As demonstrated in several of the preceding chapters, information technologies can revolutionize how organizations do business. Two aspects of such a revolution are the subject of this chapter: strategic information systems, and systems that support or provide for business reorganization. The first part of the chapter deals with strategic information systems, which are primarily used to seize the opportunities created by technological innovations and changing market conditions. Such systems are also used to increase competitiveness and effectiveness by solving organizational problems and by smoothing operations. The second part of the chapter deals with the need for organizations to fundamentally change how they are doing business, primarily in order to adjust to the changing business environment. Such changes also help organizations seize opportunities and solve major business problems.

What is unique to both types of systems is the strategic, long-range organizational impact of a magnitude much larger than that of operational and tactical/managerial systems described in earlier chapters. This magnitude can be so large that a failing system may force organizations to go out of business, whereas successful systems may place a company in a leading position in its industry, as the opening case of British Airways illustrates.

CHAPTER PREVIEW

13.1 Strategic Advantage and Information Technology
13.2 Porter’s Competitive Forces Model and IT
13.3 Strategic Information Systems: Some Examples
13.4 Ineffective Organizations in the Information Age
13.5 Business Process Reengineering
13.6 Virtual Corporations and Information Technology

LEARNING OBJECTIVES

1. Describe strategic information systems and explain their advantages.
2. Describe Porter’s competitive forces model and how IT improves competitiveness.
3. Describe representative strategic information systems and the advantage they provide with the support of IT.
4. Understand the role of business processes in organizations and the reasons why reengineering is necessary.
5. Demonstrate the role of IT in supporting BPR and especially mass customization, cycle time reduction, self-directed teams, and empowerment.
6. Describe virtual corporations and their IT support.
British Airways’ customers are, by definition, on the move. Given the heavy competition within the travel industry, customer satisfaction and loyalty have become increasingly important to British Airways. This focus on customer loyalty drives British Airways to continually look for new ways to improve the “complete” flight experience—from reservation, through the journey to the airport, check-in, the flight itself, and completion of arrival procedures at the destination airport. As one of the biggest international airlines in the world, British Airways strives to stay ahead of competitors and to turn customer satisfaction into profit.

British Airways wanted to extend its existing e-commerce program to an additional channel—providing its customer base with flight information and the ability to check in while on the move, from their mobile phones or PDAs. Giving customers access to check-in and flight information facilities from mobile phones was an extension of service that British Airways knew customers would appreciate. What better way to enhance passengers’ travel experience than to make the journey simpler, faster, and more convenient?

Together, IBM and British Airways have implemented the technology, infrastructure, and services to extend British Airways’ highly successful e-commerce platform to the mobile channel. The resultant mobile service—the first of its kind in the United Kingdom—allows passengers to check flight availability and view British Airways’ flight arrival and departure information from around the world, using the convenience of a mobile Internet-enabled phone. In addition, Executive Club members on selected departures from the U.K. can check-in for their flights and pick a seat from mobile devices.

As part of the British Airways e-commerce platform, customers now have simple and personalized access to the British Airways Web site via the My TravelSpace feature. This feature also links in with outbound e-mail marketing programs. For British Airways, the e-commerce platform seamlessly integrates the airline’s systems and processes to provide multichannel customer facilities and a greatly increased capacity to manage the requests and transactions of its customer base. Working with IBM on the initial integrated platform, British Airways was able to add the mobile phone as one further channel through which customers can gain access to a truly personalized service—on the Web, via self-service check-in kiosks, and through other planned digital channels. All of these will offer a familiar and consistent user experience to loyal customers.

A total of 4,500 British Airways passengers now check in for their flights via the Web site or their mobile devices each month—in addition to the 50,000 a week who check in with British Airways’ IBM kiosks, 160 of which are installed at over 40 airports. While greatly improving the customer experience, the addition of the mobile channel allows British Airways to improve the efficiency of its check-in process, reducing staff costs and freeing customers from unnecessary queuing. The advent of mobile data capability also gives British Airways an opportunity to understand and test the capability of mobile devices, particularly for transactions. Furthermore, for British Airways' customers, the mobile service provides a convenient and efficient way to check in while on the move, enhancing their overall travel experience.
A irways, the mobile service promised true business value through reductions in cus-
tomer call center and service costs, alongside brand enhancement and first-mover 
advantage in a highly competitive environment. The real benefit to British A irways 
and its passengers involves being able to extend the benefits of British A irways’ 
e-commerce platform, to bring convenience, choice, and control to the mobile e-business experience.

**What We Learned from This Case**

This case demonstrates the following points:

1. Industries with slim profit margins, like airlines, must compete on several strategic fronts, customer service being an important one.

2. Those companies in an industry who do not compete on the basis of low cost are often the most innovative with customer service. Using conventional strategies, such as cutting prices, may not be sufficient to gain a competitive edge and market share, or may not allow sufficient profits.

3. A fundamental change in the manner in which business is done is sometimes the only way to succeed, or even to survive.

4. Those firms that can successfully implement an IT-driven innovation can gain a significant competitive advantage as first movers.

These points are the major topics of this chapter, which concentrates on strategic information systems. Strategic information systems can be used by themselves as a change mechanism, or they can be used as enablers of fundamental structural changes known as business process reengineering.

### 13.1 STRATEGIC ADVANTAGE AND INFORMATION TECHNOLOGY

**Strategic Information Systems**

Strategic information systems (SISs) are systems that support or shape an organization’s competitive strategy. A n SIS is characterized by its ability to significantly change the manner in which business is done, as in the case of British A irways. The system does so through its contribution to achievement of the strategic goals of an organization and/or its ability to increase performance and productivity significantly. 

For example, British A irways, like its competitors, understands that customers need access to their travel information 24/7. However, the great strategic insight is that customers also need this access from wherever they are. Knowing that the majority of its customers are equipped with mobile phones and PDAs, British A irways made it a strategic priority to provide the desired information via these channels. Although competitors can duplicate this strategic advantage in customer service, they cannot do so quickly, easily, or cheaply.

Originally, strategic systems were considered to be outwardly focused, aiming at direct competition in their industry, for example, by providing new services to customers and/or suppliers, with the specific objective of beating competitors. But since the late 1980s, strategic systems are also being viewed inwardly: They are focused on enhancing the competitive position of the firm by increasing employees’ productivity, improving teamwork, and enhancing communication. British A irways combined both outward and inward orientations to its advantage.
In addition to the inward and outward approaches, there is another dimension to SIS—strategic alliances—wherein two or more companies share an interorganizational system. For example, GM, Ford and Chrysler have an extranet that enables them to compete against Toyota and other car manufacturers.

**The Role of IT in Strategic Systems**

Information technology contributes to strategic systems in several ways. Consider these four:

1. Information technology creates applications that provide direct strategic advantage to organizations. For example, Federal Express was the first company in its industry to use information technology for tracking the location of every package in its system.

2. IT supports strategic changes such as reengineering. For example, IT allows efficient decentralization by providing high-speed communication lines, and it streamlines and shortens product design time with computer-aided engineering tools.

3. IT provides for technological innovations or acts as an enabler of innovation. These can be incorporated in the firm’s goods or services, or affect how those are provided.

4. IT provides competitive intelligence by collecting and analyzing information about innovations, markets, competitors, and environmental changes. Such information provides strategic advantage: If a company knows something important before its competitors, or if it can make the correct interpretation of information before its competitors, then it can introduce changes first and benefit from them.

**Competitive Intelligence**

Information about the competition can mean the difference between winning and losing a business battle. Many companies continuously monitor the activities of their competitors. For example, Hertz monitors car rental prices of its competitors on a daily basis, and Kraft, the giant food maker, closely monitors the performance of its competitors. Such activities to gather information on competitors are part of competitive intelligence. Information about markets, technologies, and government’s actions is also collected by competitive intelligence. Competitive intelligence drives business performance by increasing market knowledge and raising the quality of strategic planning.

**EXAMPLE**

**How Frito Lay chips away at its competition.** Frito Lay, the world’s largest snack food producer and distributor, is known for its extensive use of IT. Its strategic information system is a central nervous system within the business that integrates marketing, sales, manufacturing, logistics, and finance, and it provides managers with information about suppliers, customers, and competitors. Frito’s employees in the field collect sales and inventory level information daily, by store and by product, across the United States and in some other countries. They feed this information electronically to the company. The employees also collect information about the quantities of competing products available in each store, sales and promotions of competing products, and new products launched by competitors. By combining the data with internal information, Frito’s managers can better target local demand patterns, plan sales promotions, and determine pricing strategy.
Competitive intelligence can be enhanced by several information technologies, including intelligent agents. Research indicates that the percentage of companies using IT to support competitive intelligence increased from 31 percent in 1993 to about 50 percent in 1999. This increase is due primarily to the use of the Internet. The Internet plays an increasingly important role in supporting competitive intelligence. Using Internet tools, a company can implement specific search strategies to gather competitive intelligence easily, quickly, and relatively inexpensively, as illustrated in Table 13.1.

There is another aspect to competitive intelligence: industrial espionage. Corporate spies are looking for marketing plans, cost analyses, new products/services, and strategic plans. Such espionage can sometimes be unethical or illegal. Another problem is the theft of portable computers at conferences, which is spreading all over the world. Many of the thieves are interested in the information stored in the computers, not in the computers themselves. Protecting against such activities is important and is discussed in Chapter 15.

**Before you go on . . .**

1. Define strategic information systems (SISs).
2. Describe the role of IT in SIS.
3. Describe IT-based business intelligence.
Some studies show that more than 90 percent of executives surveyed strongly agree that IT can facilitate a strategic advantage that has a significant impact on profitability and even survival of their organizations. In this section we will examine some of the theories related to competition and strategic advantage.

**Porter’s Model**

Competition is at the core of a firm’s success or failure. One of the most well-known frameworks for analyzing competitiveness is Porter’s competitive forces model. This model (mentioned briefly in Chapter 1) has been used to develop strategies for companies to increase their competitive edge. The model recognizes five major forces that could endanger a company’s position in a given industry. Although the details of the model differ from one industry to another, its general structure is universal (see Figure 13.1). The five major forces can be generalized as follows.

1. The threat of entry of new competitors
2. The bargaining power of suppliers

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**Figure 13.1** Porter’s five forces model (including the major determinant of each force). [Source: M. E. Porter, Competitive Advantage: Creating and Sustaining Superior Performance. Copyright 1985–1988 by Michael E. Porter. Reprinted with permission from the Free Press, a division of Simon & Schuster, Inc.]
3. The bargaining power of customers (buyers)
4. The threat of substitute products or services
5. The rivalry among existing firms in the industry

The strength of each force is determined by several factors in the industry structure, examples of which are also cited in Figure 13.1. Most of the forces and the determining factors are related to the business pressures identified in Chapter 1.

Response Strategies

The purpose of identifying competitive forces is to enable an organization to develop a strategy aimed at establishing a profitable and sustainable position against these five forces. To do so, a company needs to develop a strategy of performing activities differently from its competitors. Porter proposed the following three response strategies to competitive forces.

1. **Cost leadership strategy**: Producing products and/or services at the lowest cost in the industry. An example is Wal-Mart, which through business alliances supported by computers and by computerized purchasing and inventory management is able to provide low-cost products at its stores.

2. **Differentiation strategy**: Being unique in the industry, such as providing high-quality products at a competitive price. For example, using an extranet and a computerized inventory system, Caterpillar provides its customers with a product maintenance service that no other competitor can match.

3. **Focus strategy**: Selecting a narrow-scope segment (niche market) and achieving either a cost leadership or a differentiation strategy in this segment. For example, several computer chip manufacturers make customized chips for specific industries or companies. Another example is frequent flyer programs that allow airlines to identify frequent travelers and offer them special incentives. Some airlines have several million customers registered in the programs, which can be managed efficiently only with the help of computers.

Over the years, Porter and others have added to the list of response strategies. The major extensions are the following.

- **Growth strategy**: Increasing market share, acquiring more customers, or selling more products by using electronic commerce to strengthen a company and increase profitability in the long run.

- **Alliances strategy**: Working with business partners. Facilitated by EDI, extranets, and groupware, this strategy creates synergy, allows companies to concentrate on their core business, and provides opportunities for growth.

- **Innovation strategy**: Developing new products and services, new features in existing products and services, and new ways to produce or sell them (for example, via the Internet). Also included are innovative information systems applications.

- **Internal efficiency strategy**: Improving the manner in which business processes are executed (for example, by using CAD/CAM). Such improvements increase employee and customer satisfaction, quality, and productivity, while decreasing time to market. Improved decision making and management activities also contribute to improved efficiency.

- **Customer-oriented strategy**: Concentrating on making customers happy. Strong competition and the realization that the customer is king/queen is the basis of this
approach. IT contributions to this strategy include improved customer service facilitated by e-mail or computerized catalogs, for example.

These strategies may be interrelated. For example, some innovations are achieved through alliances that reduce cost and increase growth. Cost leadership improves customer satisfaction and may lead to growth.

Examples of IT-supported competitive strategies can be found in Section 13.3. (Indeed, examples can be found throughout the entire book.) In certain industries there may be a greater emphasis on one strategy than another. For example, in the trucking industry, cost leadership is critical, and companies are using innovative techniques to achieve it, as illustrated in IT’s About Business 13.1.

Before we describe specific applications of how IT supports Porter’s strategies, though, let us first explore in more detail how the model works.

How the Model Is Used

Porter’s model is industry related, assessing the position of a company relative to competitors in its industry. The specific actions suggested by use of the model do not necessarily relate to IT. However, in most cases, response strategies these days do involve the use of IT. We’ll use Wal-Mart (see Figure 13.2) as an example to demonstrate the four steps involved in using Porter’s model.

Step 1: List the players in each competitive force. An illustration of a competitive threat, for example, is electronic shopping via the Internet, which may be a substitute for going shopping at a Wal-Mart store.

Box 13.1: Trucking companies use it for gaining cost leadership

The trucking business is very competitive. Here are some examples of how IT helps in significant cost savings.

J.B. Hunt of Lowell, Arkansas, is a large truckload carrier. Its corporate PCs are connected to the fuel commodity market for minute-by-minute monitoring of the greatly fluctuating fuel prices. They can trigger the purchase of fuel at the lowest possible prices, which can result in significant savings since fuel costs represent 18 to 35 percent of the company’s total operating costs. In addition, the system allows J.B. Hunt to pass on very accurate fuel surcharge to its customers every week.

Roadway Express, another trucking company, owns several hundred gas pumps nationwide. Using computers, the company continuously compares six vendors’ prices and related expenses to purchase the least expensive gas available at any given time.

Leaseway Trucking does not own pumps, but it centrally controls the purchasing of gas by over 10,000 drivers. Using geographical positioning systems (GPSs), the company knows where its trucks are at any given time. Knowing where the nearest, least expensive gas station is located, corporate headquarters instructs drivers, in real time, where to buy gas. This strategy has reduced fuel costs by 10 percent.

Computers are also used by large companies to monitor drivers’ and trucks’ productivity. Using telecommunications and GPS, companies can monitor the exact location of trucks, study their performance, and thereby improve it. In addition, large trucking companies use DSS and EIS to optimize their operations. IT provides large companies with a competitive edge against the small companies and allows truckers to survive in an extremely competitive business.

Questions

1. Why do large truckers have the competitive edge?
2. Which of Porter’s response strategies can be used by small truckers? Can IT be of any help?
3. A small trucking company can afford GPS (cost is less than $200 per unit). What is the advantage of using GPS?
Step 2: Relate the major determinants of each force (shown in the model in Figure 13.1) to each player listed in Figure 13.2. For example, with respect to electronic shopping, we can check the switching cost of the buyers, the buyers’ propensity to substitute, the price advantage of electronic shopping, and so forth.

Step 3: Devise a strategy with which Wal-Mart can defend itself against these forces, based on the specific players and the determinants. For example, to counter electronic shopping, Wal-Mart could provide playgrounds for children, hand out free samples of products, and recognize frequent shoppers personally. Wal-Mart could also respond by imitating the competition; the company actually did just that by introducing Wal-Mart Online.

Step 4: Look for supportive information technologies. An illustration of this step for Wal-Mart’s online shopping is a technology for managing frequent shoppers. It will be necessary to use a gigantic database and an online processing system with a good database management system and analytical capability to assess shoppers’ activities accurately.

Of course, a similar process using Porter’s model can be employed by Wal-Mart’s competitors. A competitor can portray all the determinants and then look for response strategies and information technologies to increase the competitive pressure on Wal-Mart.

Table 13.2 summarizes the role of IT in relation to each competitive force. Strategic advantage must be sustained in order for organizations to survive and thrive. While the expense required to establish IT systems may prohibit some competitors from imitating successful systems, other competitors will follow suit. Therefore constant innovations are required. Also, inward systems can be helpful in providing competitive advantage. Specific examples of IT facilitating additional competitive strategies are presented in the next section.
In this section we present several examples of how IT has successfully supported the competitive response strategies presented in the previous section. Several of the cases illustrate support for more than one strategy.

**EXAMPLES**

**Intranet gives Geisinger a shot in the arm.** Health maintenance organizations (HMOs) are growing very rapidly in the United States as an approach to containing health care costs. The rapid growth of some HMOs creates problems of inefficient operations and poor customer service, as in the case of Geisinger, a rural HMO in Danville, Pennsylvania.

### Table 13.2 Impact of Competitive Forces and the Role of IT

<table>
<thead>
<tr>
<th>Key Force Affecting the Industry</th>
<th>Business Implications</th>
<th>Potential IT Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threat of new entrants</td>
<td>Additional capacity</td>
<td>Provide entry barriers/reduce access by exploiting existing economies of scale, differentiating products/services, controlling distribution channels, segmenting markets.</td>
</tr>
<tr>
<td></td>
<td>Reduced prices</td>
<td></td>
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<tr>
<td></td>
<td>New basis for competition</td>
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<tr>
<td>Supplier power high</td>
<td>Raises prices/costs</td>
<td>Implement supplier sourcing systems.</td>
</tr>
<tr>
<td></td>
<td>Reduces quality of supply</td>
<td>Extend quality control into suppliers’ operations.</td>
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<tr>
<td></td>
<td>Reduces availability</td>
<td>Use forward planning with supplier.</td>
</tr>
<tr>
<td>Buyer power high</td>
<td>Forces prices down</td>
<td>Differentiate products/services and improve price/performance.</td>
</tr>
<tr>
<td></td>
<td>Higher quality demanded</td>
<td>Increase switching costs of buyers.</td>
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<tr>
<td></td>
<td>Service flexibility required</td>
<td>Facilitate buyer product selection.</td>
</tr>
<tr>
<td>Substitute products threatened</td>
<td>Limits potential market and profit</td>
<td>Use differentiation strategy.</td>
</tr>
<tr>
<td></td>
<td>Imposes price ceilings</td>
<td>Incorporate IT into product, services or method of provision.</td>
</tr>
<tr>
<td>Intense competition from rivals</td>
<td>Price competition</td>
<td>Improve price/performance.</td>
</tr>
<tr>
<td></td>
<td>Need to develop new products and services</td>
<td>Redefine products and services to increase value.</td>
</tr>
<tr>
<td></td>
<td>Distribution and service become critical</td>
<td>Redefine market segments.</td>
</tr>
<tr>
<td></td>
<td>Customer loyalty required</td>
<td>Improve price/performance.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Differentiate products and services in distribution channel and to consumer.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Get closer to the end consumer—understand the use requirements.</td>
</tr>
</tbody>
</table>


**Before you go on...**

1. Describe Porter’s competitive forces and response strategies.
2. Explain how Porter’s model is used and what role IT plays in the model.

**13.3 STRATEGIC INFORMATION SYSTEMS: SOME EXAMPLES**

In this section we present several examples of how IT has successfully supported the competitive response strategies presented in the previous section. Several of the cases illustrate support for more than one strategy.
The company, which grew through mergers and acquisitions, had 40 different IT legacy systems that needed to be upgraded and integrated. An innovative approach required use of an intranet to deal with the complexity of this integration. Not only does its intranet allow Geisinger to integrate its systems, but it also allows the HMO to offer innovative services such as “Tel-a-Nurse,” which enables patients to communicate comfortably with nurses by asking medical questions over the intranet. Moreover, Geisinger installed a clinical management information system to work with its intranet. Doctors use digital cameras to take pictures of patients’ injuries. Stored in a database, the pictures are accessible through the intranet for specialist consultation and for insurance processing.

The HMO’s intranet is also used for patient education, human resources management, routine paperwork, and library systems. Geisinger’s radiology department, for example, which performs diagnostic procedures such as X-rays, mammograms, and MRIs, has placed an electronic information kiosk in its waiting rooms for patients’ education.

Image management software cuts PC setup, maintenance costs. A PC image is made up of the hardware and software loaded on a personal computer. Most large companies maintain many different PC images to support a variety of hardware configurations, operating systems, languages, network drivers, and business applications. Each one of these separate images has to be developed, tested, managed, maintained, backed up, and documented—all of which takes time and money. When this process is applied to thousands of individual PCs, it quickly becomes a costly and time-consuming problem that drains IT resources and budgets. Industry analysts say most companies report that managing PC images represents as much as 50 percent of their total hardware support costs, and that they need to dedicate at least 30 percent of their internal computing staffs to deal with this problem. New ImageUltra software from IBM can reduce the number of PC images from hundreds or thousands to a single “super-image” for all PCs in an enterprise network. IBM estimates the new technology and related services can save businesses an average of $100 per PC, per year, over the life of the system, establishing a new benchmark for the PC industry in long-term affordability and manageability.

Dun & Bradstreet evaluates credit. Dun & Bradstreet (D&B) is a credit clearinghouse that provides risk analysis to manufacturers, wholesalers, jobbers, and marketers in various industries. D&B maintains and updates a database of credit ratings on approximately 220,000 businesses. Customers who pay D&B for the credit analysis used to complain about long waiting periods and inaccuracies (it is difficult to update the material constantly), inconsistencies (such as different interpretations by different risk analysts), and slow response time. An expert system is now capable of handling more than 95 percent of all requests. As a result, response time has been reduced from about three days to a few seconds, and the credit recommendations are more accurate and consistent. As soon as there are changes in a company’s data, the expert system reevaluates the implications for creditworthiness and informs its clients if needed. The system has helped the company maintain its position as a leading information provider. Clients communicate with D&B via the Internet or a value-added network. Once a client purchases a report from D&B, it can be placed on the buyer’s intranet and accessed by all authorized employees.

National Car Rental makes a quick and satisfactory car pickup. National Car Rental has been an innovator in using IT to become competitive in the car rental business. Market research revealed that car rental customers were tired of long delays, waiting in line, and providing the same information again and again (driver’s license, car preferences, features in rental cars, and so on). Customers were also frustrated because cars were randomly assigned to them; they were unable to select the exact
model, color, or features they wanted. Customers who tried to specify car model or color caused delays, which upset other customers waiting in line.

National Car Rental came up with an innovation called the Emerald Card. The Emerald Card prequalifies customers; they simply make a reservation, skip the line, and select a car of their choice from the rental lot. When they leave the lot, they use the Emerald Card as documentation to show that they rented a car and are leaving with it. When they return the car, they again use the Emerald Card to indicate the return, and an invoice is generated automatically. Advertising the card, National was able to attract some competitors’ customers who value this service, as well as retaining their own customers.

**Dialing up Coca-Cola.** Coca-Cola has always faced fierce competition around the world. By using a radical new SIS that marries “smart” Coke machines with cellular telephone technology, Coca-Cola has a strong competitive advantage in Singapore. There, people can now buy drinks from vending machines by using their mobile telephones. As a result of a joint venture between Singapore Telecommunications, Ltd. and F&N Coca Cola Pte. Ltd. of Singapore, subscribers to the SingTel cellular network interact with the Coke machine via their mobile phone by punching in an ID number and pressing the call button or by sending a short mail message. The machine receives the call or mail, identifies the user, and enables the user to then make the desired selection from the machine. The charge is transferred to the user’s telephone bill. The telephone company does not collect a commission from Coke, but does make money on the phone call or electronic message sent. Many of the machines in Singapore also accept electronic money cards.

**Sustaining a Competitive Advantage**

The SISs of the 1970s and 1980s were primarily outward systems, which are visible to competitors and can now be duplicated quickly (in months rather than years). Also, innovations in technology may make even new systems obsolete very quickly. Therefore, the major problem that companies face now is how to sustain their competitive advantage. Porter’s extension of his classical model includes strategies such as growth and internal efficiency that help facilitate sustainability.

When SISs are combined with structural changes in the organization, they can provide a sustainable strategic advantage. For example, Federal Express uses a comprehensive strategic information system (called PRISM) to manage its human resources and increase the effectiveness and efficiency of its operations. The system does not compete directly with any company, but it does provide a strategic advantage by building and maintaining a first-class personnel system. (For an application that demonstrates the significance of the shift of corporate operations to a strategic orientation, see the Web site.

Another popular approach to sustaining a competitive advantage is the use of inward systems that are not visible to competitors. Companies such as General Motors and American Airlines, for example, use inward intelligent systems in a number of ways, but the details are secret. It is known that several investment companies are using neural computing, but again the details are not known. Such inward systems can provide a sustainable advantage as long as they remain a secret, or as long as competitors do not develop similar or better systems using their own creativity.

Yet another approach to sustaining a competitive advantage is to install a comprehensive, innovative, and expensive system that is very difficult to duplicate. This is basically what Caterpillar has done to fend off its Japanese competitors. Federal Express’s online package tracking systems is another example of this strategy, although any system that is outwardly visible and seen as a source of competitive advantage will eventually be duplicated by competitors (as FedEx’s system was).
A Framework for Global Competition

Many companies are operating in a global environment. First, there are the truly global or multinational corporations. Second are the companies engaged in export or import. Third, a large number of companies face competition from products created in countries where labor and other costs are low, or where there is an abundance of natural resources. Finally, other companies have low-cost production facilities in these same countries. Doing business in a global environment is becoming more and more challenging as the political environment improves (more opportunities become available) and as telecommunications and the Internet open the door to a large number of buyers, sellers, and competitors worldwide. The increased competition forces companies to look for better ways to do business, and they frequently evaluate IT as a potential solution.

According to the global business drivers framework, the success of companies doing business in a competitive global environment depends on the alignment of their global business strategy and their information systems. This connection can be seen in multinational companies such as Caterpillar, where a business strategy of strong support to dealers and customers worldwide is accomplished by developing an effective global information system. Information managers must be innovative in identifying the IT systems that a firm needs in order to be competitive worldwide and must tie them to strategic business imperatives. The global business drivers framework provides a tool for identifying the business entities such as customers, suppliers, projects, and orders that will benefit most from an integrated global IT management system. These entities are the business pressures—the “drivers”—that form the basis for the strategic information systems. Advances in e-commerce are of special interest to global traders. Many of the business drivers can be facilitated by the Internet, which is much cheaper and more accessible than private communication networks.

Before you go on . . .

1. Describe the issue of sustainability and list solutions.
2. Describe the global business drivers framework.

13.4 INEFFECTIVE ORGANIZATIONS IN THE INFORMATION AGE

As indicated earlier, one of the strategies used to sustain competitive advantage is to combine IT with structural change. A fundamental change in the manner in which business is conducted is frequently referred to as reorganization or business process reengineering (BPR). Information technology is usually the major enabler of such reorganization, as will be illustrated in this and the following sections.

The Need for a Fundamental Change

Organizations are managed today by a set of principles that have evolved since the beginning of the Industrial Revolution. This revolution started with the concept of division of labor, conceived by Adam Smith in 1776. According to this concept, instead of one craftsman making an entire product (such as a shoe or a pin), several people would make the product, each specializing in one task. Each task would be relatively simple, so it would be easy to learn. This would reduce the long apprenticeship peri-
ods. In addition, when people specialize in these simple tasks, output can increase. This situation led to cheaper products and consequently higher demand. Because the tasks were simple, they were easy to automate when machines were introduced. Automation reduced the price of products further and further, and factories became larger and larger. Instead of producing for customers after an order was placed, products were produced in large quantities and then sold in the marketplace. Several principles and methods were created over the years that enhanced the development of the Industrial Revolution. The most important ones are:

- Specialization of labor
- Mass production (producing large quantities, storing them, selling them at a later time)
- Hierarchical organizational structure following functional specialties with top-down lines of authority
- Assembly lines that bring the work to the worker whenever possible
- Complex support systems for planning and budgeting, resource allocation, coordination, and control

These principles and methods were successful in developing world-class organizations, moving nations to a developed status, and significantly increasing standards of living.

However, these principles and methods are not working as they used to for many companies because the world has moved into a competitive global environment with continuous and unpredictable change. Significant change in the environment or in any component of the organization results in an organization’s disequilibrium. Unless the structure, processes, strategy, management, and technology are adjusted in response to the disequilibrium, organizations will not function well. As long as the pace of the change was slow, it was possible to deal with change by using continuous improvement programs, which included automation of existing processes, small structural modifications, quality and productivity improvement programs, and modifications in management procedures. But as the pace and the magnitude of business pressures and changes have accelerated, continuous improvement programs have become inappropriate in many cases.

Research shows that it is five to six times more difficult and expensive to obtain a new customer than it is to retain an existing one. So keeping customers should be one of an organization’s most basic concerns. Yet during the 1980s and early 1990s, customers in almost every area of business became disillusioned with the types of services they were receiving from most organizations. When customers tried to get service, they often got answers like: “We have them on order.” “I’ll have to check with the other department and get back to you.” “I’ll get to you when I can. It’s not my job.” “You can have any color as long as it’s black.” “I don’t care what she told you, it can’t be returned.” “We’ll need more people if we do that.” What went wrong with these organizations? The answer is simple: Companies continued with their old structures and processes while the business environment was changing. The result was ineffective organizations.

The Problem of the Stovepipe

One fundamental problem that makes organizations ineffective is that the ways they do things do not keep up with technology. Many of the traditional approaches used by organizations were developed before computing technology and, more recently, network technology. Organizations typically have used what is called the hierarchical organization. This is a pyramidal structure in which the ultimate authority and responsibility reside at the top, and authority and responsibility flow down through
successions of levels to the bottom of the organization. However, all organizations have both horizontal and vertical dimensions. The organization’s layers (usually top, middle, and supervisory management) define the horizontal dimensions; the organization’s functional departments define the vertical dimensions.

The vertical dimension of the organization, which is primarily focused on functional specialization, has caused many problems in organizations as they have tried to move into the information-based economy. Such problems are sometimes referred to as “stovepipes” in recognition of their vertical nature. Interaction among vertical functions—across the stovepipes—turns out to be crucial in order for organizations to operate efficiently and effectively.

Here is an example of a stovepipe problem: A customer places an order with the sales department. After a few days, she calls Sales to find out the status of the order. To answer the customer’s questions, Sales starts to call various departments. Frequently, it is difficult to trace the order. People push the order from place to place and feel only a small sense of responsibility and accountability, so Sales may not be able to give the customer an answer in time, or may even give an incorrect answer.

As this simple example illustrates, the difference between duties of functional units and business processes in an organization often is confused. In the stovepipe problem example, for instance, the business processes involved in filling an order could be considered the responsibility of the selling department or the distribution department; finance personnel may also be involved depending on how the payment for the product is to be made. Figure 13.3 illustrates that an organization can have vertical functions but also have processes that transcend departmental boundaries horizontally. These are sometimes referred to as cross-functional activities. Product development, order processing, planning, resourcing, control, and customer service are examples of business processes that can transcend the functional boundaries of distribution, purchasing, research and development, production, and sales.

The problem of the stovepipe can intensify if the supporting information systems are structured improperly. As we’ve seen earlier in the book, organizations generally have operated and built information systems along functional boundaries. For example, a budgeting system was perceived to be primarily that of the finance department, even though all functional areas of the organization do budgeting. A net effect of focusing on vertical functions has been fragmented, piecemeal information systems that operate so that the “left hand doesn’t know what the right hand is doing.”

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**Figure 13.3** Business processes across functional areas and organizational boundaries. [Source: E. Turban et al., Information Technology for Management (New York: Wiley, 1999), p. 119.]
The Need for Integration

Besides creating inefficient redundancies, the vertical structure with its functional information systems causes difficulties in the integration of information that is required for decision making. For example, account numbers in an information system developed along departmental lines may not be logically related and so cannot be used for cross-referencing a customer’s accounts. This seriously limits reporting capabilities. A loan officer, for instance, may want to check information pertaining to a loan applicant’s savings accounts. However, there may be no linkage to these data from the loan system. Indeed, the loan officer may even have to ask the loan applicant if he or she has a savings account with the bank and what the account number is.

Consider a case where the management of the bank wants to increase the offering of mortgage loans. Management decides to send letters encouraging specific customers to consider buying homes, using convenient financing available through the bank. Management also decides that the best customers to whom to send such letters are the following.

1. Customers who do not currently have mortgage loans or who have loans for a very small percentage of the value of their homes
2. Customers who have good checking account records (i.e., few or no overdrafts)
3. Customers with sufficient funds in their savings accounts to make a down payment on a home
4. Customers who have good payment records on any installment loans with the bank

Because the data necessary to identify such customers may be available in different files of different databases, there may be no convenient or economical way to

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Box 13.2: Carl Zeiss and its suppliers integrate business processes

The Carl Zeiss Group, well known as the manufacturer of some of the world’s finest optical equipment, relies heavily on its supply chain. Through consignment arrangements, the supply chain partners provide Carl Zeiss with a wide variety of manufactured parts that are then incorporated into the company’s products.

Much of the responsibility for making the consignment arrangement work rests on the shoulders of Zeiss’s suppliers. They have the task of ensuring that their supply matches the manufacturing demand and is delivered when needed. While in theory this arrangement made Carl Zeiss’s internal operations simpler by delegating the responsibility for filling the supply pipeline to its suppliers, in practice it required a great deal of coordination between Zeiss’s IT systems and those of its suppliers. Different suppliers needed different data, and it all had to be collated more or less manually; suppliers had no direct access to the Zeiss systems.

Carl Zeiss saw the potential for making the process far more efficient by leveraging its internal systems through an extended ERP solution. By giving access to critical SAP R/3 data to suppliers, Zeiss could eliminate the time- and labor-intensive routine of coordinating data between members of the supply chain. All partners are now connected via an extranet to relevant manufacturing demand data at Zeiss. Access to the Carl Zeiss data is controlled through user authorization, so each member of the supply chain sees only the data that is relevant to them. At the same time, Carl Zeiss’s employees are able to interact with all suppliers. The same data drives all of the processes, from shipping to inventory management to forecasting.

Questions

1. How does this system impact a supplier’s inventory management?
2. What competitive advantage is realized through improved data sharing?
3. How does the integrated software help?
integrate them. Management is understandably disappointed and unable to function effectively.

For optimum use of information, integration should cross not only departmental boundaries, but also organizational ones, reaching suppliers and customers. An example of an integration of a firm with its suppliers is provided in IT’s About Business 13.2.

All too often, however, organizations have failed to integrate information systems. Nonintegrated information systems and the conflict between the horizontal nature of business processes and the vertical (functional) structure of businesses are the primary reasons for organizational problems that necessitate business process reengineering, the topic of the next section.

Before you go on . . .

1. Explain the need for a fundamental change in the way organizations are organized and operated.
2. What is the stovepipe problem?

13.5 BUSINESS PROCESS REENGINEERING

One popular approach to improving organizational effectiveness is referred to as business process reengineering (BPR). BPR is a holistic process that can lead to a complete organizational transformation and stabilization. As described earlier, an organization’s business processes are the activities that use various kinds of inputs to create an output of value to the customer. For example, accepting an application for a loan, processing it, and approving (or rejecting) it is a business process in a bank. An organization operates numerous business processes to attain its goals. In business process reengineering (BPR), an organization fundamentally rethinks and radically redesigns its business processes to achieve dramatic improvements in such measures of performance as quality, cost, speed, and services. BPR can be introduced in one, several, or all organizational processes. As shown in Figure 13.4, information technology supports most BPR projects.

Figure 13.4 BPR, continuous improvement programs, and IT support.
The implementation of BPR involves many concepts, some of which have been known for several decades. The approach was formalized in the late 1980s and early 1990s, when the term “BPR” was coined. When BPR was first implemented, it usually involved a significant break with past business rules and practices—almost requiring an organization to start over from scratch. This extreme view of BPR has modified somewhat. It is no longer considered necessary to destroy everything and start anew; BPR now can be implemented using a more flexible approach.

**Principles of BPR**

Certain common principles exist in business process reengineering, and most of them are facilitated by IT. The major principles are as follows.

- Several jobs are combined into one.
- Employees make decisions (empowerment of employees). Decision making becomes part of the job.
- Steps in the business process are performed in a natural order, and several jobs get done simultaneously.
- Processes to manufacture similar products or provide similar services can be structured so that only slight variations will permit provision of “customized” goods or services. This makes possible the economies of scale that result from mass production, yet allows customization of products and services.

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**Box 13.3: IBM Credit Corporation reduced cycle time by 90 percent**

IBM Credit Corporation provides credit to customers who purchase IBM computers. The process of credit approval used to take an average of seven days. Because of the long processing time, salespeople felt that they were losing many potential customers. Therefore, reducing processing time became critical.

In the old process, the IBM salesperson telephoned in, requesting credit approval for a customer. A clerk logged the call on paper, and a messenger took it to the credit department. Next, a specialist entered the data into the computer, checked creditworthiness of the potential customer, and prepared a report. The report was physically moved to the Business Practices department, and the Business Practices department modified a standard loan to fit the customer’s needs. Using a spreadsheet, a pricer then determined the appropriate interest rate and payment schedule, adding another piece of paper to the application. An administrator used the information to develop a quote letter, which was delivered to the salesperson, who submitted it to the customer. Incremental attempts to increase productivity improved some of these activities, but the overall time reduction was minimal.

IBM reengineered the credit approval process. In the new process, one person, called a deal structurer, conducts all the above steps. This one generalist replaces four specialists. To enable one person to execute the above steps, a simple DSS provides the deal structurer with the guidance needed. The program guides the generalist in finding information in the databases, plugging numbers into an evaluation model, and pulling standardized clauses (boilerplate) from a file. For difficult situations, the generalist can get help from a specialist.

The results have been phenomenal: Turnaround time on orders has been slashed from seven days to four hours. Furthermore, IBM Credit can now handle a volume of business up to 100 times larger.

**Questions**

1. Why is this change considered a BPR?
2. What role did IT play in supporting the BPR?
3. What is the role of the deal structurer?
• Work is performed where it makes the most sense, including at the customer’s or supplier’s sites. Thus, work is shifted, if necessary, across organizational and even international boundaries.
• Controls and checks and other non-value-added work are minimized.
• Reconciliation—checking a product against a purchase order, for example—is minimized by cutting back the number of external contact points and by creating business alliances.
• A hybrid centralized/decentralized operation is used.
• A single point of contact (called a “case manager” or a deal structurer) is provided to customers.

A n example of how BPR is done using such principles is provided in IT’s About Business 13.3.

**The Enabling Role of Information Technology**

IT has been used for several decades to improve productivity and quality by automating existing processes. However, when it comes to reengineering, the traditional process of looking at problems first and then seeking technology solutions for them needs to be reversed. Instead, organizations can first recognize that BPR makes powerful solutions possible, and then seek the processes that can be helped by it.

IT can break old rules that limit the way work is performed. Some typical rules are presented in Table 13.3.

**The IT tools for BPR.** A large variety of IT tools can be used to support BPR. The major categories of support tools are as follows.

• **Simulation and visual simulation tools.** Simulation is essential to support the modeling activities of BPR. In addition to conventional simulation and visual simulation tools, there are simulation tools that are specifically oriented for BPR.
• **Flow diagrams.** Flow diagrams can be made with CASE tools or other systems development charting tools. They can also be made by specialized BPR tools that are usually integrated with other tools.
• **Work analysis.** Analyzing both existing processes and proposed solutions can be accomplished with tools that conduct forecasting, risk analysis, and optimization.
• **Workflow software.** In redesigning business processes, it is usually necessary to analyze the work to be done and the manner in which it flows from one place to another. A workflow system is a powerful business process automation tool that places system controls in the hands of end-user departments. There are three types of workflow software: administrative—expense reports, travel requests and messages; ad hoc—product brochures, sales proposals, and strategic plans; and production—credit card mailings, mortgage loans, and insurance claims.
• **Other tools.** Several special tools plan and manage the BPR process and the organization transformation. Information tools and technologies can also be part of the BPR solution itself. For example, CAD/CAM and imaging technologies contribute to cycle time reduction, EDI supports virtual corporations and other interorganizational systems, and expert systems support case managers and mass customization.
• **Integrated tool kits.** Several integrated tool kits are available to support BPR. The most well-known tool is SAP R/3.
• **Internet and intranet infrastructures.** The role of IT in business process reengineering is increasing due to new applications based on Internet and intranet infrastructure.

### The Major Reengineering Activities

Reengineering efforts involve many activities. We describe the major ones in this section and also show the support given by IT to BPR.

**Redesign of processes.** One of the most publicized examples of process redesign is the accounts payable process at Ford Motor Company, described in IT’s About Business 13.4. This case illustrates how IT can help in redesigning a process to result in dramatic cost reduction.

**From mass production to mass customization.** One of the most innovative concepts of the Industrial Revolution was mass production, in which a company produces a large quantity of an identical, standard product. The product is then placed in a warehouse for future distribution to many customers. Because mass production results in

### Table 13.3 Changes in Work Rules Brought by IT

<table>
<thead>
<tr>
<th>Old Rule</th>
<th>Intervening Technology</th>
<th>New Rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information appears in only one place at one time.</td>
<td>Shared databases, client/server architecture, electronic mail</td>
<td>Information appears simultaneously wherever needed.</td>
</tr>
<tr>
<td>Only an expert can perform complex work.</td>
<td>Expert systems, neural computing</td>
<td>Novices can perform complex work.</td>
</tr>
<tr>
<td>Managers make all decisions.</td>
<td>Decision support systems, enterprise support systems, expert systems</td>
<td>Decision making is part of everyone’s job</td>
</tr>
<tr>
<td>Field personnel need offices to receive, send, store, and process information.</td>
<td>Wireless communication and portable computers, information highways, electronic mail</td>
<td>Field personnel can manage information from any location.</td>
</tr>
<tr>
<td>You have to locate items manually.</td>
<td>Tracking technology, groupware, workflow software, client/server</td>
<td>Items are located automatically.</td>
</tr>
<tr>
<td>Plans get revised periodically.</td>
<td>High-performance computing systems</td>
<td>Plans get revised instantaneously whenever needed.</td>
</tr>
<tr>
<td>People must come to one place to work together.</td>
<td>Groupware and group support systems, telecommunications, electronic mail, client/server</td>
<td>People can work together from different locations.</td>
</tr>
<tr>
<td>Customized products and services are expensive and take a long time to develop.</td>
<td>CA D-CAM, CA SE tools, online systems for JIT decision making, expert systems</td>
<td>Customized products can be made quickly and inexpensively (mass customization).</td>
</tr>
<tr>
<td>A long period of time is spanned between the inception of an idea and its implementation (time-to-market).</td>
<td>CA D-CAM, electronic data interchange, groupware, imaging (document) processing</td>
<td>Time-to-market can be reduced by 90 percent.</td>
</tr>
<tr>
<td>Work should be moved to countries where labor is inexpensive (offshore production).</td>
<td>Robots, imaging technologies, object-oriented programming, expert systems</td>
<td>Work can be done in countries with high wages and salaries.</td>
</tr>
</tbody>
</table>

Box 13.4: Reengineering processes at Ford Motor Company

As part of its productivity improvement efforts, Ford management thought that by streamlining processes and installing new computer systems it could reduce the head count of its accounts payable department by some 20 percent, to 400 people.

But after visiting Mazda’s payables department (Ford is part owner of Mazda), Ford managers increased their goal: Perform the accounts payable process with only 125 clerks. Why did they think this could be done? Analysis of the existing system revealed that when the purchasing department wrote a purchase order, it sent a copy to Accounts Payable. Later, when Materials Control received the goods, it sent a copy of the receiving document to Accounts Payable. Meanwhile, the vendor also sent an invoice to Accounts Payable. If the purchase order, receiving document, and invoice matched, then Accounts Payable issued a payment. Unfortunately, the department spent most of its time on the many mismatches. To prevent them, Ford instituted “invoiceless processing.” Now, when the purchasing department initiates an order, it enters the information into an online database. It does not send a copy of the purchase order to anyone. The vendor receives notification through an EDI (see the figure).

When the goods arrive at the receiving dock, the receiving clerk checks the database to see whether the goods correspond to an outstanding purchase order. If so, he or she accepts them and enters the transaction into the computer system. (If there is no database entry for the received goods, or if there is a mismatch, the clerk returns the goods.)

Under the old procedures, the accounting department had to match 14 data items among the receipt record, the purchase order, and the invoice before it could issue payment to the vendor. The new approach requires matching only four items—part number, amount, unit of measure, and supplier code—between the purchase order and the receipt record. The matching is done automatically, and the computer prepares the check, which Accounts Payable sends to the vendor (or an electronic transfer is done). There are no invoices to worry about since Ford has asked its vendors not to send them.

Questions

1. What support was provided by IT?
2. How did IT contribute to improved quality?
3. Why was invoicing abolished?
4. Why is this a BPR?

Comparison of old and reengineered processes at Ford Motor Company. [Source: E. Turban et al., Information Technology for Management (New York: Wiley, 1999), p. 128. Reengineering accounts payable processes at Ford]
low costs, products are relatively inexpensive, and many customers purchase identical products. The concept of mass production was adapted to thousands of products, ranging from simple watches to major appliances, vehicles, and computers.

A major change in marketing started about 30 years ago with the increased competition between automobile manufacturers. Customers were able to select “options,” such as an air conditioner or automatic transmission. Manufacturers collected the customized orders. Once they accumulated enough similar orders to justify the economic manufacturing of identical customized products, they produced the items. The result was a waiting time of several months. A similar strategy was developed in other relatively expensive products. However, today’s customers are not willing to wait so long. The solution was found in mass customization.

The basic idea of **mass customization** is to enable a company to produce large volumes, yet to customize the products to the specifications of individual customers. Mass customization enables a company to provide flexible and quick responsiveness to a customer’s needs, at a low cost and with high quality. It is made possible by allowing fast and inexpensive production changes, by reducing the ordering and sales process costs, by shortening the production time, and by using prefabricated parts and modules. An important point is that mass customization involves not only the operations function but also marketing and sales, personnel, and finance. (For an example of how reengineering enabled mass customization, see the case about Bally Engineered Structures at the book’s Web site.

Mass customization will likely increase with the spread of e-commerce, which transforms the supply chain from a traditional push model to a pull model. In the push model, the business process starts with manufacturing and ends with consumers buying the products or services. In the pull model, the process starts with the consumer ordering the product (or service) and ends with the manufacturer making it. E-commerce is especially helpful in developing one-to-one relationships with customers, taking orders electronically, and learning about customers’ needs, which are then fulfilled economically.

**Cycle time reduction.** Cycle time refers to the time it takes to complete a business process from beginning to end. Because speed is recognized as a major element that provides competitive advantage, **cycle time reduction** is a major business objective. IT makes a major contribution in shortening cycle times by allowing companies to combine or eliminate steps, and to expedite various activities in the business process.

The success of Federal Express, for example, is clearly attributable to its ability to reduce the delivery time of packages by using complex computer-supported systems that allow flexible planning, organization, and control. The comeback of Chrysler Corporation and its success in the 1990s can be attributed largely to its “technology center,” which brought about a more than 30 percent reduction in its time to market (the time from beginning the design of a new model to the delivery of the car). Boeing Corporation reengineered its design of airplanes by moving to total computerization, in which an electronic rather than a physical prototype was built. In addition to reducing the cycle time, the process redesign has improved quality and reduced costs. Because of this, Boeing was able to compete successfully with Airbus Industries. Notice that both in Boeing’s and Chrysler’s cases the change was fundamental and dramatic. First, the role of the computer was changed from a tool to a platform for the total design. Second, it was not just a process change, but a cultural change relative to the role of the computer and the design engineers. Computing also played a major communications role during the entire design process.

There is an old (and true) saying that “time is money,” so saving time saves money. But cycle time reduction does more than just save money. If you beat your
competitors to the market with a new product, a product improvement, or a new service, you can gain a substantial market share. Pharmaceutical companies, for example, are desperately trying to reduce the cycle time of new drugs. If successful, they will be the first on the market, they may receive a patent on the innovation, and revenues will begin flowing sooner to repay their huge investments. Finally, telecommunications and especially the Internet and intranets provide a means of economically reducing cycle time by cutting communications time through the use of e-mail and EDI, and by allowing collaboration in design and operations of products and services. IT’s About Business 13.5 illustrates how IT can help in redesigning a process to result in dramatic cycle time reduction.

Cycle time reduction can be very beneficial, but to obtain maximum results from reengineering efforts it may be necessary to restructure not just one or a few processes, but the entire organization, as we describe next.

Restructuring Entire Organizations

We’ve seen that a current problem in many organizations is vertical structures. The fundamental problem with the hierarchical approach is that any time a decision needs to be made, it must climb up and down the hierarchy. All it takes to bring everything to a screeching halt is for one person who does not understand an issue to say “no.” Also, if information is required from several “functions,” getting all the right information coordinated can be a time-consuming and frustrating process for employees and customers alike.

In response, some businesses have felt the need to restructure the entire organization. How is organizational restructuring done? It all depends. In some cases, providing each customer with a single point of contact can solve the fundamental problem just described. For example, in a traditional bank, each department views the same customer as a separate customer. The customer interacts with each department separately, filling in duplicate applications and dealing with many contact people in the bank.
Figure 13.5 depicts the alternative—a reengineered bank. The customer deals with a single point of contact, an account manager. The account manager is responsible for all bank services and provides all services to the customer, who receives a single statement for all his or her accounts. Notice that the role of IT is to back up the account manager by providing expert advice on specialized topics, such as loans. Also, by allowing easy access to the different databases, the account manager can answer queries, plan, and organize the work with customers. Although in concept this is reengineering of a business process, the process is so integral to the bank’s operation that changing it essentially changes the entire organization.

One of the most interesting forms of a restructured organization is the networked organization.

The networked organization. Networked organizations refer to organizational structures that resemble computer networks and are supported by computerized systems. The major characteristics of the networked organization are shown in Figure 13.6 and are compared to the characteristics of the hierarchical organization.

Today there is a clear trend away from the hierarchical organization toward the networked organization. This trend is being brought about by the evolution from an industrial-based economy to an information-based economy. Today, most people do knowledge work, in which the intellectual context of the work increases to the point where the subordinate often has more expertise than the “hierarchical” supervisor. If managers know “everything,” they can use hierarchical methods to tell employees what to do, how to do it, and when to do it. But physicians, scientists, engineers, and similar employees in an organizational network are not just cogs in a hierarchical machine. Each employee has special expertise and information. Therefore, it is better to view the information-based organization as a client/server network. The best “node” should be used to solve the problem.

Figure 13.7 portrays a continuum from the hierarchical approach to the networked approach. The nodes in the network can be individuals or teams, as will be described later. Note that in the middle, between the hierarchical and networked
approaches, is the flattened organization. It has fewer layers of management and a broader span of control than the hierarchical organization, and can be considered to be an improved structure over a hierarchy.

As a straightforward example of a network approach to problem solving, let us say a student in class begins to have cardiac arrest. What should happen? If one student in the class knows CPR, he or she should become a situational leader and configure a team to solve the problem. That person is the best-equipped node in the

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**Figure 13.6** Networked versus hierarchical organization. [Source: E. Turban et al., *Information Technology for Management* (New York: Wiley, 1999), p. 136.]

**Figure 13.7** The roles of managers and subordinates in the different types of organizations. [Source: E. Turban et al., *Information Technology for Management* (New York: Wiley, 1999), p. 137.]
network. Note that the situational leader might be temporarily hierarchical in behavior. For example, he or she might tell one person to call 911, another to get some blankets, and another to keep the hallways clear for the ambulance personnel. The professor should relinquish authority, and those people assigned tasks by the CPR expert should not argue about who should call 911! The goal is to recognize the most important task. In this case, saving a life preempts teaching, and the situational leader needs to emerge from the network.

Figure 13.8 provides a graphic portrait of the network organization for a division of British Petroleum. Note the standing teams of Engineering Resources, Technology Development, and Business Services. The 16 independent clusters represent pickup teams (yellow) assigned to solve problems that develop.

Empowerment. Empowerment is the vesting of decision-making or approval authority in employees in instances where such authority traditionally was a managerial prerogative. As a philosophy and set of behavioral practices, empowerment means allowing self-managing teams and individuals to be in charge of their own tasks, as they meet company goals. As an organizational program, empowerment means giving permission to the workforce to develop and utilize their skills and knowledge to their fullest potential for the good of the organization as well as for themselves, and it means providing the framework in which this can be done.

Empowerment's relationship to IT. Empowerment can be enhanced through IT. One of IT’s most important contributions is the provision of the right information, at the right time. Information is necessary, but it may not be sufficient. To be fully empowered means to be able to make decisions, and these require knowledge. Knowledge is scarce in organizations, and specialists usually hold it. To empower employees means to increase the availability of such knowledge. Expert systems and other intelligent systems can play a major role in providing knowledge, as can the Internet, intranets, and knowledge bases. Finally, group DSS can be used to enhance the decision-making capabilities of employees working in teams.

Information technology also can provide tools that will enhance the creativity and productivity of employees, as well as the quality of their work. These tools can be special applications for increasing creativity, spreadsheets for increasing productivity, and handheld computers to improve communication.

Finally, empowerment may require training. People may need more skills and higher levels of skills. Self-directed teams, for example, are supposed to have all the necessary skills to achieve their goals. Once organized, teams will require training, which can be enhanced by IT. For example, many companies provide online training.

use multimedia, and even apply intelligent computer-aided instruction. Many companies are using intranets to provide training. Levi Strauss & Company uses a program called Training for Technology, which aims at training people to use the skills and tools they need in order to be able to find information and use it properly.

**Empowerment of customers, suppliers, and business partners.** In addition to empowering employees, some companies are empowering their customers, suppliers, and other business partners. For example, Levi Strauss allows its textile suppliers to access its database, so they know exactly what Levi Strauss is producing and can ship supplies just-in-time. The company is using a similar approach with all its suppliers. Federal Express uses the Internet to empower its customers to check prices, prepare shipping labels, find the location of the nearest drop box, and trace the status of packages. Finally, Dell empowers its customers to track orders and troubleshoot problems. Extranets, a combination of the Internet and intranets, allow companies to empower their business partners.

**Teams.** Many of the largest U.S. corporations are using self-directed teams. Types of teams include the following:

- Permanent or workgroup teams, usually multiskilled, which conduct the routine work of the organization
- Problem-solving teams, usually multidisciplinary and multiskilled, which are established for the purpose of solving a specific problem and then are dismantled
- Quality circles, which meet intermittently to find and solve workplace-related problems
- Management teams consisting mainly of managers from different functional areas, whose major objective is to coordinate the work of other teams
- Virtual teams, whose members are in different places, frequently belong to different organizations, and communicate electronically

In all of these teams, IT plays a critical role in empowering team members and providing the necessary communication links among teams.

The networked organization and self-directed teams are related to another BPR innovation—the virtual corporation—which is presented in Section 13.6.

**Ethical and Societal Issues**

Gaining competitive advantage through the use of IT may sometimes involve the temptation to commit unethical or even illegal actions. Companies use IT to monitor the activities of other companies and may invade the privacy of individuals, for instance. In using business intelligence (for example, spying on competitors), companies may engage in unethical tactics such as pressuring a competitor’s employees to reveal information or using software that is the intellectual property of other companies (frequently without the knowledge of these other companies). Finally, companies may need to use IT to monitor the activities of their employees and customers, and in so doing they may invade the privacy of individuals.

Conducting BPR may result in the need to lay off, retrain, or transfer employees. Should management notify the employees in advance regarding such possibilities? And what about older employees who may be more difficult to retrain? Should they be offered the choice between an early retirement package and retraining? Other ethical issues may involve the need to share sensitive or personal information. Finally, individuals may have to share computer programs that they designed for their personal
use in doing their jobs. Such programs may be considered the intellectual property of the individuals.

Reengineering efforts involve dramatic changes in people's jobs and working relationships. Often jobs are eliminated. Remaining competitive often does involve pain. However, the pain of reengineering is much less than the pain of being completely eliminated as a viable business. A statement by the artist Pablo Picasso puts into perspective the meaning of reengineering: "Every act of creation is first of all an act of destruction."

### Before you go on . . .

1. List the major BPR principles
2. List the major IT tools for BPR.
3. Describe mass customization, cycle time reduction, restructuring, networked organizations, empowerment, and teams.
4. Describe the role of IT in each of the above.

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### 13.6 Virtual Corporations and Information Technology

One of the most interesting reengineered organizational structures is the virtual organization, usually referred to as a virtual corporation (VC). The creation, operation, and management of a VC are heavily dependent on IT, and virtual corporations are especially facilitated by the Internet and extranets.

**Characteristics of Virtual Corporations**

A virtual corporation (VC) is an organization composed of several business partners sharing costs and resources for the purpose of producing a product or service. The VC can be temporary, with a onetime mission such as launching a satellite, or it can be permanent. Permanent virtual corporations are designed to create or assemble a broad range of productive resources rapidly, frequently, and concurrently. VCs include several partners, each creating a portion of a product or service, in an area in which they have special advantage such as expertise or low cost.

The concept of VCs is not new, but recent developments in IT allow new implementations that exploit its capabilities. The modern VC can be viewed as a network of creative people, resources, and ideas connected via online services and/or the Internet, who band together to produce products or services. A typical structure of a VC is shown in Figure 13.9.

The major characteristics of virtual corporations are:

- **Excellence.** Each partner brings its core competence (area of excellence), thus creating an all-star winning team. No single company can match what the virtual corporation can achieve.

- **Full utilization of resources.** Some resources of the business partners are sometimes underutilized; when not in use; such resources can be put to use in the VC, providing a competitive advantage.
Opportunism. The partnership is opportunistic. A VC is organized to seize a market opportunity. For example, if one of the partners is in a different country, the VC has access to more customers and/or to inexpensive resources.

Lack of borders. It is difficult to identify the boundaries of a VC. For example, close cooperation among competitors, suppliers, and customers makes it difficult to determine where one company ends and another begins in the VC partnership.

Trust. Business partners in a VC must be far more reliant on each other and more trusting than ever before. Their business destinies are intertwined.

Adaptability to change. The VC can adapt quickly to the environmental changes discussed in Chapter 1 because its structure is relatively simple.

Technology. Information technology makes the VC possible. A networked information system is a must.

How IT Supports Virtual Corporations

In a VC the resources of the business partners remain in their original locations but are integrated for the VC’s use. Because the partners are in different locations, they need information systems for supporting communication and collaboration. Such systems are a special case of interorganizational information systems (IOIs), as described in Chapter 8.

IT can support virtual corporations in several ways. The most obvious are those that allow communication and collaboration among the dispersed business partners. For example, e-mail, desktop videoconferencing, screen sharing, and several other groupware technologies support VCs. Standard transactions are supported by EDI and EFT. The Internet is the infrastructure for these and other technologies. Virtual office systems, for example, can be supported by intelligent agents. Modern database technologies and networking permit business partners to access each other’s databases. Lotus Notes and similar integrated groupware tools permit diversified interorganizational collaboration. In general, most VCs cannot exist without information technology.

EXAMPLES

Five companies join in IBM’s Ambra. IBM’s Ambra was formed to produce and market a PC clone. Ambra’s headquarters are in Raleigh, North Carolina. There, 80 employees use global telecommunications networks to coordinate the activities of five companies that are business partners in the virtual company.
Wearnes Technology of Singapore is doing engineering design and subsystem development services and manufacture for Ambra PC components. SCI Systems assembles the Ambra microcomputers in its assembly plants on a build-to-order basis from order data received by its computers from A1 Incorporated. A1, a subsidiary of Insight Direct, a national telemarketing company based in Tempe, Arizona, receives orders for Ambra computers from customers over its 800-number telephone lines or its Web site. Merisel Enterprises provides the product and delivery database used by A1 and handles Ambra order fulfillment and customer delivery. Finally, another IBM subsidiary provides field service and customer support.

No need to buy office furniture for Turnstone. Steelcase Inc. is a major U.S. maker of office furniture. It formed a virtual corporation subsidiary called Turnstone that sells its products through catalogs designed and printed by a third-party company (and now also available on the Web). Turnstone customers e-mail or phone in credit card orders to a telemarketing company based in Denver, Colorado, which transmits the order data to computers at warehouses operated by Excel Logistics, Inc. in Westerville, Ohio. From there the products are shipped to customers by subcontracted carriers. Excel's computer systems handle all order processing, shipment tracking, and inventory control applications. Marketing, financial management, and coordinating the virtual company's business partners are the only major functions left to Turnstone's managers.

Before you go on . . .

1. Define virtual corporations (VCs).
2. Describe VC benefits and IT support.

FOR THE ACCOUNTING MAJOR
One of the major issues in both strategic information systems and business process reengineering is the justification of the investment, which can be substantial. In order to collect the data for such a justification the accountant must understand these technologies and the role of IT. Also, the auditing of the supporting information systems, reengineered organizations, and virtual corporations may be more complex.

FOR THE FINANCE MAJOR
Investments in both SIS and BPR can be substantial. The finance department needs to conduct a cost-benefit analysis of proposed investments in either. Also, budgets for SIS and BPR projects need to be prepared and funds secured. To do an appropriate job, finance people must understand the nature of these technologies and the manner in which they enable organizations to seize opportunities and solve problems.

FOR THE MARKETING MAJOR
SIS and/or BPR are likely to change distribution channels, order fulfillment, customer service, and many tasks that are under the control of marketing and sales. SIS and BPR provide a chance for marketing and sales to significantly improve their
Describe strategic information systems and explain their advantages. Strategic information systems (SISs) support or shape competitive strategy. They can be outward (customer) oriented or inward (organization) oriented. They provide an organization with a competitive edge in its industry.

Describe Porter’s competitive forces model and how IT improves competitiveness. Porter’s model of competitive industry forces is frequently used to explain how companies can increase their competitiveness. It lists five forces that shape competition. Response strategies and related SIS can be used to lessen these forces. To counter the forces one can use strategies such as cost leadership, differentiation, and focus, which can be facilitated by SIS.

Describe representative strategic information systems and the advantage they provide with the support of IT. SIS can be used by both suppliers of goods and suppliers of services. A variety of companies use SIS to compete in their respective industries in cost leadership, quality, speed, growth, innovation, internal efficiency, and customer orientation. An SIS may provide support for more than one strategy. Today companies use the Internet, intranets, EDI, global ISDN networks, decision support systems, and intelligent systems to increase quality, productivity, and speed.

SUMMARY

1. Describe strategic information systems and explain their advantages.
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2. Describe Porter’s competitive forces model and how IT improves competitiveness.
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**Understand the role of business processes in organizations and the reasons why reengineering is necessary.**

Continual incremental improvements in business processes are necessary but are frequently insufficient to deal with today’s business pressures. One reason is that hierarchical organizations tend to be bureaucratic and inflexible and have difficulty in responding to cross-functional needs. BPR is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements. IT is the major enabler of BPR.

**Demonstrate the role of IT in supporting BPR and especially mass customization, cycle time reduction, self-directed teams, and empowerment.**

The trend is for organizations that are reengineered to behave like networks and operate in an online, real-time, empowered mode of operation. BPR applications include: (a) mass customization, which enables production of customized goods by methods of mass production at a low cost; (b) cycle time reduction, which is an essential part of many BPR projects and is usually attainable only by IT support; (c) self-directed teams, which can be permanent teams or quickly configured teams that solve specific problems and are then dissolved; and (d) empowerment of employees, which is done by providing them with IT-supported information and knowledge so they can work autonomously to make the necessary decisions.

**Describe virtual corporations and their IT support.**

One of the most innovative BPR strategies is the creation of business alliances and virtual corporations. A virtual corporation is an organization composed of several business partners sharing costs and resources for the purpose of producing a product or service. The VC can be temporary or it can be permanent. It is supported by telecommunications, extranets, EDI, and groupware software.

**DISCUSSION QUESTIONS**

1. Review the opening case. Explain how the use of IT helped the firm reengineer its core business process and how it will change delivery of its service.
2. Provide three examples of IT being used to build a barrier to entry for new competitors and new products.
3. Discuss the idea that IT by itself can rarely provide a sustainable competitive advantage.
4. What is the importance of business intelligence in strategic information systems?
5. Explain the role an intranet can play in lessening the stovepipe problem.
6. Relate virtual corporations to networked organizations. Why is a VC considered to be business process reengineering?
7. Discuss what it would be like if the registration process and class scheduling process were reengineered to an online, real-time basis with good connectivity and good empowerment in the university organization.
PROBLEM-SOLVING ACTIVITIES

1. Study the Web sites of Amazon.com and Barnes & Noble (barnesandnoble.com) and find some information about the competition between the two. Analyze Barnes & Noble’s defense strategy using Porter’s five forces model and its extensions. Prepare a report.

2. The normal way to collect fees from travelers on expressways is to use tollbooths. Automatic coin-collecting baskets can expedite the process, but do not eliminate the long waiting lines during rush hours. About 80 percent of the travelers are frequent users of the expressways near their homes, and they complain bitterly. The money collection process in some highways has been reengineered, reducing travelers’ waiting time by 90 percent and money processing cost by 80 percent. Several new information technologies including smart cards are used in the process. Find information on how IT is used to expedite toll collection.

3. Carlson Travel Network of Minneapolis is the second largest travel agency in the country. To save time and money for its customers it provides an agentless service to corporate clients, the first of which was General Electric Company. A computerized system allows GE employees to book trips by filling out a form on their PCs. The system is available 24 hours a day. It is connected with the computer reservation systems of major airlines, car rental companies, and hotel chains. The automated system generates detailed spending reports, enabling GE to negotiate special rates for their employees. Complex travel itineraries are still handled manually, but they account for less than 5 percent of the total trips. The system saves GE several million dollars each year.
   a. Identify the process reengineering activities.
   b. Describe the support provided by IT.
   c. Find other companies that allow their employees to book trips by themselves.

INTERNET ACTIVITIES

1. Enter SEC’s EDGAR database (http://freeedgar.com). Prepare a list of the documents that are available, and discuss the benefits one can derive in using this database for conducting a competitive intelligence.

2. Access the site of Levi Strauss or J.C. Penney. Find information about how to order their customized clothes. E-mail either company to find out more about their mass customization plan.

3. Surf the Internet to find some recent material on the role IT plays in supporting BPR. Search for products and vendors and download an available demo.

4. Enter ets.org. Find the ways you can download software for GMAT preparation. Compare the services provided to those you get in a regular bookstore. What competitive advantage does ETS have? How is it supported by IT?

TEAM ACTIVITIES AND ROLE PLAYING

1. Assign group members to each of the major car rental companies. Find out their latest strategies regarding customer service. Visit their Web sites, compare the findings, and prepare a report on competitiveness in the car rental industry and the role of IT. Prepare a Porter’s forces model to substantiate your findings.

2. Assign members to UPS, FedEx, and the United States Postal Service. Each group will study the strategies of one company with respect to overnight delivery and the use of the Internet as a transport medium.

3. Explore the concept of virtual classrooms and universities. (Start by visiting cs.unc.edu and arpa.mil/sbir.) Each member will explore an actual case. Summarize the findings. What competitive advantage is provided to universities that are offering virtual classes?
**REAL-WORLD CASE**

**Reengineering Professional Work with IT**

**The Business Problem**  
Mir Fox & Rodriguez P.C. is a 60-person Houston-based professional accounting firm that was experiencing a problem common to many professional services firms: stiff competition for qualified employees. The firm’s managers were spending more and more time supervising the staff. Work was getting bogged down in the process, and the firm’s bottom line began to suffer. That’s when Carolyne Fox, one of the firm’s founders, and her partners began looking for technology that could help them reengineer the actual process of one of their most common services, conducting an accounting audit. At the end of 1994, the principals at Mir Fox & Rodriguez embarked on a five-year plan to automate their business using new technology. Their initial goal was to work faster. “When we first started this process we had our blinders on,” Fox comments. “We were just focused on working faster, which we did. But we had simply automated what was designed to be a paper-intensive process. Then we realized we needed to completely change what we do and how we do it.”

**The IT Solution**  
Mir, Fox & Rodriguez chose Lotus Notes as the format to reengineer their business, run a virtually paperless office, and create new opportunities. Fox and her team created Virtual AuditorSM, a custom application developed using Lotus Notes R5. Virtual AuditorSM is comprised of 17 different Lotus Notes forms, programs within the application that automate the audit process. The heart and soul of the application is RiskmasterSM, a complex form that walks the auditor through a series of questions about the client’s business. Using mathematical formulas, RiskmasterSM evaluates answers to the questions and helps the auditor make the right decisions about what to do next. Fox says the firm chose Lotus Notes because it offers the advanced functions they needed, yet was not difficult to learn. “That was the real value,” Fox says. “With Lotus Notes, we could learn how to create these programs ourselves. We didn’t need to hire developers.”

While managers still need to review the audits, the staff is able to provide higher-quality work with minimal supervision because the application is providing the guidance that a senior person would offer. “We’ve taken our intellectual capital and encapsulated it in this application,” says Fox. “The program asks the right questions and then executes the judgment that a very senior person would.”

**The Results.** With Virtual AuditorSM, the firm is now operating in a virtually paperless environment. Fox says the staff is working at a higher level because no one is wasting time doing menial tasks such as photocopying. The technology helps the firm remain extremely profitable while keeping hourly rates down. “After the first year using Virtual AuditorSM our effective rate per hour went up $11 per hour, and we expect it to go up more this year,” Fox reports. “There’s no measure more critical than that.” Mir Fox & Rodriguez was so successful with Virtual AuditorSM, the firm is using the technology to create new business opportunities. After its consulting practice merged with another firm in January 2001, the firm launched Your Corner Office. The new company will offer financial and business advisory services over the Web to small and mid-size businesses—a market Fox says is often priced out of traditional professional services.


**Questions**

1. Most examples of reengineering of business processes deal with manufacturing and service provision, and relatively few deal with redesign of knowledge work of professionals. Should we assume that highly trained professionals have already designed their work processes to be as efficient and as effective as possible?
2. Which of the five forces of Porter are countered by the new systems at Mir Fox & Rodriguez?
3. Which competitive strategies of those suggested in the chapter are noticeable in this case?
4. Which of the business pressures discussed in Chapter 1 are evident in this case?
5. Which of the corporate response activities of Chapter 1 are evident in this case?
VIRTUAL COMPANY ASSIGNMENT

Extreme Descent Snowboards