below what the government had forecast. Healthcare.gov also forced the Obama administration to delay by one year an online exchange for small business.

A spokeswoman for the Centers for Medicare and Medicaid Services said on Nov. 19 that the government had fixed "two-thirds of the high-priority bugs" that were responsible for inaccuracies in enrollment data. Mr. Chao said the government was still working on "back office systems," including those needed to pay insurance companies.

Reuters reported in mid-October 2013, that the total cost of building Healthcare.gov using contractors had tripled from an initial estimate of $93.7 million to about $292 million. Overall cost for building the Web site reached $500 million by October 2013.

By early 2014, Healthcare.gov was working much better, but was not problem-free. The Healthcare.gov site went down shortly after midnight March 30, 2014 and remained unusable until about 7:45 a.m. the following morning. It then experienced another problem around noon that same day that prevented new users from creating accounts, while some people who already had accounts were unable to log in. Some of the hundreds of thousands of Americans trying to sign up for health care at the last minute of the enrollment period were unable to do so. Obama administration officials nevertheless remained confident that they would reach their initial target of seven million health insurance signups by the March 31, 2014 deadline.

On July 30, 2014 the U.S. Government Accountability Office (GAO) released a non-partisan study finding that the Healthcare.gov Web site was developed without effective planning or oversight practices. Kathleen Sibelius resigned as Secretary for Health and Human Services on April 10, 2014 and was replaced by Sylvia Mathews Burwell on June 9 of that year.

Sources: Robert Pear, "Health Website Failures Impede Signup Surge as Deadline Nears," *New York Times*, March 31, 2014; Spencer E. Ante and Louis Radnofsky,"New Technical Woes Hobble Health-Insurance Sign-Ups at Zero Hour," *Wall Street Journal*, March 31, 2014; "How HealthCare.gov Was Supposed to' Work and How It Didn't," *New York Times*, December 2, 2013; Sheryl Gay Stolberg and Michael D. Shear, "Inside the Race to Rescue a Health Care Site, and Obama," *New York Times*, November 30, 2013; Gautham Nagesh, "Health Website Problems Weren't Flagged in Time," *Wall Street Journal*, December 2, 2013; Christopher Weaver and Louise Radnofsky, "Healthcare.gov's Flaws Found, Fixes Eyed," *Wall Street Journal*, October 10, 2013 and "Federal Health Site Stymied by Lack of Direction," Wall Street Journal, October 28, 2013; Christopher Weaver, "Errors Continue to Plague Government Health Site," *Wall Street Journal*, December 13, 2013; Jack Gillum and Julie Pace, "Builders of Obama's Health Website Saw Red Flags," Associated Press, October 22, 2013; "Fast Recovery for Health Care Web Site," *New York Times*, December 2, 2013;and Eric Lipton, Jan Austen, and Sharon LaFraniere, "Tension and Flaws Before Health Website Crash," *New York Times*, November 22, 2013.

CASE STUDY QUESTIONS

14-13 Why was the Healthcare.gov project so important?

14-14 Evaluate the key risk factors in this project.

14-15 Classify and describe the problems encountered by this project. What management, organization, and technology factors were responsible for these problems?

14-16 What was the economic, political, and social impact of Healthcare.gov's botched implementation?

14-17 Describe the steps that should have been taken to prevent a negative outcome in this project.

MyMISLab

Go to **mymislab.com** for the following Assisted-graded writing questions:

14-18 Identify and describe 3 methods for helping managers select information systems projects.

14-19 Compare the two major types of planning and control tools.

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Managing Global Systems

CHAPTER 15

LEARNING OBJECTIVES

After reading this chapter, you will be able to answer the following questions:

1. What major factors are driving the internationalization of business?
2. What are the alternative strategies for developing global businesses?
3. What are the challenges posed by global information systems and management solutions for these challenges?
4. What are the issues and technical alternatives to be considered when developing international information systems?

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Monsanto Uses Cisco and Microsoft to Manage Globally

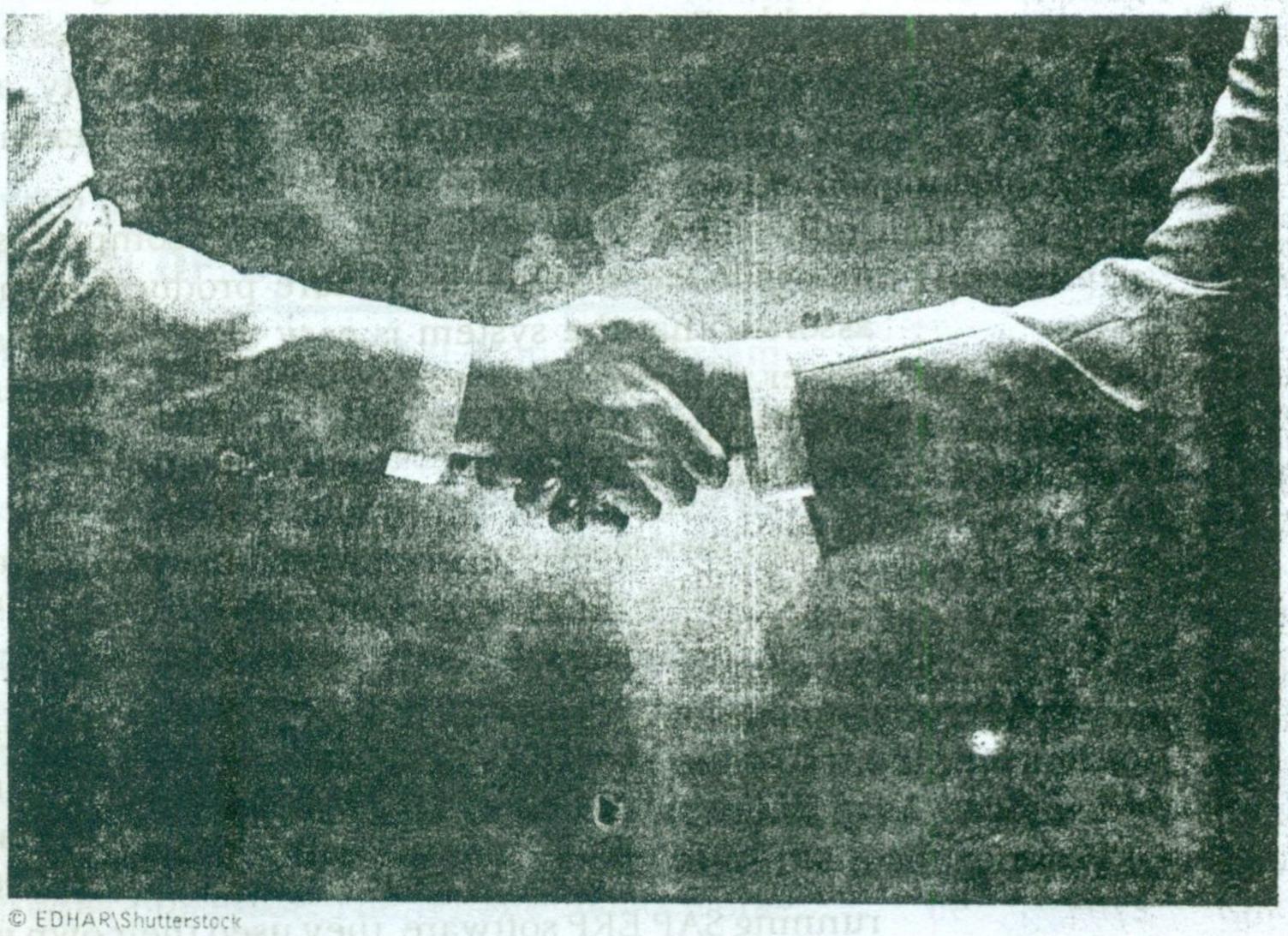
L'ORÉAL'S GLOBAL MAKEOVER

L'Oréal Group is the world's largest cosmetics and beauty company, and it is a truly global brand. Virtually everyone has heard of this company or used its products, with world-name brands including L'Oréal Paris and Maybelline (mass-market), Lancôme (luxury), Redken and SoftSheen-Carson (retail and salon), and The Body Shop natural cosmetics. Altogether L'Oréal has more than 28 global brands in 130 countries and more than 77,000 employees. This is a very challenging company to manage worldwide.

Each of L'Oréal's 40 manufacturing sites deals with hundreds or even thousands of different recipes for L'Oréal products. Every recipe must be followed exactly, and every ingredient must be tested for quality. This level of complexity increases the chances of human error and waste. L'Oréal's management believed the company needed to do more to ensure that its products are all manufactured worldwide under uniform production and quality standards.

L'Oréal's various operating units in different regions and countries were running their own versions of SAP enterprise resource planning (ERP) systems. In order to achieve the goal of global product uniformity, these disparate systems had to be standardized and consolidated. It was hoped that productivity, quality, and safety would be improved by standardizing best-practice processes throughout the company.

Management knew that this level of organizational change required changes in employee behavior, and it dedicated significant resources to change management and promoting knowledge-sharing across geographical and cultural boundaries. The company assigned a business "owner" for each core business



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process who would help analyze the processes at each site and implement the necessary changes. L'Oréal's information systems team would then create the system design and implementation plan for the solution.

L'Oréal was able to implement a single global instance of SAP's ERP system and integrate that with Apriso's FlexNet for operations management using a core model that is replicated at each site. FlexNet is a unified suite of manufacturing software applications for coordinating all manufacturing operations—within the plant, between plants, and across a company's supply chain and enterprise. L'Oréal named its new system ISIS, standing for Integrated Solution for Industrial Systems. L'Oréal's transactional processes, financial controls, and purchasing are all integrated into the FlexNet manufacturing operations system on the shop floor run. L'Oréal runs ISIS at its central data center in Montpellier, France, where it keeps the master data for the business. FlexNet runs on servers in individual factories so that operations can continue if there is a problem with L'Oréal's main servers.

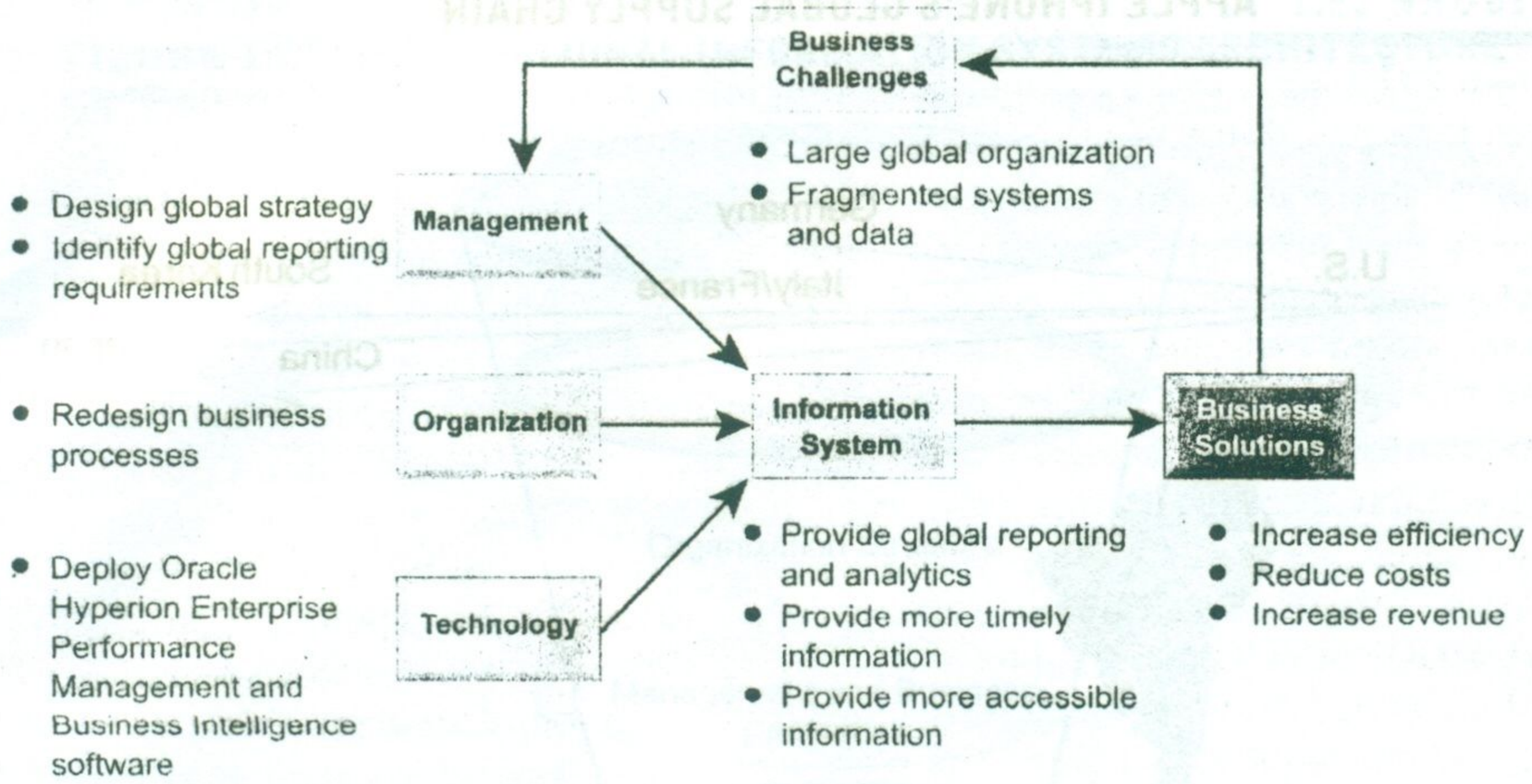
ISIS guides factory operators through each recipe for a product and automatically records the weight of each ingredient to ensure exact quantities are being used. All ingredients are tested, and raw materials that have passed tests for quality are given labels that must be scanned by the worker before being added to the recipe. In the past, shop workers used to rummage around for information on recipes or raw materials. The labels also provide forklift drivers with directions on which materials need to be taken to the packaging station.

With this level of centralization and global processes, L'Oréal is able to implement new processes and related systems changes globally much more rapidly than in the past. For example, when the company had multiple versions of SAP running in different operating units, it could take two to five years for the entire company to upgrade to the latest version of the software. With its global enterprise-wide version of SAP and FlexNet, a recent L'Oréal's upgrade took just one weekend. That means that the company can easily update its systems without disrupting its factories, and bring new factories on board much more quickly. For example, a recently acquired Yves St. Laurent factory was integrated with L'Oréal's global quality assurance, safety, and efficiency practices within a few months. However, there is still some flexibility in the system to tailor some processes to local needs if necessary.

L'Oréal management believes the company's overall capacity has increased and that the workplace is more productive and efficient. Shop workers have asserted that the system is easy to use and has reduced confusion and stress. Fewer materials are wasted, there are fewer discrepancies between actual versus planned production, and the company is able to maintain lower, better managed inventories.

Sources: www.loreal.com, "Key Figures," accessed January 2014. Jacques Playe, "L'Oréal's Manufacturing Makeover," *Baseline*, January/February 2011; www.apriso.com, accessed October 1, 2012.

L'Oréal's efforts to create global manufacturing systems identify some of the issues that truly global organizations need to consider if they want to operate worldwide. Like many large, multinational firms, L'Oréal has numerous operating units in many different countries. Even though these units were running SAP ERP software, they used their own versions and business processes. As a result, L'Oréal was unable to effectively coordinate global manufacturing operations or ensure that its vast array of products met global quality and production standards.



The chapter-opening diagram calls attention to important points raised by this case and this chapter. To solve its global management and business challenges, L'Oréal had all of its business units adopt a standard core version of SAP software and standard manufacturing and production processes. The ERP system was integrated with the FlexNet manufacturing software suite to coordinate manufacturing operations on a global scale. Management realized that this level of organizational change required careful attention to change management. Although L'Oréal now has standard global manufacturing and production systems and business processes, it is sensitive to local differences and gives units some leeway to tailor processes to local needs.

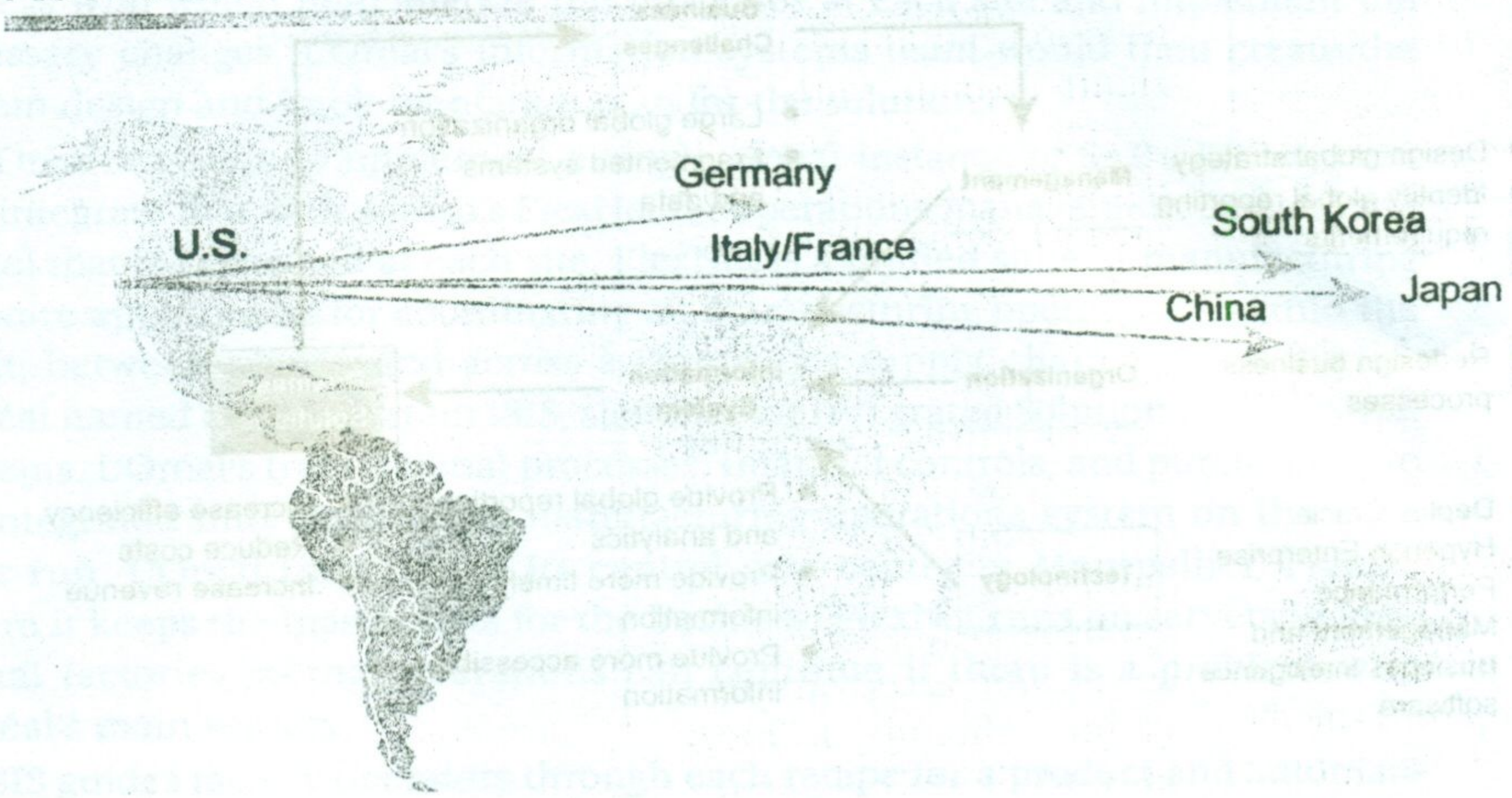
Here are some questions to think about: How did information technology improve operations at L'Oréal? Why did management think it desirable to centralize its systems by developing a single ERP system across all its operational units?

15.1 WHAT MAJOR FACTORS ARE DRIVING THE INTERNATIONALIZATION OF BUSINESS?

In earlier chapters, we describe the emergence of a global economic system and global world order driven by advanced networks and information systems. The new world order is sweeping away many national corporations, national industries, and national economies controlled by domestic politicians. Many localized firms will be replaced by fast-moving networked corporations that transcend national boundaries. The growth of international trade has radically altered domestic economies around the globe.

Consider the path to market for an iPhone, which is illustrated in Figure 15.1. The iPhone was designed by Apple engineers in the United States, sourced with more than 100 high-tech components from around the world, and assembled in China. Among the iPhone 5's major suppliers, Samsung Electronics in South Korea has supplied the applications processor. The iPhone 5's accelerator and gyroscope are made in Italy and France by STMicroelectronics, and its electronic compass is made by AKM Semiconductor in Japan. Germany's Dialog Semiconductor designed chips for power management. Texas Instruments (TI) and Broadcom in the United States supply the touch screen controller, Japan's

FIGURE 15.1 APPLE IPHONE'S GLOBAL SUPPLY CHAIN



Apple designs the iPhone in the United States, and relies on suppliers in the United States, Germany, Italy, France, and South Korea for other parts. Final assembly occurs in China.

Japan Display and Sharp Electronics and South Korea's LG Display make the high-definition display screen. Foxconn, a Chinese division of Taiwan's Hon Hai Group, is in charge of manufacturing and assembly.

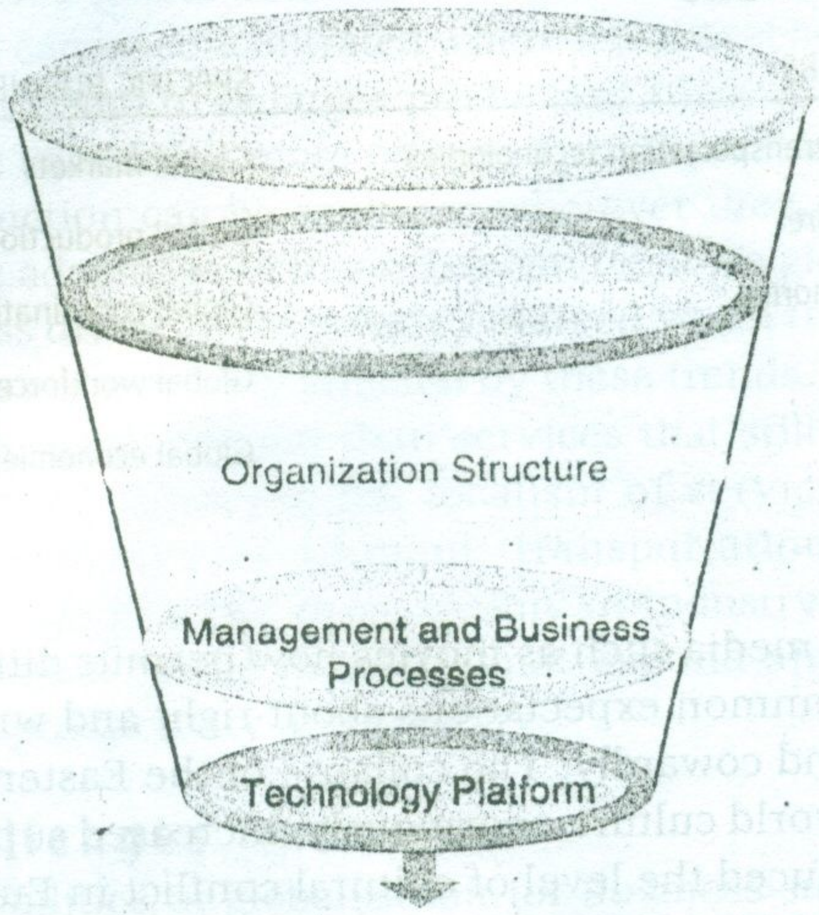
DEVELOPING AN INTERNATIONAL INFORMATION SYSTEMS ARCHITECTURE

This chapter describes how to go about building an international information systems architecture suitable for your international strategy. An **international information systems architecture** consists of the basic information systems required by organizations to coordinate worldwide trade and other activities. Figure 15.2 illustrates the reasoning we follow throughout the chapter and depicts the major dimensions of an international information systems architecture.

The basic strategy to follow when building an international system is to understand the global environment in which your firm is operating. This means understanding the overall market forces, or business drivers, that are pushing your industry toward global competition. A **business driver** is a force in the environment to which businesses must respond and that influences the direction of the business. Likewise, examine carefully the inhibitors or negative factors that create *management challenges*—factors that could scuttle the development of a global business. Once you have examined the global environment, you will need to consider a corporate strategy for competing in that environment. How will your firm respond? You could ignore the global market and focus on domestic competition only, sell to the globe from a domestic base, or organize production and distribution around the globe. There are many in-between choices.

After you have developed a strategy, it is time to consider how to structure your organization so it can pursue the strategy. How will you accomplish a division of labor across a global environment? Where will production, administration, accounting, marketing, and human resource functions be located? Who will handle the systems function?

FIGURE 15.2 INTERNATIONAL INFORMATION SYSTEMS ARCHITECTURE



The major dimensions for developing an international information systems architecture are the global environment, the corporate global strategies, the structure of the organization, the management and business processes, and the technology platform.

Next, you must consider the management issues in implementing your strategy and making the organization design come alive. Key here will be the design of business processes. How can you discover and manage user requirements? How can you induce change in local units to conform to international requirements? How can you reengineer on a global scale, and how can you coordinate systems development?

The last issue to consider is the technology platform. Although changing technology is a key driving factor leading toward global markets, you need to have a corporate strategy and structure before you can rationally choose the right technology.

After you have completed this process of reasoning, you will be well on your way toward an appropriate international information systems portfolio capable of achieving your corporate goals. Let's begin by looking at the overall global environment.

THE GLOBAL ENVIRONMENT: BUSINESS DRIVERS AND CHALLENGES

Table 15.1 lists the business drivers in the global environment that are leading all industries toward global markets and competition.

The global business drivers can be divided into two groups: general cultural factors and specific business factors. Easily recognized general cultural factors have driven internationalization since World War II. Information, communication, and transportation technologies have created a *global village* in which communication (by telephone, television, radio, or computer network) around the globe is no more difficult and not much more expensive than communication down the block. The cost of moving goods and services to and from geographically dispersed locations has fallen dramatically.

The development of global communications has created a global village in a second sense: A **global culture** created by television, the Internet, and

TABLE 15.1 THE GLOBAL ENVIRONMENT: BUSINESS DRIVERS AND CHALLENGES

GENERAL CULTURAL FACTORS	SPECIFIC BUSINESS FACTORS
Global communication and transportation technologies	Global markets
Development of global culture	Global production and operations
Emergence of global social norms	Global coordination
Political stability	Global workforce
Global knowledge base	Global economies of scale

other globally shared media such as movies now permits different cultures and peoples to develop common expectations about right and wrong, desirable and undesirable, heroic and cowardly. The collapse of the Eastern bloc has accelerated the growth of a world culture enormously, increased support for capitalism and business, and reduced the level of cultural conflict in Europe considerably.

A last factor to consider is the growth of a global knowledge base. At the end of World War II, knowledge, education, science, and industrial skills were highly concentrated in North America, western Europe, and Japan, with the rest of the world euphemistically called the *Third World*. This is no longer true. Latin America, China, India, southern Asia, and eastern Europe have developed powerful educational, industrial, and scientific centers, resulting in a much more democratically and widely dispersed knowledge base.

These general cultural factors leading toward internationalization result in specific business globalization factors that affect most industries. The growth of powerful communications technologies and the emergence of world cultures lay the groundwork for *global markets*—global consumers interested in consuming similar products that are culturally approved. Coca-Cola, American sneakers (made in Korea but designed in Los Angeles), and Cable News Network (CNN) programming can now be sold in Latin America, Africa, and Asia.

Responding to this demand, global production and operations have emerged with precise online coordination between far-flung production facilities and central headquarters thousands of miles away. At SeaLand Transportation, a major global shipping company based in Newark, New Jersey, shipping managers in Newark can watch the loading of ships in Rotterdam online, check trim and ballast, and trace packages to specific ship locations as the activity proceeds. This is all possible through an international satellite link.

The new global markets and pressure toward global production and operation have called forth whole new capabilities for global coordination. Production, accounting, marketing and sales, human resources, and systems development (all the major business functions) can be coordinated on a global scale.

Frito Lay, for instance, can develop a marketing sales force automation system in the United States and, once provided, may try the same techniques and technologies in Spain. Micromarketing—marketing to very small geographic and social units—no longer means marketing to neighborhoods in the United States, but to neighborhoods throughout the world! Internet-based marketing means marketing to individuals and social networks through out the world. These new levels of global coordination permit for the first time in history the location of business activity according to comparative advantage. Design should be located where it is best accomplished, as should marketing, production, and finance.

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Finally, global markets, production, and administration create the conditions for powerful, sustained global economies of scale. Production driven by worldwide global demand can be concentrated where it can best be accomplished, fixed resources can be allocated over larger production runs, and production runs in larger plants can be scheduled more efficiently and precisely estimated. Lower-cost factors of production can be exploited wherever they emerge. The result is a powerful strategic advantage to firms that can organize globally. These general and specific business drivers have greatly enlarged world trade and commerce.

Not all industries are similarly affected by these trends. Clearly, manufacturing has been much more affected than services that still tend to be domestic and highly inefficient. However, the localism of services is breaking down in telecommunications, entertainment, transportation, finance, law, and general business. Clearly, those firms within an industry that can understand the internationalization of the industry and respond appropriately will reap enormous gains in productivity and stability.

Business Challenges

Although the possibilities of globalization for business success are significant, fundamental forces are operating to inhibit a global economy and to disrupt international business. Table 15.2 lists the most common and powerful challenges to the development of global systems.

At a cultural level, **particularism**, making judgments and taking action on the basis of narrow or personal characteristics, in all its forms (religious, nationalistic, ethnic, regionalism, geopolitical position) rejects the very concept of a shared global culture and rejects the penetration of domestic markets by foreign goods and services. Differences among cultures produce differences in social expectations, politics, and ultimately legal rules. In certain countries, such as the United States, consumers expect domestic name-brand products to be built domestically and are disappointed to learn that much of what they thought of as domestically produced is in fact foreign made.

Different cultures produce different political regimes. Among the many different countries of the world are different laws governing the movement of information, information privacy of their citizens, origins of software and hardware in systems, and radio and satellite telecommunications. Even the hours of business and the terms of business trade vary greatly across political cultures. These different legal regimes complicate global business and must be considered when building global systems.

TABLE 15.2 CHALLENGES AND OBSTACLES TO GLOBAL BUSINESS SYSTEMS

GLOBAL	SPECIFIC
Cultural particularism: Regionalism, nationalism, language differences	Standards: Different Electronic Data Interchange (EDI), e-mail, telecommunications standards
Social expectations: Brand-name expectations, work hours	Reliability: Phone networks not uniformly reliable
Political laws: Transborder data and privacy laws, commercial regulations	Speed: Different data transfer speeds, many slower than United States
	Personnel: Shortages of skilled consultants

For instance, European countries have very strict laws concerning transborder data flow and privacy. **Transborder data flow** is defined as the movement of information across international boundaries in any form. Some European countries prohibit the processing of financial information outside their boundaries or the movement of personal information to foreign countries. The European Union Data Protection Directive, which went into effect in October 1998, restricts the flow of any information to countries (such as the United States) that do not meet strict European information laws on personal information. Financial services, travel, and health care companies are often directly affected. In response, most multinational firms develop information systems within each European country to avoid the cost and uncertainty of moving information across national boundaries.

Cultural and political differences profoundly affect organizations' business processes and applications of information technology. A host of specific barriers arise from the general cultural differences, everything from different reliability of phone networks to the shortage of skilled consultants.

National laws and traditions have created disparate accounting practices in various countries, which impact the ways profits and losses are analyzed. German companies generally do not recognize the profit from a venture until the project is completely finished and they have been paid. Conversely, British firms begin posting profits before a project is completed, when they are reasonably certain they will get the money.

These accounting practices are tightly intertwined with each country's legal system, business philosophy, and tax code. British, U.S., and Dutch firms share a predominantly Anglo-Saxon outlook that separates tax calculations from reports to shareholders to focus on showing shareholders how fast profits are growing. Continental European accounting practices are less oriented toward impressing investors, focusing rather on demonstrating compliance with strict rules and minimizing tax liabilities. These diverging accounting practices make it difficult for large international companies with units in different countries to evaluate their performance.

Language remains a significant barrier. Although English has become a kind of standard business language, this is truer at higher levels of companies and not throughout the middle and lower ranks. Software may have to be built with local language interfaces before a new information system can be successfully implemented.

Currency fluctuations can play havoc with planning models and projections. A product that appears profitable in Mexico or Japan may actually produce a loss because of changes in foreign exchange rates.

These inhibiting factors must be taken into account when you are designing and building international systems for your business. For example, companies trying to implement "lean production" systems spanning national boundaries typically underestimate the time, expense, and logistical difficulties of making goods and information flow freely across different countries.

STATE OF THE ART

One might think, given the opportunities for achieving competitive advantages as outlined previously and the interest in future applications, that most international companies have rationally developed marvelous international systems architectures. Nothing could be further from the truth. Most companies have inherited patchwork international systems from the distant past,

often based on concepts of information processing developed in the 1960s—batch-oriented reporting from independent foreign divisions to corporate headquarters, manual entry of data from one legacy system to another, with little online control and communication. Corporations in this situation increasingly face powerful competitive challenges in the marketplace from firms that have rationally designed truly international systems. Still other companies have recently built technology platforms for international systems but have nowhere to go because they lack global strategy.

As it turns out, there are significant difficulties in building appropriate international architectures. The difficulties involve planning a system appropriate to the firm's global strategy, structuring the organization of systems and business units, solving implementation issues, and choosing the right technical platform. Let's examine these problems in greater detail.

15.2 WHAT ARE THE ALTERNATIVE STRATEGIES FOR DEVELOPING GLOBAL BUSINESSES?

Three organizational issues face corporations seeking a global position: choosing a strategy, organizing the business, and organizing the systems management area. The first two are closely connected, so we discuss them together.

GLOBAL STRATEGIES AND BUSINESS ORGANIZATION

Four main global strategies form the basis for global firms' organizational structure. These are domestic exporter, multinational, franchiser, and transnational. Each of these strategies is pursued with a specific business organizational structure (see Table 15.3). For simplicity's sake, we describe three kinds of organizational structure or governance: centralized (in the home country), decentralized (to local foreign units), and coordinated (all units participate as equals). Other types of governance patterns can be observed in specific companies (e.g., authoritarian dominance by one unit, a confederacy of equals, a federal structure balancing power among strategic units, and so forth).

The **domestic exporter** strategy is characterized by heavy centralization of corporate activities in the home country of origin. Nearly all international companies begin this way, and some move on to other forms. Production, finance/accounting, sales/marketing, human resources, and strategic management are set up to optimize resources in the home country. International sales are sometimes dispersed using agency agreements or subsidiaries, but

TABLE 15.3 GLOBAL BUSINESS STRATEGY AND STRUCTURE

BUSINESS FUNCTION	DOMESTIC EXPORTER	MULTINATIONAL	FRANCHISER	TRANSNATIONAL
Production	Centralized	Dispersed	Coordinated	Coordinated
Finance/Accounting	Centralized	Centralized	Centralized	Coordinated
Sales/Marketing	Mixed	Dispersed	Coordinated	Coordinated
Human Resources	Centralized	Centralized	Coordinated	Coordinated
Strategic Management	Centralized	Centralized	Centralized	Coordinated

even here, foreign marketing relies on the domestic home base for marketing themes and strategies. Caterpillar Corporation and other heavy capital-equipment manufacturers fall into this category of firm.

The **multinational** strategy concentrates financial management and control out of a central home base while decentralizing production, sales, and marketing operations to units in other countries. The products and services on sale in different countries are adapted to suit local market conditions. The organization becomes a far-flung confederation of production and marketing facilities in different countries. Many financial service firms, along with a host of manufacturers, such as General Motors, Chrysler, and Intel, fit this pattern.

Franchisers are an interesting mix of old and new. On the one hand, the product is created, designed, financed, and initially produced in the home country, but for product-specific reasons must rely heavily on foreign personnel for further production, marketing, and human resources. Food franchisers such as McDonald's, Mrs. Fields Cookies, and KFC fit this pattern. McDonald's created a new form of fast-food chain in the United States and continues to rely largely on the United States for inspiration of new products, strategic management, and financing. Nevertheless, because the product must be produced locally—it is perishable--extensive coordination and dispersal of production, local marketing, and local recruitment of personnel are required.

Generally, foreign franchisees are clones of the mother country units, but fully coordinated worldwide production that could optimize factors of production is not possible. For instance, potatoes and beef can generally not be bought where they are cheapest on world markets but must be produced reasonably close to the area of consumption.

Transnational firms are the stateless, truly globally managed firms that may represent a larger part of international business in the future. Transnational firms have no single national headquarters but instead have many regional headquarters and perhaps a world headquarters. In a **transnational** strategy, nearly all the value-adding activities are managed from a global perspective without reference to national borders, optimizing sources of supply and demand wherever they appear, and taking advantage of any local competitive advantages. Transnational firms take the globe, not the home country, as their management frame of reference. The governance of these firms has been likened to a federal structure in which there is a strong central management core of decision making, but considerable dispersal of power and financial muscle throughout the global divisions. Few companies have actually attained transnational status.

Information technology and improvements in global telecommunications are giving international firms more flexibility to shape their global strategies. Protectionism and a need to serve local markets better encourage companies to disperse production facilities and at least become multinational. At the same time, the drive to achieve economies of scale and take advantage of short-term local advantage moves transnationals toward a global management perspective and a concentration of power and authority. Hence, there are forces of decentralization and dispersal, as well as forces of centralization and global coordination.

GLOBAL SYSTEMS TO FIT THE STRATEGY

Information technology and improvements in global telecommunications are giving international firms more flexibility to shape their global strategies. The configuration, management, and development of systems tend to follow the

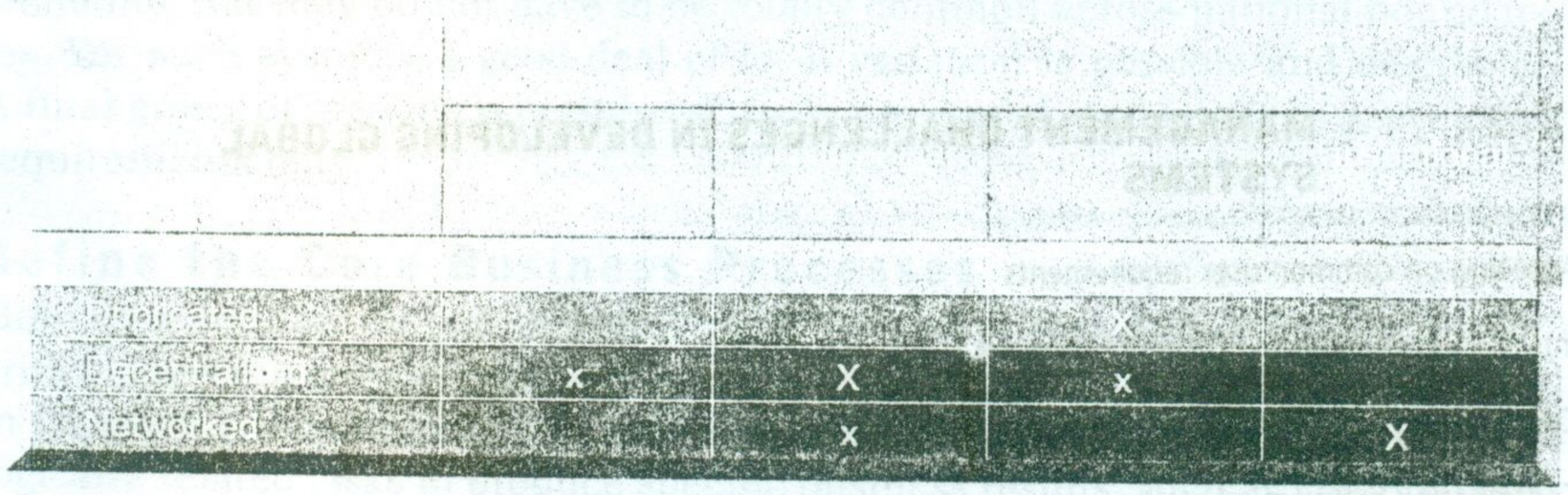
global strategy chosen. Figure 15.3 depicts the typical arrangements. By *systems* we mean the full range of activities involved in building and operating information systems: conception and alignment with the strategic business plan, systems development, and ongoing operation and maintenance. For the sake of simplicity, we consider four types of systems configuration. *Centralized systems* are those in which systems development and operation occur totally at the domestic home base. *Duplicated systems* are those in which development occurs at the home base but operations are handed over to autonomous units in foreign locations. *Decentralized systems* are those in which each foreign unit designs its own unique solutions and systems. *Networked systems* are those in which systems development and operations occur in an integrated and coordinated fashion across all units.

As can be seen in Figure 15.3, domestic exporters tend to have highly centralized systems in which a single domestic systems development staff develops worldwide applications. Multinationals offer a direct and striking contrast: Here, foreign units devise their own systems solutions based on local needs with few if any applications in common with headquarters (the exceptions being financial reporting and some telecommunications applications). Franchisers have the simplest systems structure: Like the products they sell, franchisers develop a single system usually at the home base and then replicate it around the world. Each unit, no matter where it is located, has identical applications. Last, the most ambitious form of systems development is found in transnational firms: Networked systems are those in which there is a solid, singular global environment for developing and operating systems. This usually presupposes a powerful telecommunications backbone, a culture of shared applications development, and a shared management culture that crosses cultural barriers. The networked systems structure is the most visible in financial services where the homogeneity of the product—money and money instruments—seems to overcome cultural barriers.

ORGANIZING THE BUSINESS

How should a firm organize itself for doing business on an international scale? To develop a global company and information systems support structure, a firm needs to follow these principles:

FIGURE 15.3 GLOBAL STRATEGY AND SYSTEMS CONFIGURATIONS



The large Xs show the dominant patterns, and the small Xs show the emerging patterns. For instance, domestic exporters rely predominantly on centralized systems, but there is continual pressure and some development of decentralized systems in local marketing regions.

1. Organize value-adding activities along lines of comparative advantage. For instance, marketing/sales functions should be located where they can best be performed, for least cost and maximum impact; likewise with production, finance, human resources, and information systems.
2. Develop and operate systems units at each level of corporate activity—regional, national, and international. To serve local needs, there should be *host country systems units* of some magnitude. *Regional systems units* should handle telecommunications and systems development across national boundaries that take place within major geographic regions (European, Asian, American). *Transnational systems units* should be established to create the linkages across major regional areas and coordinate the development and operation of international telecommunications and systems development (Roche, 1992).
3. Establish at world headquarters a single office responsible for development of international systems—a global chief information officer (CIO) position.

Many successful companies have devised organizational systems structures along these principles. The success of these companies relies not only on the proper organization of activities, but also on a key ingredient—a management team that can understand the risks and benefits of international systems and that can devise strategies for overcoming the risks. We turn to these management topics next.

15.3 WHAT ARE THE CHALLENGES POSED BY GLOBAL INFORMATION SYSTEMS AND MANAGEMENT SOLUTIONS FOR THESE CHALLENGES?

Table 15.4 lists the principal management problems posed by developing international systems. It is interesting to note that these problems are the chief difficulties managers experience in developing ordinary domestic systems as well. But these are enormously complicated in the international environment.

A TYPICAL SCENARIO: DISORGANIZATION ON A GLOBAL SCALE

Let's look at a common scenario. A traditional multinational consumer-goods company based in the United States and operating in Europe would like to expand into Asian markets and knows that it must develop a transnational strategy and a supportive information systems structure. Like most multinationals, it

TABLE 15.4 MANAGEMENT CHALLENGES IN DEVELOPING GLOBAL SYSTEMS

Agreeing on common user requirements
Introducing changes in business processes
Coordinating applications development
Coordinating software releases
Encouraging local users to support global systems

has dispersed production and marketing to regional and national centers while maintaining a world headquarters and strategic management in the United States. Historically, it has allowed each of the subsidiary foreign divisions to develop its own systems. The only centrally coordinated system is financial controls and reporting. The central systems group in the United States focuses only on domestic functions and production.

The result is a hodgepodge of hardware, software, and telecommunications. The e-mail systems between Europe and the United States are incompatible. Each production facility uses a different manufacturing resources planning system (or a different version of the same ERP system), and different marketing, sales, and human resource systems. Hardware and database platforms are wildly different. Communications between different sites are poor, given the high cost of European intercountry communications. The central systems group at headquarters in the United States recently was decimated and dispersed to the U.S. local sites in the hope of serving local needs better and reducing costs.

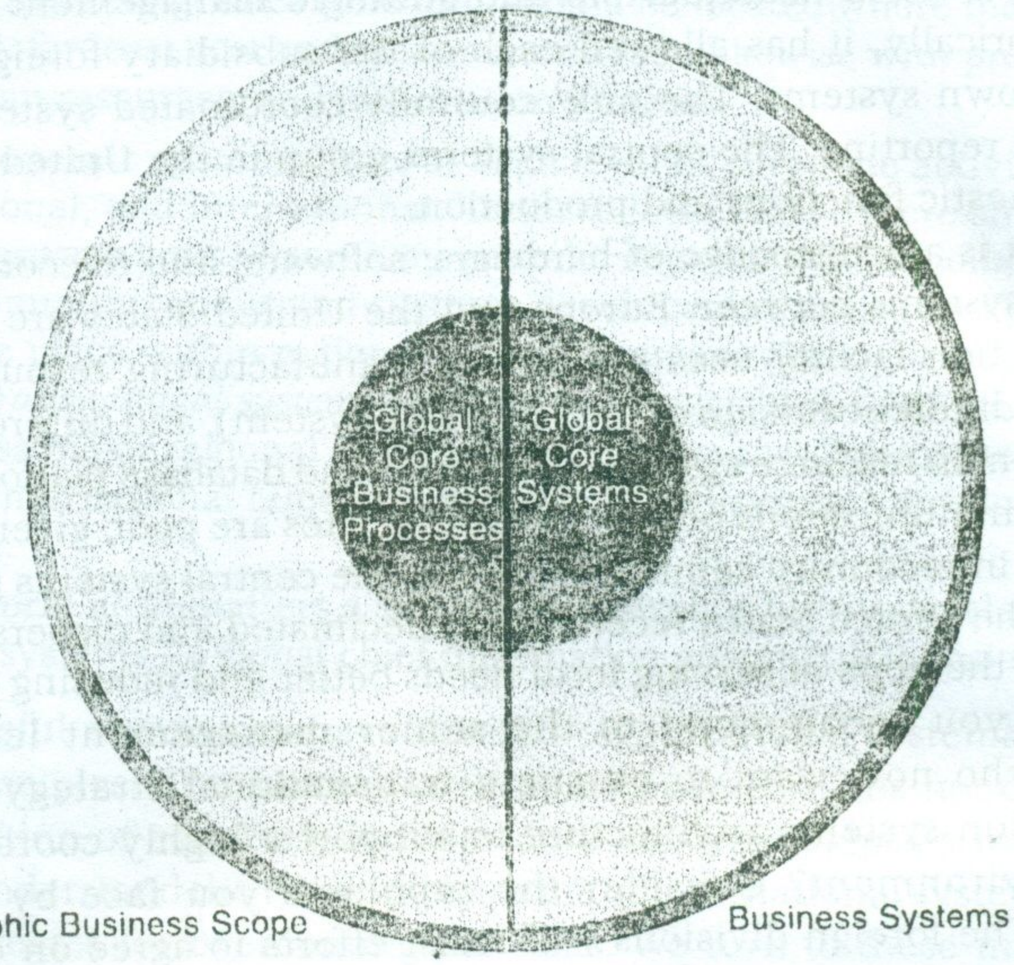
What do you recommend to the senior management leaders of this company, who now want to pursue a transnational strategy and develop an information systems architecture to support a highly coordinated global systems environment? Consider the problems you face by reexamining Table 15.4. The foreign divisions will resist efforts to agree on common user requirements; they have never thought about much other than their own units' needs. The systems groups in American local sites, which have been enlarged recently and told to focus on local needs, will not easily accept guidance from anyone recommending a transnational strategy. It will be difficult to convince local managers anywhere in the world that they should change their business procedures to align with other units in the world, especially if this might interfere with their local performance. After all, local managers are rewarded in this company for meeting local objectives of their division or plant. Finally, it will be difficult to coordinate development of projects around the world in the absence of a powerful telecommunications network and, therefore, difficult to encourage local users to take on ownership in the systems developed.

Figure 15.4 lays out the main dimensions of a solution. First, consider that not all systems should be coordinated on a transnational basis; only some core systems are truly worth sharing from a cost and feasibility point of view. **Core systems** support functions that are absolutely critical to the organization. Other systems should be partially coordinated because they share key elements, but they do not have to be totally common across national boundaries. For such systems, a good deal of local variation is possible and desirable. A final group of systems is peripheral, truly provincial, and needed to suit local requirements only.

Define the Core Business Processes

How do you identify core systems? The first step is to define a short list of critical core business processes. Business processes are defined and described in Chapter 2, which you should review. Briefly, business processes are sets of logically related tasks to produce specific business results, such as shipping out correct orders to customers or delivering innovative products to the market. Each business process typically involves many functional areas, communicating and coordinating work, information, and knowledge.

FIGURE 15.4 LOCAL, REGIONAL, AND GLOBAL SYSTEMS



Agency and other coordination costs increase as the firm moves from local option systems toward regional and global systems. However, transaction costs of participating in global markets probably decrease as firms develop global systems. A sensible strategy is to reduce agency costs by developing only a few core global systems that are vital for global operations, leaving other systems in the hands of regional and local units.

Source: From *Managing Information Technology in Multinational Corporations* by Edward M. Roche, © 1993. Adapted by permission of Prentice Hall, Inc., Upper Saddle River, N.J.

The way to identify these core business processes is to conduct a business process analysis. How are customer orders taken, what happens to them once they are taken, who fills the orders, and how are they shipped to the customers? What about suppliers? Do they have access to manufacturing resource planning systems so that supply is automatic? You should be able to identify and set priorities in a short list of ten business processes that are absolutely critical for the firm.

Next, can you identify centers of excellence for these processes? Is the customer order fulfillment superior in the United States, manufacturing process control superior in Germany, and human resources superior in Asia? You should be able to identify some areas of the company, for some lines of business, where a division or unit stands out in the performance of one or several business functions.

When you understand the business processes of a firm, you can rank-order them. You then can decide which processes should be core applications, centrally coordinated, designed, and implemented around the globe, and which should be regional and local. At the same time, by identifying the critical business processes, the really important ones, you have gone a long way to defining a vision of the future that you should be working toward.

Identify the Core Systems to Coordinate Centrally

By identifying the critical core business processes, you begin to see opportunities for transnational systems. The second strategic step is to conquer the

core systems and define these systems as truly transnational. The financial and political costs of defining and implementing transnational systems are extremely high. Therefore, keep the list to an absolute minimum, letting experience be the guide and erring on the side of minimalism. By dividing off a small group of systems as absolutely critical, you divide opposition to a transnational strategy. At the same time, you can appease those who oppose the central worldwide coordination implied by transnational systems by permitting peripheral systems development to progress unabated, with the exception of some technical platform requirements.

Choose an Approach: Incremental, Grand Design, Evolutionary

A third step is to choose an approach. Avoid piecemeal approaches. These surely will fail for lack of visibility, opposition from all who stand to lose from transnational development, and lack of power to convince senior management that the transnational systems are worth it. Likewise, avoid grand design approaches that try to do everything at once. These also tend to fail, because of an inability to focus resources. Nothing gets done properly, and opposition to organizational change is needlessly strengthened because the effort requires huge resources. An alternative approach is to evolve transnational applications incrementally from existing applications with a precise and clear vision of the transnational capabilities the organization should have in five years. This is sometimes referred to as the "salami strategy," or one slice at a time.

Make the Benefits Clear

What is in it for the company? One of the worst situations to avoid is to build global systems for the sake of building global systems. From the beginning, it is crucial that senior management at headquarters and foreign division managers clearly understand the benefits that will come to the company as well as to individual units. Although each system offers unique benefits to a particular budget, the overall contribution of global systems lies in four areas.

Global systems—truly integrated, distributed, and transnational systems—contribute to superior management and coordination. A simple price tag cannot be put on the value of this contribution, and the benefit will not show up in any capital budgeting model. It is the ability to switch suppliers on a moment's notice from one region to another in a crisis, the ability to move production in response to natural disasters, and the ability to use excess capacity in one region to meet raging demand in another.

A second major contribution is vast improvement in production, operation, and supply and distribution. Imagine a global value chain, with global suppliers and a global distribution network. For the first time, senior managers can locate value-adding activities in regions where they are most economically performed.

Third, global systems mean global customers and global marketing. Fixed costs around the world can be amortized over a much larger customer base. This will unleash new economies of scale at production facilities.

Last, global systems mean the ability to optimize the use of corporate funds over a much larger capital base. This means, for instance, that capital in a surplus region can be moved efficiently to expand production of capital-starved regions; that cash can be managed more effectively within the company and put to use more effectively.

These strategies will not by themselves create global systems. You will have to implement what you strategize.

THE MANAGEMENT SOLUTION: IMPLEMENTATION

We now can reconsider how to handle the most vexing problems facing managers developing the global information systems architectures that were described in Table 15.4.

Agreeing on Common User Requirements

Establishing a short list of the core business processes and core support systems will begin a process of rational comparison across the many divisions of the company, develop a common language for discussing the business, and naturally lead to an understanding of common elements (as well as the unique qualities that must remain local).

Introducing Changes in Business Processes

Your success as a change agent will depend on your legitimacy, your authority, and your ability to involve users in the change design process. **Legitimacy** is defined as the extent to which your authority is accepted on grounds of competence, vision, or other qualities. The selection of a viable change strategy, which we have defined as evolutionary but with a vision, should assist you in convincing others that change is feasible and desirable. Involving people in change, assuring them that change is in the best interests of the company and their local units, is a key tactic.

Coordinating Applications Development

Choice of change strategy is critical for this problem. At the global level there is far too much complexity to attempt a grand design strategy of change. It is far easier to coordinate change by making small incremental steps toward a larger vision. Imagine a five-year plan of action rather than a two-year plan of action, and reduce the set of transnational systems to a bare minimum to reduce coordination costs.

Coordinating Software Releases

Firms can institute procedures to ensure that all operating units convert to new software updates at the same time so that everyone's software is compatible.

Encouraging Local Users to Support Global Systems

The key to this problem is to involve users in the creation of the design without giving up control over the development of the project to parochial interests. The overall tactic for dealing with resistant local units in a transnational company is cooptation. **Cooptation** is defined as bringing the opposition into the process of designing and implementing the solution without giving up control over the direction and nature of the change. As much as possible, raw power should be avoided. Minimally, however, local units must agree on a short list of transnational systems, and raw power may be required to solidify the idea that transnational systems of some sort are truly required.

How should cooptation proceed? Several alternatives are possible. One alternative is to permit each country unit the opportunity to develop one transnational application first in its home territory, and then throughout the world. In this manner, each major country systems group is given a piece of the action in developing a transnational system, and local units feel a sense of ownership in the transnational effort. On the downside, this assumes the ability to develop high-quality systems is widely distributed, and that, a German team, for example, can successfully implement systems in France and Italy. This will not always be the case.

A second tactic is to develop new transnational centers of excellence, or a single center of excellence. There may be several centers around the globe that focus on specific business processes. These centers draw heavily from local national units, are based on multinational teams, and must report to worldwide management. Centers of excellence perform the initial identification and specification of business processes, define the information requirements, perform the business and systems analysis, and accomplish all design and testing. Implementation, however, and pilot testing are rolled out to other parts of the globe. Recruiting a wide range of local groups to transnational centers of excellence helps send the message that all significant groups are involved in the design and will have an influence.

Even with the proper organizational structure and appropriate management choices, it is still possible to stumble over technology issues. Choices of technology platforms, networks, hardware, and software are the final element in building transnational information systems architectures.

15.4 WHAT ARE THE ISSUES AND TECHNICAL ALTERNATIVES TO BE CONSIDERED WHEN DEVELOPING INTERNATIONAL INFORMATION SYSTEMS?

Once firms have defined a global business model and systems strategy, they must select hardware, software, and networking standards along with key system applications to support global business processes. Hardware, software, and networking pose special technical challenges in an international setting.

One major challenge is finding some way to standardize a global computing platform when there is so much variation from operating unit to operating unit and from country to country. Another major challenge is finding specific software applications that are user friendly and that truly enhance the productivity of international work teams. The universal acceptance of the Internet around the globe has greatly reduced networking problems. But the mere presence of the Internet does not guarantee that information will flow seamlessly throughout the global organization because not all business units use the same applications, and the quality of Internet service can be highly variable (just as with the telephone service). For instance, German business units may use an open source collaboration tool to share documents and communicate, which is incompatible with American headquarters teams, which use Microsoft solutions. Overcoming these challenges requires systems integration and connectivity on a global basis.

COMPUTING PLATFORMS AND SYSTEMS INTEGRATION

The development of a transnational information systems architecture based on the concept of core systems raises questions about how the new core systems will fit in with the existing suite of applications developed around the globe by different divisions, different people, and for different kinds of computing hardware. The goal is to develop global, distributed, and integrated systems to support digital business processes spanning national boundaries. Briefly, these are the same problems faced by any large domestic systems development effort. However, the problems are magnified in an international environment. Just imagine the challenge of integrating systems based on the Windows,

Linux, Unix, or proprietary operating systems running on IBM, Sun, HP, and other hardware in many different operating units in many different countries!

Moreover, having all sites use the same hardware and operating system does not guarantee integration. Some central authority in the firm must establish data standards, as well as other technical standards with which sites are to comply. For instance, technical accounting terms such as the beginning and end of the fiscal year must be standardized (review the earlier discussion of the cultural challenges to building global businesses), as well as the acceptable interfaces between systems, communication speeds and architectures, and network software.

CONNECTIVITY

Truly integrated global systems must have connectivity—the ability to link together the systems and people of a global firm into a single integrated network just like the phone system but capable of voice, data, and image transmissions. The Internet has provided an enormously powerful foundation for providing connectivity among the dispersed units of global firms. However, many issues remain. The public Internet does not guarantee any level of service (even in the United States). Few global corporations trust the security of the Internet and generally use private networks to communicate sensitive data, and Internet virtual private networks (VPNs) for communications that require less security. Not all countries support even basic Internet service that requires obtaining reliable circuits, coordinating among different carriers and the regional telecommunications authority, and obtaining standard agreements for the level of telecommunications service provided. Table 15.5 lists the major challenges posed by international networks.

While private networks have guaranteed service levels and better security than the Internet, the Internet is the primary foundation for global corporate networks when lower security and service levels are acceptable. Companies can create global intranets for internal communication or extranets to exchange information more rapidly with business partners in their supply chains. They can use the public Internet to create global networks using VPNs from Internet service providers, which provide many features of a private network using the public Internet (see Chapter 7). However, VPNs may not provide the same level of quick and predictable response as private networks, especially during times

TABLE 15.5 CHALLENGES OF INTERNATIONAL NETWORKS

Quality of service
Security
Costs and tariffs
Network management
Installation delays
Poor quality of international service
Regulatory constraints
Network capacity

of the day when Internet traffic is very congested, and they may not be able to support large numbers of remote users.

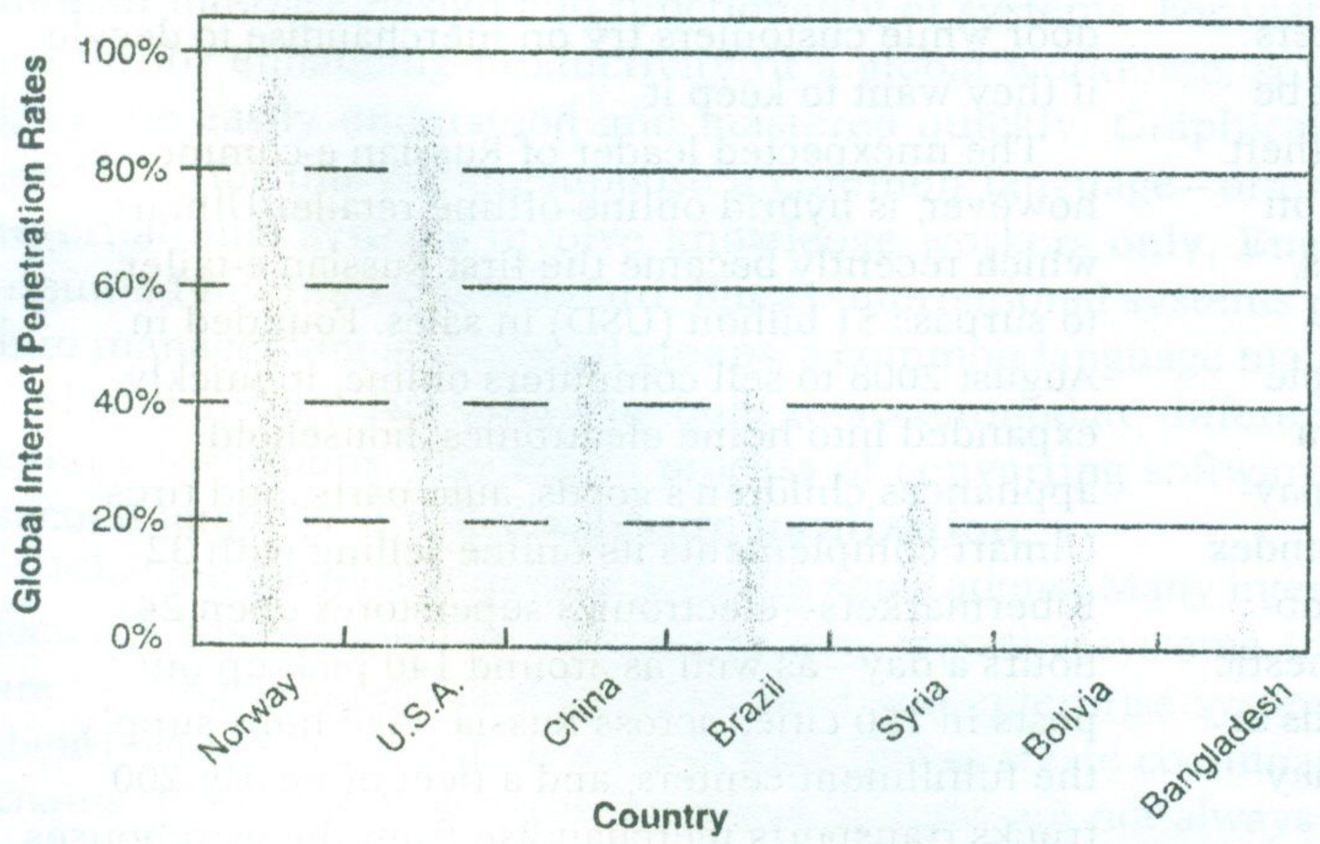
The high cost of PCs, and low incomes, limit access to Internet service in many developing countries (see Figure 15.5). Where an Internet infrastructure exists in less-developed countries, it often lacks bandwidth capacity, and is unreliable in part due to power grid issues. The purchasing power of most people in developing countries makes access to Internet services very expensive in local currencies. In the case of Russia, uneven Internet service and an undeveloped infrastructure for distributing and paying for goods has hampered the growth of e-commerce (see the Interactive Session on Organizations).

In addition, many countries monitor transmissions (see the Interactive Session on Management). Governments in China, Singapore, Iran, and Saudi Arabia monitor Internet traffic and block access to Web sites considered morally or politically offensive. On the other hand, the rate of growth in the Internet population is far faster in Asia, Africa, and the Middle East than in North America and Europe, where the Internet population is growing slowly if at all. Therefore, in the future, Internet connectivity will be much more widely available and reliable in less-developed regions of the world, and it will play a significant role in integrating these economies with the world economy.

SOFTWARE LOCALIZATION

The development of core systems poses unique challenges for application software: How will the old systems interface with the new? Entirely new interfaces must be built and tested if old systems are kept in local areas (which is common). These interfaces can be costly and messy to build. If new software must be created, another challenge is to build software that can be realistically used by multiple business units from different countries given that business units are accustomed to their unique business processes and definitions of data.

FIGURE 15.5 INTERNET POPULATION IN SELECTED COUNTRIES



The percentage of the total population using the Internet in developing countries is much smaller than in the United States and Europe, but it is growing rapidly.

Source: Based on data from Internerworldstats.com, 2014, Pew Global Attitudes Project, 2014 and authors.

E-COMMERCE RUSSIAN-STYLE

Nearly 63.6 million Russians have Internet access, making Russia the second-largest e-commerce market in all of Europe, behind only Germany. By the end of 2014, Russia will surpass Germany with an estimated 80 million users. Broadband reach is estimated at 40 percent of all households—around 20 million households. Still, only a scant 24 to 26 million—about 38 percent to 40 percent of Internet users—have made an online purchase through 2013 and e-commerce accounts for only 2 percent of Russian retail sales. Why? What's holding e-commerce back?

Russia has expanded its online consumer base faster than any other country, but there are serious barriers to further growth. Russia lacks both logistics infrastructures and online payment systems for e-commerce to flourish. The postal system is both expensive and unreliable, with lost or stolen packages, excessive delivery time, and non-distributed parcel rates of up to 100 percent in remote areas. Cash is the predominant payment method due to an under-developed financial services sector, exorbitant bank charges, and lack of consumer trust in electronic payments. Pre-authorization is often required for card use, merchants lack the infrastructure to store card data, and fraud poses a significant threat to merchants. Combined with the prohibitively expensive investment required to deploy fiber connections across the vast expanses of Russian terrain, the impediments to e-commerce expansion are substantial.

Russian online consumers by and large pay cash-on-delivery (COD) at "pick-up stores" where they collect their purchases. The collection centers accumulate large quantities of cash, which must be deposited every few hours to reduce the risk of theft. A system of payment kiosks has also sprung up on street corners, and in grocery stores, small shops, and convenience stores. These kiosks also serve as bill payment centers and often include multiple terminals from different companies, fashioning a comprehensive payment island. Several online payment systems have been developed including Yandex Money and WebMoney. These e-wallets, often subject to daily transaction limits, are linked to domestic bank accounts or debit cards or loaded with funds at the kiosks or offline stores. Though Yandex Money has signed up 20,000 merchants and 14 million consumers, and WebMoney 2,200 merchants and 6 million users, 80 percent of all B2C e-commerce in Russia is still conducted in cash.

Russian e-commerce is developing, but at a slower pace than Western markets. Half of habitual e-commerce consumers only began shopping online in the last two years. Card and online payment systems are gaining acceptance for digital goods (software, e-books, and digital music) and travel purchases such as airline tickets and hotel reservations. Shoppers have entered the online sphere for these products as well as for books, and are expanding to electronics, computers, and home appliances, and then jewelry, cosmetics, clothing, and shoes.

Online shopping mall Ozon began in 1998 as an online bookstore but now stocks well over 2 million items. Ozon adopted a multi-pronged strategy to combat Russia's market challenges. In the short-term, it accepted customer preference for COD in order to build trust, expand its customer base, and establish market position. Its delivery service (O'Courier) and 2,100 pick-up centers serve 350 cities throughout Russia and Kazakhstan. This logistics network dwarfs those of its competitors.

Another domestic leader, KupiVIP, has also succeeded largely because it built its own logistics network including multiple warehouses and a fleet of delivery trucks. Centered on its original high-fashion flash sales site, KupiVIP (kupi means buy in Russian) now includes nine white-label sites and ShopTime, a full-priced fashion site. KupiVIP's delivery drivers to double as customer service reps. In addition to collecting COD payments and merchandise for return, they will even wait at the door while customers try on merchandise to decide if they want to keep it.

The unexpected leader of Russian e-commerce, however, is hybrid online-offline retailer Ulmart, which recently became the first Russian e-tailer to surpass $1 billion (USD) in sales. Founded in August 2008 to sell computers online, it quickly expanded into home electronics, household appliances children's goods, auto parts, and tires. Ulmart complements its online selling with 32 Kibermarkets—electronics superstores open 24 hours a day—as well as around 140 pick-up outposts in 150 cities across Russia. Five hubs supply the fulfillment centers, and a fleet of nearly 200 trucks transports merchandise from the warehouses to the outposts and makes home deliveries. Floor space that would traditionally be taken up with row after row of product is instead used for computer

terminals and giant state-of-the-art touch screens that serve as virtual display cases. Customers browse and choose products from a virtual catalog, use cash, credit cards, or Yandex Money at a payment zone terminal, and proceed to a comfy waiting zone accoutered with couches and tables for a 15-minute or less wait for their purchases. Ulmart is also at the forefront of Russian m-commerce, building a new Web site for smartphones, even while continuing to support 24-hour call centers.

Ulmart's conspicuous vulnerability is its neglect of the nearly 88 percent of Russia's landmass that lies beyond the reach of its logistics network. To reach these customers, Ulmart must rely on the government-owned Russian Post. Pochta Rossii, still struggles to transport goods between Ulmart's St. Petersburg headquarters and Moscow (400 miles) in less than two weeks, let alone service Novosibirsk, Russia's third most populous city and most populous in Asian Russia, nearly 1,750 miles away.

Russian e-commerce is dominated by a handful of these large companies. Most medium and small domestic retailers have yet to establish an Internet presence. EBay has launched a Russian language site and Amazon is in the process of building one, but their presence is overshadowed by Russian firms, which control 90 percent of the market.

Sources: "Broadband Internet penetration in Russia," themoscownews.com, April 4, 2014;Diane Brady, "Russia's Online Retail Leader Says 'Amazon Has No Chance," Bloomberg Businessweek, February 27, 2014; MaelleGavet, "The CEO of Ozon on Building an e-Commerce Giant in a Cash-Only Economy, " Harvard Business Review (July-August 2014);Ben Hopkins, "The 'good times' could be over for foreign retailers in Russia," rusbase.com, January 29, 2014; James Marson, "At E-Commerce Firms, Russia Rises," by James Marson, Wall Street Journal, Nov. 12, 2013; Juho, "Is E-commerce in Russia Exploding?" magentaadvisory.com, February 4, 2014; "Insight: Online Payment Preferences: Russia," cybersource.com, 2013; Alexi Moskin, "Ulmart and the Benefits of Hybrid Shopping," The St. Petersburg Times, August 14, 2013; "Expansion Ahead for Russian E-commerce," The Moscow News, August 29, 2013;and OlenaSikorska, "E-commerce in Russia: Trends, Problems and Winning Local Players," digitalintheround.com, December 3, 2013.

1. Describe the technical and organizational obstacles to e-commerce growth in Russia.
2. How do these technical and organizational factors hamper companies from doing business in Russia or setting up Russian e-commerce sites?
3. Will non-Russian companies like Amazon.com and eBay flourish in Russia? Explain.

Aside from integrating the new with the old systems, there are problems of human interface design and functionality of systems. For instance, to be truly useful for enhancing productivity of a global workforce, software interfaces must be easily understood and mastered quickly. Graphical user interfaces are ideal for this but presuppose a common language--often English. When international systems involve knowledge workers only, English may be the assumed international standard. But as international systems penetrate deeper into management and clerical groups, a common language may not be assumed and human interfaces must be built to accommodate different languages and even conventions. The entire process of converting software to operate in a second language is called **software localization**.

What are the most important software applications? Many international systems focus on basic transaction and management reporting systems. Increasingly, firms are turning to supply chain management and enterprise systems to standardize their business processes on a global basis and to create coordinated global supply chains. However, these cross-functional systems are not always compatible with differences in languages, cultural heritages, and business processes in other countries (Martinons, 2004; Liang et al., 2004; Accenture, 2014). Company units in countries that are not technically sophisticated may also encounter problems trying to manage the technical complexities of enterprise applications.

INTERACTIVE SESSION: MANAGEMENT

SOUTH KOREA'S RESTRICTED INTERNET

At an average speed of 17 MBPs, South Korea boasts the highest average Internet speed in the world and tops the world on speed for the price. All large office and apartment buildings are equipped with fiber-optic broadband and a $24 billion high-speed backbone links public institutions and government facilities. This country's population also boasts a high level of Internet usage: 97 percent of South Koreans have high-speed Internet access at home and subway riders in Seoul enjoy free access on their smartphones. By the end of 2014, Koreans will have access to 1GB per second connections, 200 times faster than the average household connection in the United States.

The paradox is that this flourishing tech-savvy democracy, which enjoys broad constitutional freedoms, is also among the most Internet-regulated countries in the world. South Korea's 1995 Electronic Communication Business Law granted wide latitude to the Information and Communications Ethics Office to block material deemed morally offensive or harmful to South Korean youth. Political speech, particularly relating to longtime foe North Korea, was, and still is, rigorously controlled. North Korean URLs have been off-limits and online support for North Korea could be grounds for investigation, detention, and revocation of Internet access.

The Internet Content Filtering Ordinance, enacted by the Ministry of Information and Communication (MIC) in 2001, required ISPs to block a specific list of Web sites. Schools and public libraries were required to provide access but had to install filtering software. Web sites are ostensibly self-monitoring based on a content ratings system administered today by the Korean Communications Standards Commission (KCSC). However, if MIC orders a site to classify itself as "indecent," failure to block access to minors can result in fines or imprisonment.

The Internet Content Filtering Ordinance also recommended a verifiable real-name registration system that would require all users who posted comments or uploaded content to have an account that included their Resident Registration Number (RRN). In 2003, MIC asked the four major Web portals to develop such a system. These actions were sold to the public as necessary to curb abusive behavior and cyber-bullying, particularly following a number of high-profile celebrity suicides.

One of the largest sites affected was Google-owned YouTube, which chose to block South Korean users from uploading content rather than collect RRNs. The system was easily thwarted, however, by simply changing the location setting for an account to Worldwide. Press reports even indicated that the YouTube channel for the presidential office used this simple ploy.

While pressure from citizens' groups and court challenges have rolled back some restrictions, the threat of criminal liability has fostered a culture of fear and self-censorship. ISPs are ultimately held responsible if inappropriate—immoral, violent, obscene, speculative, or antisocial—content is found on their networks. RRNs must still be proffered for adults to access online games at night because curfews bar minors. Mobile service providers do not yet know if the ruling exempts them from collecting RRNs, and there have been several high-profile prosecutions involving online postings on Twitter and Facebook. Searching the Internet is often unproductive because Web sites prohibit search engines from indexing their pages.

Google is also finding South Korea a challenging environment for Google Maps. The National Security Law (NSL), the basis for censoring Web sites with North Korean content, also prohibits the export of map data to safeguard infrastructure details. For travelers, and the companies that want to profit from helping them navigate, this has presented a challenge. Directions from airports to area hotels can only be divined for mass transit, thanks to publically available routes and schedules.

President Park Geun-hye has expressed willingness to ease regulations for foreign competition. A division of the Ministry of Land, Infrastructure, and Transport will release an English-language digital map in 2014. However, points of interest, pedestrian overpasses, bicycle lanes, and details of intersections will still not be available. What's more, without domestic servers, Google will not be able to provide the level of detail of local rivals such as Naver—which only serves Korean-language users. Driving directions, traffic data, and building floor plans must be processed at Google's servers outside of South Korea, subjecting them to export restrictions.

Even in this game-obsessed nation, home to half the world's professional gamers, who are often

celebrities netting six-figure contracts, game developers must contend not only with the nighttime curfew for minors but also with the Game Rating Board (GRB). The GRB can ban any game, though its focus has been graphically violent games such as Grand Theft Auto III. The already lengthy approval process increases development costs for mobile games and discourages young entrepreneurs. Domestic companies such as Nexon Co. and NCSoft Corp. are competitively disadvantaged globally, and global companies such as Apple and Google have decided not to enter the Korean market.

If President Park is serious about developing the high-tech software and services sector to match South Korea's success in hardware—Samsung and LG, for example—she must perform a balancing act. Elimination of online restrictions must be balanced with rational national security objectives. Safeguarding citizens must be balanced against disadvantaging domestic operators whose users will simply switch to foreign competitors. Conversely, leveling the playing field so that domestic operators are not advantaged—and are pushed to develop world-class service—must be balanced against the threat that foreign competitors (such as Google) could squash domestic competition.

South Korea's dilemma illustrates the struggle all organizations face to balance competing interests. The South Korean government must decide how its cultural mores and national security concerns can coexist with its economic development goals. For both foreign and domestic companies trying to do business in South Korea, government control of information can create a challenging and even hostile environment.

Sources: Peng HwaAng, "How Countries Are Regulating Internet Content," Peng HwaAng, isoc.org, 1997, accessed January 30, 2014; Bhavesh Patel, "Global Internet Usage Statistics 2013," slideshare.net, August 28, 2013; "South Korea: Perspectives on Chinese New Net Control Laws," Global Voice Advocacy, advocacy.globalvoicesonline.org, January 1, 2013; Eric Pfanner, "Google Jousts With Wired South Korea Over Quirky Internet Rules," *New York Times*, October 13, 2013; "South Korea," Open Net Initiative, opennet.net, August 6, 2012; Evan Ramstad, "South Korea Court Knocks Down Online Real-Name Rule," *Wall Street Journal*, August. 24, 2012; "Censorship in South Korea: Game Over," *The Economist*, April 14, 2011; and "Internet Censorship in South Korea," Internet Business Law Services, ibls.com, January 8, 2010.

CASE STUDY QUESTIONS

1. Why is the Internet restricted in South Korea?
2. What are the implications of South Korea's Internet restrictions for international companies doing business in South Korea?
3. What management, organization, and technology factors should be taken into account when developing an e-commerce presence for the South Korean market?

Electronic Data Interchange (EDI) systems and supply chain management systems are widely used by manufacturing and distribution firms to connect to suppliers on a global basis. Collaboration systems, e-mail, and videoconferencing are especially important worldwide collaboration tools for knowledge- and data-based firms, such as advertising firms, research-based firms in medicine and engineering, and graphics and publishing firms. Internet-based tools will be increasingly employed for such purposes.

Review Summary

1. *What major factors are driving the internationalization of business?*

The growth of inexpensive international communication and transportation has created a world culture with stable expectations or norms. Political stability and a growing global knowledge base that is widely shared also contribute to the world culture. These general factors create the conditions for global markets, global production, coordination, distribution, and global economies of scale.

2. *What are the alternative strategies for developing global businesses?*

There are four basic international strategies: domestic exporter, multinational, franchiser, and transnational. In a transnational strategy, all factors of production are coordinated on a global scale. However, the choice of strategy is a function of the type of business and product.

There is a connection between firm strategy and information systems design. Transnational firms must develop networked system configurations and permit considerable decentralization of development and operations. Franchisers almost always duplicate systems across many countries and use centralized financial controls. Multinationals typically rely on decentralized independence among foreign units with some movement toward development of networks. Domestic exporters typically are centralized in domestic headquarters with some decentralized operations permitted.

3. *What are the challenges posed by global information systems and management solutions for these challenges?*

Global information systems pose challenges because cultural, political, and language diversity magnifies differences in organizational culture and business processes and encourages proliferation of disparate local information systems that are difficult to integrate. Typically, international systems have evolved without a conscious plan. The remedy is to define a small subset of core business processes and focus on building systems to support these processes. Tactically, managers will have to coopt widely dispersed foreign units to participate in the development and operation of these systems, being careful to maintain overall control.

4. *What are the issues and technical alternatives to be considered when developing international information systems?*

Implementing a global system requires an implementation strategy that considers both business design and technology platforms. The main hardware and telecommunications issues are systems integration and connectivity. The choices for integration are to go either with a proprietary architecture or with open systems technology. Global networks are extremely difficult to build and operate. Firms can build their own global networks or they can create global networks based on the Internet (intranets or virtual private networks). The main software issues concern building interfaces to existing systems and selecting applications that can work with multiple cultural, language, and organizational frameworks.

Key Terms

Business driver, 610
Cooptation, 622
Core systems, 619
Domestic exporter, 615
Franchisers, 616
Global culture, 611
International information systems architecture, 610
Legitimacy, 622
Multinational, 616
Particularism, 613
Software localization, 627
Transborder data flow, 614
Transnational, 616

MyMISLab

Go to **mymislab.com** to complete the problems marked with this icon .

Review Questions

15-1 What major factors are driving the internationalization of business?

- List and describe the five major dimensions for developing an international information systems architecture.
- Describe the five general cultural factors leading toward growth in global business and the four specific business factors. Describe the interconnection among these factors.

- Explain why different cultures across the world represent a challenge to global systems.
- Explain why some firms have not planned for the development of international systems.

15-2 What are the alternative strategies for developing global businesses?

- Describe the four main strategies for global business and organizational structure.
- How should a firm organize itself for doing business on an international scale?

15-3 What are the challenges posed by global information systems and management solutions for these challenges?

- List and describe the major management issues in developing international systems.
- Identify and describe three principles to follow when organizing the firm for global business.
- Identify and describe three steps of a management strategy for developing and implementing global systems.
- List and define the most difficult problems facing managers who are attempting to implement a global system.

15-4 What are the issues and technical alternatives to be considered when developing international information systems?

- Describe the main technical issues facing global systems.
- Explain why connectivity is a major issue facing the development of global systems.

Discussion Questions

15-5 If you were a manager in a company that operates franchises in many countries, what global systems strategy would you use recommend for global systems?

15-6 Explain why software localization is an important aspect of building global information systems, and why achieving localization is so difficult.

Hands-On MIS Projects

The projects in this section give you hands-on experience conducting international market research, analyzing international systems issues for an expanding business, and building a job posting database and Web page for an international company.

Management Decision Problems

15-7 United Parcel Service (UPS) has been expanding its package delivery and logistics services in China, serving both multinational companies and local businesses. UPS drivers in China need to use UPS systems and tools such as its handheld Driver Information and Delivery Acquisition Device for capturing package delivery data. UPS wants to make its WorldShip, CampusShip, and other shipping-management services accessible to Chinese and multinational customers via the Web. What are some of the international systems issues UPS must consider in order to operate successfully in China?

15-8 Your company manufactures and sells tennis rackets and would like to start selling outside the United States. You are in charge of developing a global Web strategy and the first countries you are thinking of targeting are Brazil, China, Germany, Italy, and Japan. Using the statistics in the CIA World Factbook, which of these countries would you target first? What criteria did you use? What other considerations should you address in your Web strategy? What features would you put on your Web site to attract buyers from the countries you target?

Achieving Operational Excellence: Building a Job Database and Web Page for an International Consulting Firm

Software skills: Database and Web page design
Business skills: Human resources internal job postings

15-9 Companies with many overseas locations need a way to inform employees about available job openings in these locations. In this project you'll use database software to design a database for posting internal job openings and a Web page for displaying this information.

KTP Consulting operates in various locations around the world. KTP specializes in designing, developing, and implementing enterprise systems for medium- to large-size companies. KTP offers its employees opportunities to travel, live, and work in various locations throughout the United States, Europe, and Asia. The firm's human resources department has a simple database that enables its staff to track job vacancies. When an employee is interested in relocating, she or he contacts the human resources department for a list of KTP job vacancies. KTP also posts its employment opportunities on the company Web site.

What type of data should be included in the KTP job vacancies database? What information should not be included in this database? Based on your answers to these questions, build a job vacancies database for KTP. Populate the database with at least 20 records. You should also build a simple Web page that incorporates job vacancy data from your newly created database. Submit a copy of the KTP database and Web page to your professor.

Improving Decision Making: Conducting International Marketing and Pricing Research

Software skills: Internet-based software
Business skills: International pricing and marketing

15-10 In this project you'll use the Web to research overseas distributors and customs regulations and use Internet-based software to calculate prices in foreign currencies.

You are in charge of marketing for a U.S. manufacturer of office furniture that has decided to enter the international market. You have been given the name of Sorin SRL, a major Italian office furniture retailer, but your source had no other information. You want to test the market by contacting this firm to offer it a specific desk chair that you have to sell at about $125. Using the Web, locate the information needed to contact this firm and to find out how many European euros you would need to get for the chair in the current market. One source for locating European companies is the Europages Business Directory. In addition, consider using the Universal Currency Converter Web site, which determines the value of one currency expressed in other currencies. Obtain both the information needed to contact the firm and the price of your chair in their local currency. Then locate and obtain customs and legal restrictions on the products you will export from the United States and import into Italy. Finally, locate a company that will represent you as a customs agent and gather information on shipping costs.

Collaboration and Teamwork Project

15-11 In MyMISLab, you will find a Collaboration and Teamwork Project dealing with the concepts in this chapter. You will be able to use Google Drive, Google Docs, Google Sites, Google+, or other open source collaboration tools to complete the assignment.

Unilever's Push Toward Unified Global Systems

CASE STUDY

Palm oil was the driving force behind the 1929 merger that created what is today the third largest consumer goods company in the world behind Proctor Gamble and Nestlé. What may have seemed an odd marriage between British soap maker, Lever Brothers, and Dutch margarine producer, Margarine Unie, provided new company, Unilever, unprecedented purchasing power for the primary raw material of both products. Today Unilever focuses on 14 brands, each netting more than €1 billion annually including laundry soap Surf (Omo), soap, shower gel, shampoo and conditioner brands Lux, Dove, and Sunsilk, and deodorant and personal care brands Axe (Lynx) and Rexona, also sold as Sure, Degree, Shield, and Rexena. On the edible side, top sellers include ice cream brands Magnum and Heartbrand, margarine brands Becel (Flora/Promise/Fruit d'Or) and Rama, mayonnaise brands Hellmann's and Best Foods, and soup, seasonings, and tea brands Lipton and Knorr. All told, the Anglo-Dutch multinational boasts over 400 brands, sells its products in over 190 countries, and employs more than 175, 000 people worldwide.

Unilever is organized as two separate holding companies: Unilever PLC (public limited company), headquartered in London, United Kingdom, and Unilever N.V., headquartered in Rotterdam, The Netherlands. The two legal divisions operate as nearly as possible to a single economic entity—The Unilever Group—with unity of management, operations, purpose, and mission.

Since 2009, when Dutchman Paul Polman took the reins as CEO, The Unilever Group has made sustainable living the core goal of its business model. Using the inputs common to all major packaged goods manufacturers—brands, people, and operations—Unilever's Compass strategy focuses on using cost leveraging and cost efficiencies, innovation in marketing and marketing investment, and profitable volume growth to yield sustained growth, lowered environmental impact, and positive social impact.

By 2010, a 10 year plan quantified the goals: to double sales from €40 billion to €80 billion, halve its environmental footprint, reach 4 billion of the world's estimated 9 billion 2020 citizens, bring safe drinking water to 500 million people, source 100 percent of its raw materials sustainably, and improve the lives of 500,000 small farmers and distributors by bringing them into its supply chain. Given the reality of climate change and the growing scarcity of water and other natural resources, Polman believes viable business models for the 21st century must include strategies for maximizing social and environmental returns along with profits and investor returns.

In order to grow its business in developing and emerging markets, Unilever needed to unify its core business processes, including supply chain management. Standardized processes were essential to effectively manage volatile prices and changing commodity supplies. However, ambitious company-wide goal setting such as this was not feasible prior to 2007. At that point, almost every business in each of the more than 190 countries in which Unilever operated functioned as an independent division. Approximately 30,000 transactions per minute, including every order received, invoice issued, material produced, and product shipped were processed through 250 different enterprise resource planning (ERP) systems.

Unilever's Global ERP Vice President Marc Bechet has pointed out that the company's worldwide business runs on ERP systems. Every transaction for each order it receives, material it produces, item it ships, and invoice it issues runs through Unilever's backbone ERP systems. Trying to run a global business that was doubling its transaction volume with 250 systems proved too challenging.

Instead of adding layers of IT infrastructure to prepare for rapid business growth, Unilever's globalization strategy involved the exact opposite action. For the past two decades, Unilever has been consolidating and simplifying its technology platform so that it would support the company operating as a single global entity. Unilever transitioned to running its worldwide business on only four instances of SAP ERP, with the ultimate goal of managing these landscapes as one global platform by 2015.

By 2008, the rollout of the Western European regional SAP ERP system was complete with three more regional centers to come. North America was online by the beginning of 2012. Return on this investment was already notable by 2013. IT research and advisory firm, Gartner ranked Unilever fourth on its Supply Chain Top 25 list, and revenue had increased €10 billion, already one quarter of the way towards its 2020 goal.

With transactions slated to reach the 60,000 per minute range, Unilever was still investigating additional tools to increase transaction processing speed. To remain a leader in modern demand-driven supply chain management, Unilever began adding SAP HANA (High-Performance Analytic Appliance) software to some of its key SAP ERP applications at the end of 2012. HANA is an in-memory data platform (see Chapter 6) that is deployable as an on-premise appliance, or in the cloud. It is very well suited for performing real-time analytics and processing extremely large numbers of transactions very rapidly.

One of Unilever's first projects was implementing SAP CO-PA (Controlling-Profitability Analysis) Accelerator powered by SAP HANA. The enhanced financial analysis software reduced the number of days to produce the month-end close from three to just one. This experience was valuable for Unilever on several levels. It allowed the company to start with a single critical business process that could easily be rolled back into a traditional database if necessary, gain experience, and lay the groundwork for future HANA implementations. The success of this project and its enthusiastic embrace by end users convinced Unilever that other business processes could indeed benefit from the addition of the SAP HANA in-memory computing platform.

The second tangible benefit was the ability to input raw material costs and quickly calculate product price. Understanding its margins--the percent profit after all costs have been deducted--enabled Unilever to analyze ways to improve them. Production cost analysis confirmed for Unilever that HANA's ability to accelerate business processes was well worth the investment, substantially improving real-time decision making.

Unilever's Enterprise Data Warehouse (EDW) system extracts, transforms, and integrates ERP transaction data with external data for use in reporting and data analysis. The next target of the SAP HANA initiative was to accelerate, simplify, and harmonize all ERP transaction systems so that the data being fed into its global EDW was of the highest quality possible. Valuable business insights depend on real-time analysis of accurate data. The profitability analysis accelerator analyzes reams of financial data and outputs valuable statistics about cost and profit drivers. By mid-2013, the SAP CO-PA Accelerator had been added to all four regional ERP centers over a 16 week timeframe and was being managed as a single global platform. Each region now runs a 27 terabyte relational database using 30 gigabytes of HANA in-memory system. Two hundre million records are now processed in 30 seconds, down from 440.

Cost Center assessment time was reduced 39 percent, pushing this data into CO-PA in 6.7 hours rather than 11 hours and speeding profitability reporting. Overall, controlling and profitability reports were produced ten times more quickly. The Material Ledger Accelerator reduced runtime for period-end closing reports by 66 percent, and cost reduction opportunities were identified by the Overall Equipment Effectiveness (OEE) Management platform. Four and a half billion records for General Ledger line items and over 400 million controlling and profitability analysis records are now run through the CO-PA Accelerator.

Next, SAP Cash Forecasting was added to SAP ERP Financials to minimize liquidity risk and maximize the use of working capital and cash. Product Cost Planning (CO-PC-PCP) was incorporated to help Unilever plan the costs for materials independently from orders; set prices for materials, operations, production lines, and processes; analyze the costs of manufactured materials; and assess product profitability. The time to analyze the approximately 150 million records produced each month was halved, and product cost forecasts could be generated in 30 seconds, down from seven minutes.

On the macro level, the SAP HANA initiative transformed Unilever's attitude towards IT. Until HANA, IT pushed solutions to functions in need of modernization. Now, optimized functions pinpoint business opportunities and stakeholders ripe for HANA solutions. Unilever's Global Director of Finance Thomas Benthien believes this swing from push to pull is a driver for innovation and a growth agenda. Proofs of concept (prototypes used for feasibility testing) were conducted to add the HANA in-memory platform to many components of Unilever's SAP Business Suite, including the SCM (Supply Chain Management) application. Other tests involved components of the Enterprise Performance Management (EPM) system, SAP Advanced Planning & Optimization (APO), SAP Business Planning and Consolidation, and SAP Trade Promotion Management.

Unilever wanted to maximize product availability on store shelves during new product launches and promotional campaigns. Since trade promotion processes drive a significant portion of its sales, Marc Béchet wanted to enhance the speed and efficiency with which they could be planned, budgeted, and executed and in how stock was allocated. Previously, Unilever used a process in

which stock was sequentially assigned to orders as they were received. There was no mechanism for assigning limited stock between customers running a promotion and those who were not. Using HANA-accelerated trade promotion management tools, different inventory matching scenarios are instantly available. Allocation options can be compared and the most profitable chosen. Inventory shortfalls can be handled while safeguarding current promotions to the maximum extent possible.

Plans are now underway to add in-memory technology to the rest of the SAP Business Suite. SAP released the first version of SAP Business Suite powered by HANA in January 2013. Unilever is weighing its options so that the risk of adoption to one of the largest SAP ERP systems in the industry is minimized, but it is likely to switch to the newest product before 2015.

By significantly cutting the time it takes to calculate product costs, the HANA in-memory database accelerators fast-track raw material sourcing decisions and pricing analysis. Unilever estimates that time spent tracking raw materials has declined by 80 percent. Improved understanding of the supply chain, in turn, supports managerial decision-making to both improve efficiency and reduce environmental impact. Without the analytics solution it devised and implemented, Unilever would have had a difficult time tracking the 10,000 home and personal care products that use the 2,000 different chemicals that must be reduced to meet the European Union's REACH (Registration, Evaluation, Authorization and Restriction of Chemicals) regulations and its own more stringent sustainability goals. Consolidation of its ERP platforms and the transaction and processing speed of the HANA platform are the keys to improved performance, reporting, and scalability that will enable Unilever to fulfill its ambitious growth, social impact, and environmental goals.

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CASE STUDY QUESTIONS

15-12 What management problems typical of global systems was Unilever experiencing? What management, organization, and technology factors were responsible for those problems?

15-13 How did Unilever's new systems and use of SAP HANA support its business strategy? How effective was the solution chosen by the company?

15-14 How did Unilever's new systems improve operations and management decision-making?

15-15 What influence does the global business environment have on firms like Unilever and how does that affect its choice of systems?

MIS

Go to **mymislab.com** for the following Assisted-graded writing questions:

15-16 Identify and describe solutions to the five management challenges of developing global systems.

15-17 Identify and describe five problems of international networks that prevent companies from developing effective global systems.

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