



Gaining Competitive Advantage Through Operations

Learning Objectives

After completing this chapter, you should be able to:

- Understand how business processes create competitive capabilities that enable organizations to satisfy customer requirements.
- Explain how operations management can maintain an organization's competitive edge through high-quality production, convenient delivery, effective customer service, and competitive cost.
- Describe key business processes including strategy development, product development, system creation to produce services and goods, and order fulfillment.
- Discuss why operations are strategically important.
- List and define the steps necessary to link operations to corporate strategy.
- Describe how operations managers use information technology to increase productivity, improve quality, provide a safer environment, and reduce costs.

2.1 Achieving Competitive Advantage

Operations presents top management with many opportunities to develop competitive advantages. A **competitive advantage** is a capability that customers value, such as short delivery lead-time or high product quality that gives an organization an edge against its competition. When properly used, operations can be an important tool for improving profits, increasing market share, and developing new markets. A firm's **market share** is its percentage of sales in a particular market, that is, its sales divided by total sales for all organizations competing in a particular market.

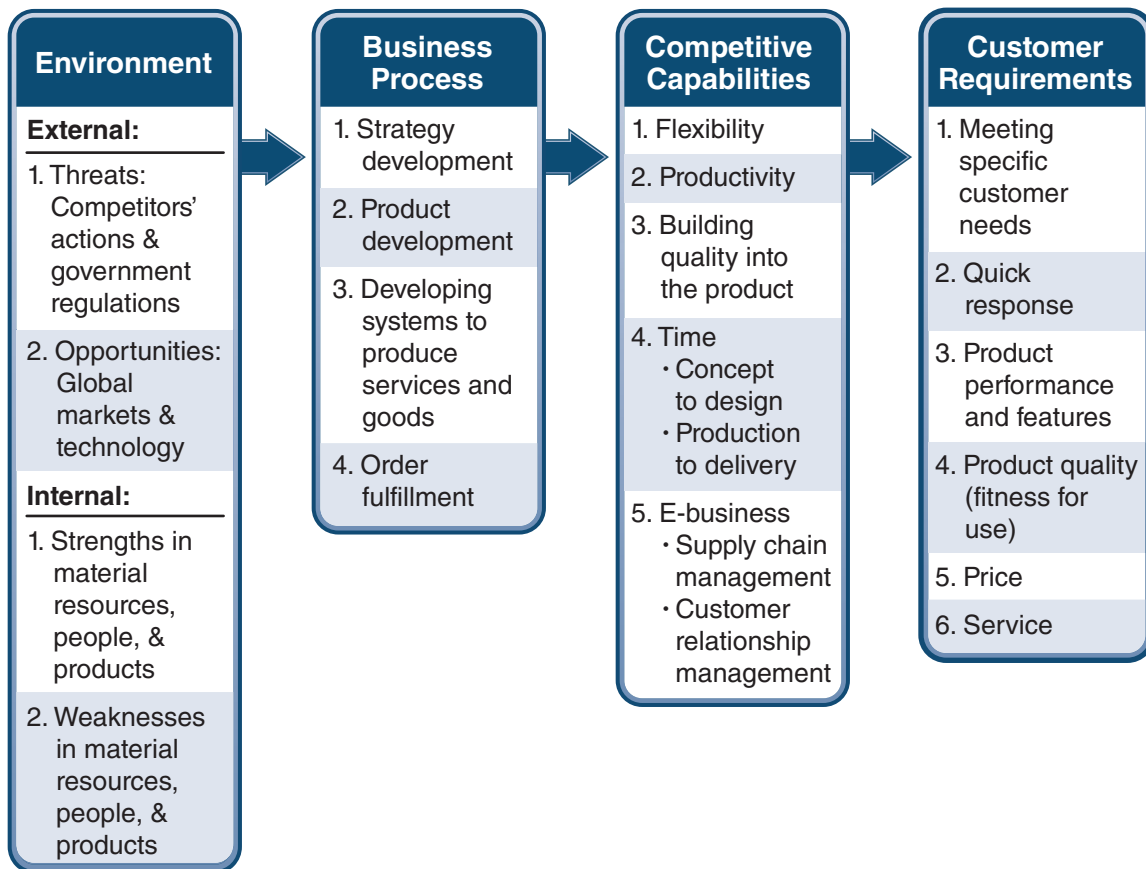
An organization creates a competitive advantage by giving customers what they want in a better way than other companies. What do customers want, or in other words, what do they value? Figure 2.1 provides a model for understanding how an organization can deliver competitive advantage to its customers. An organization should know its external environment (threats and opportunities) and its internal environment (strengths and weaknesses), and have a clear understanding of the customers it is trying to serve. This is often called "SWOT analysis," for strengths, weaknesses, opportunities, and threats. An in-depth understanding of customer requirements allows the firm to determine a set of competitive capabilities that will enable it to delight, rather than merely satisfy, customers. These competitive capabilities are, in turn, the result of well-designed business processes. These key business processes are cross-functional and require operations managers to work closely with their counterparts in accounting, finance, information systems, marketing, and other disciplines within the organization.



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A competitive advantage gives an organization the edge over its competition. By improving profits, increasing market share, and expanding into new areas, operations can work toward achieving this desired advantage.

A list of factors that customers value is provided in Figure 2.1. The factors that customers value as well as the relative importance of each factor vary from industry to industry and from customer to customer, but this list presents a good starting point. Figure 2.1 also provides a set of competitive capabilities that are affected by decisions made by operations managers. These competitive capabilities help the organization meet customer requirements, although there is not a one-to-one correlation between a competitive capability and a customer requirement. For example, flexibility in operations enables firms to meet specific customer needs quickly, but it may also impact product quality and price.

Figure 2.1: Model for developing competitive advantage

As shown in Figure 2.1, organizations must create business processes that enable the organization to improve the competitive capabilities needed to meet customer requirements, thereby satisfying customers. However, an organization's impact on competitive capabilities is not immediate, that is, no firm can create flexibility, productivity, or quality. Competitive capabilities are indirectly impacted through effective design and the implementation of the business processes that help the firm meet customer requirements. Figure 2.1 also provides a list of business processes that are related to operations. This list also may vary from industry to industry and from company to company within the same industry. Other processes not listed, such as those to recruit personnel or raise capital, are important, but they are not discussed in this text mainly because they are not central elements of operations management.

Upcoming sections in this chapter examine customer requirements, competitive capabilities, business processes, and technology, which is a critical tool for developing competitive advantage. Coverage of the environmental factors often appears in a course on business strategy or business policy and, with the exception of global competition and technology, will not be discussed here.

2.2 Customer Requirements

Customers are at the core of business operations. Satisfying customer requirements leads to a competitive advantage if an organization can meet needs better than its competitors. If these requirements were equally valued by all customers, regardless of product or industry, assessing customer requirements would be easy. However, there is no universal set of customer requirements for all industries or for all customers within one industry. For example, customers who purchase gasoline buy based on convenience, price, and service because gasoline is (despite industry claims to the contrary) an undifferentiated or standard product that is virtually identical from one company to the next. On the other hand, many customers buy automobiles based on product features, performance, quality, and price because automobiles are differentiated products. Some automobile buyers are less concerned about price and buy for the status associated with a high-priced, high-performance luxury car with all possible features. The same customer may

have requirements that change over time, so organizations must continuously measure and evaluate customer requirements.



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Because gasoline is, essentially, an undifferentiated product, customers purchase it based on convenience, price, service, and location.

To be successful at building competitive advantage, organizations should know who their customers are, and what their customers want. By understanding their customers' requirements, organizations can build a competitive advantage that enables them to compete in global markets. Understanding these customer requirements is essential for focusing on the right competitive capabilities and designing the best business processes. A brief description of customer requirements is listed in Figure 2.1.

- *Meeting specific customer needs*—Value is created by precisely meeting specific customer needs. For example, one approach to providing payroll software is to provide a generic package that many firms can use, but that does not exactly fit any given customer's needs. The generic package is usually less expensive than a software package written specifically for a particular organization. The generic package may require extra work by the customer, or the customer may decide to pay an additional fee to have the software customized to meet its needs. A competitive advantage can be gained by creating software with built-in flexibility, so that it meets the different needs of various customers. The competitive advantage of the software is greatly enhanced when this flexibility is offered and the price is close to the price for software that lacks this flexibility. This approach, sometimes called *mass customization*, enables firms to design, produce, and quickly deliver products that meet specific customer needs at a price that rivals mass-production. Mass customization is the firm's ability to produce differentiated products with

- cost effectiveness, volume effectiveness, and responsiveness to customers' needs. Volume effectiveness is the ability to produce goods and services in large enough quantities to meet overall demand.
- *Quick response*—It is usually an advantage for customers to have products available immediately upon request. Late delivery may create delays, increase costs, and create other problems for customers. Early delivery often creates storage problems, raises the risk of theft or damage as the item sits in inventory, and increases the need for working capital to carry inventory. Long lead times force customers to commit to the purchase decision before they need the product. This situation can lead to mistakes because the circumstances may change during the lead time. For example, buying next summer's wardrobe at a clearance sale in September incurs substantial risk for the style-conscious consumer. Similar problems occur when organizations force their customers to contend with long lead times when placing orders.
 - *Product performance and features*—Generally, high-performing products with many features are preferred by consumers, especially when acquired for little or no additional cost. Organizations that are innovative in design and production of services and goods can achieve this. When it was first proposed that automobiles come equipped with air bags to increase safety, there was great concern that the cost of the air bag (estimated at about \$600–700 each) would make the price of an automobile too high for the average consumer. Today, air bags are touted as an important safety feature; some vehicles have six, seven, or more. The cost of air bags has dropped dramatically because of better design, economies of scale in production, and productivity improvement through learning how to make the product better and cheaper—often called the learning curve. This is true for a variety of goods and services from the iPhone to automatic braking systems for vehicles, to mobile phone plans that offer more minutes as well as data downloads and Internet access at lower prices than voice-only plans from a few years ago.
 - *Product quality*—To the customer, product quality means fitness for use. Does the product do what the customer wants, and does it perform well? Quality is broadly defined and can include both product performance and features.
 - *Price*—The amount paid for a service or good is still important to consumers. In fact, it is the other half of the value equation. Value is what a customer gets for the price paid.
 - *Service*—Service is broadly defined. It includes companion activities, such as helping to arrange financing for a purchase or helping to install equipment. It also includes service after the sale—advice on operating a piece of equipment, providing repair parts, and processing warranty claims. If an organization can provide better service than its competitors, it may achieve a competitive advantage.

2.3 Competitive Capabilities

Competitive capabilities are the outcomes of well-designed business processes and, in turn, enable a firm to satisfy its customer requirements. They are outcomes that an organization has achieved, such as flexibility, so that a customer's needs can be met precisely, or productivity, so that costs can be kept low. The purposes of this discussion are to identify and define some of the most important capabilities required by most

organizations and to describe how they might be achieved. The list of competitive capabilities in Figure 2.1 is not intended to be exhaustive. The emphasis is on operations and discussion focuses primarily on operating issues and concerns.

Flexibility

Flexibility, as defined for operations, is the ability to modify production from one product to another in response to customer demands with minimal costs and delays. With flexibility, customer satisfaction increases and delivery time is reduced. Flexibility in operations may be as simple as a barber's chair that can be adjusted for a customer's height. It may be an employee at a medical clinic who can schedule patients, access electronic medical records, and bill insurance companies for medical claims. It may be a metal-bending press that can quickly be changed to produce a van door panel or a car hood. Flexibility can be helpful in gaining a competitive advantage in a variety of ways:

- With the ability to produce a wide variety of products quickly and cheaply, marketing can meet specific customer demands more closely and at a lower cost.
- Timely deliveries are possible because flexibility implies that inexpensive and quick changes can be made from one product to another.
- Changeover costs are reduced because it takes less time and effort to change production resources, thereby reducing operating costs.
- When sudden shifts in market preference occur, the cost of redesigning facilities and equipment is reduced because the system can more easily adapt to producing new and different products.

Marketing departments would like to satisfy all demands made by any customer because selling is part of the job. Sales can be more easily achieved when a wide variety of products is available for customer choice. Marketing also aims to avoid any unnecessary delays in delivering the service or good. Requesting that operations keep adequate stock of inventory for all items is one approach that can be used in the production of goods. Inventory, however, is very expensive to hold. Also, a high level of inventory does not ensure that the firm has what the customer wants because companies often have in inventory what is not selling, rather than what is selling. An organization can maintain quick delivery and still keep finished goods inventory low through reducing the changeover time between products, thereby adjusting production to meet the customer's needs.



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A barber chair can easily be adjusted to best fit each customer's height. This exemplifies operational flexibility, which is the ability to alter production processes in response to customer demands, with minimal costs or delays.

Real World Scenarios: Flint Auto Stamping Creates Flexibility Through Set-up Time Reduction

Flint Auto Stamping uses flexibility to gain a competitive advantage. Stamping involves sending flat sheets of steel through a series of large presses that shape the metal by hitting it with dies (molds). The dies are formed to the shape of the finished product. Flint Auto Stamping produces left-front and right-front quarter panels (fenders) for cars. To change from left to right quarter panels, the press must be stopped, and the dies that shape the metal must be changed. At Flint Auto Stamping, 4–8 hours are required to change dies. If they change dies each day, they will spend four to eight hours each day without production. Because of these delays, management will probably choose long production runs so the changeover times and costs will not be excessive. Longer production runs will lead to greater inventory of one part. Demand for the quarter panel not being produced must be satisfied from inventory because car assembly requires both front quarter panels at the same time.

If the time required to make the change was reduced to only 15 minutes, then management could afford more changeovers because less time would be taken away from production. More changes mean less inventory buildup, because the time until the next change is short and less inventory is needed to supply the part that is not being produced. Less inventory leads to lower cost, which is a competitive advantage.

Greater flexibility is a result of good planning and effectively organized changeover procedures that use written documentation and dedicated people—engineering, management, and labor—who are willing to work together. Flexibility can also be enhanced through the application of the most current technologies.

For service organizations, flexibility can be achieved by cross-training employees. Many service operations are labor intensive; if an organization wants to deliver a variety of services, it is important to train employees to perform more than one function. For example, an automotive repair firm may repair brakes, align wheels, and install batteries. If it has only one person who specializes in performing each service, it may have customers waiting for batteries, while no work is being done in brakes and wheel alignments, and two idle workers are present. Cross training can eliminate a problem such as this.

Flexibility in the production process also permits facilities to adapt to market changes. Disruptive technology, geo-political change, and global trade can cause relatively quick changes. Dramatic changes make it difficult for companies to maintain their competitiveness. Without the flexibility to adjust, firms may face lower profitability, declining market share, and even bankruptcy.

Highlight: Market Changes in Communication, Automotive, and Health Care Industries

iPhone as Disruptive Technology. A disruptive technology is a product that is substantially better than existing products: The iPhone is one such example. Disruptive technology makes it difficult for other companies to compete. For several years, the iPhone was available only with AT&T service, but as service expanded to include Verizon as an option, a large segment of the market purchased the iPhone. This had a negative impact on sales of the BlackBerry unit sold by Research In Motion (RIM), and RIM is struggling to regain lost market share with new products that are designed to compete with the iPhone. So far, these products have not been successful competitors. As a result, the stock price for RIM dropped from more than \$80 per share to less than \$15 in a very short time. Over the same period of time, Apple's stock price has increased to more than \$600 per share. Supplying new, better performing products to the market more quickly could possibly have helped RIM maintain its market share and financial performance. Apple's ability to design and improve its technology quickly—flexibility in design and production—and RIM's inability to do the same determine in large part their relative performance.

Oil Price and the U.S. Automobile Industry. Since 1973, the date of the first oil embargo, the U.S. automobile industry has faced several major changes in market preference between large and small cars. Prior to the embargo, gasoline was selling for \$.30/gallon, but afterward, gasoline doubled to \$.60/gallon, sending shock waves through the industry. In the early-1980s, the price more than doubled again to about \$1.30/gallon. In 1986, with crude oil prices falling, the price of gasoline dropped dramatically to about \$.70/gallon. However, the price soared again in 1990 to about \$1.50/gallon, only to drop again in 1998 to \$1.10/gallon. From 2000 to 2004, the price of gasoline fluctuated from as high as \$1.90/gallon to as low as \$1.20/gallon. By 2007, it approached \$5.00/gallon, but it was back below \$2.00 a gallon the next year. As of late-2012, it stands at about \$3.50/gallon, and it is not clear what the cost will be in the future.

Each dramatic increase in gasoline prices has decreased the demand for large vehicles with 8-cylinder engines and increased the demand for more fuel-efficient small cars with 4-cylinder engines. Once gasoline prices stabilized (or at least remained stable for a while) larger vehicles with 8-cylinder engines were in demand once again. For many years, the production lines that machined the engines were not flexible; they were set up to make only one type of engine. It was very time consuming and costly to shift production from 8-cylinder engines to 6-cylinder or 4-cylinder engines, and it was just as expensive to shift back when gasoline prices dropped. This inflexibility was a function of equipment design. When determining the most effective level of flexibility, decision makers in the automobile industry should consider the tradeoffs between shifts to new technology, extra costs of designing and operating flexible machining centers for engine blocks, and the cost of converting inflexible systems each time crude oil prices drastically change.

Global Trade and Health Care. For many years, items once manufactured in the United States such as apparel, furniture, and televisions, have been produced in other countries, such as Mexico, China, and India. Now, global trade is impacting health care as well as hospitals. Other countries are attempting to lure U.S. patients abroad for surgical and other procedures because the costs for these procedures are far less in other countries. This small but growing trend, called medical tourism, may eventually impact hospitals in the same way that global trade has impacted manufacturing. Health care providers must find ways to keep costs in check or reduce them, improve service quality, and enhance customer service to maintain their market position.

Productivity

Productivity is a mathematical calculation; it is the ratio of the outputs achieved divided by the inputs consumed to achieve those outputs. As productivity increases, organizations can do the same work with less effort, or can do more work with the same effort. Increases in productivity reduce costs, lower prices, and provide a basis for competing in world markets. While productivity is defined by a mathematical equation, efficiency is a general descriptor of the time or effort needed to do work. Efficiency is often used to mean achieving an outcome with a minimum amount of effort, that is, no waste. In this way, efficiency addresses the same challenges as productivity, which is a precise measure. More is discussed about productivity in a later chapter.

Productivity improvements are beneficial to the organization, to management, to consumers, and to workers. In any situation, there are limits on resources, capital and equipment, material and energy, and labor. Additionally, none of these resources is free. If an organization can produce more products with fewer resources, while improving quality, it will achieve two significant advantages. First, the unit cost of the product will decline because less labor or fewer materials are required to produce each unit. This, in turn, makes the product cost less and the company more price competitive. Second, there will be unused resources that can be used to develop and produce new products and enhance existing products. When significant increases in productivity have been achieved, revolutionary changes in resource allocation have occurred. These types of shifts in resource allocation have changed the face of economic development in the United States three times.

The First Revolution

Increases in farming productivity resulting from the development of better methods and machinery have caused farm labor in the United States



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The advent of farming equipment caused farm labor in the United States to decline from 95% to less than 3%. This shift allowed workers to focus on creating and producing consumer goods and services.

to decline from 95% in the early 1800s to less than 3% today. Those who had been working on the farms then became free to work in other areas producing a vast array of consumer goods. It also provided the opportunity to expand leisure time by reducing the work time to only 40 hours per week. At the same time, the prices consumers paid for food as a percentage of income have declined drastically. Consumer goods such as automobiles, home appliances, and electronic gadgets were developed and produced by labor freed from farming tasks. These changes have improved business opportunities, created new jobs, and improved living standards. These improvements

would not have been possible without the development of better methods and machinery that allowed companies to reallocate their human and physical resources from farming to the production of goods.

The Second Revolution

During the late-1800s and the first half of the 1900s, improvements in manufacturing productivity freed resources for the rapid expansion of service operations. As manufacturers invested in equipment to automate production, less labor was needed to make the same amount of finished goods. Banking, health care, insurance, retail, and other service industries grew because of the labor freed by mechanizing operations. Greater opportunities for services became possible because labor productivity improvements in manufacturing allowed the U.S. economy to do more with fewer people and resources. This is how real improvement in living standards can be made.

The Third Revolution

The next wave of productivity improvements began in the 1950s with the development and commercial application of computers. This phase, which some call the post-industrial era, began with large, difficult to operate mainframe computers used by governments and a few very large businesses. Improvements have progressed with the use of large scale databases, telecommunications technology, the personal computer, the Internet, and smart devices. Now, the possibilities and potential uses of these kinds of technologies are endless. As this technology is applied to problems in decision making on the factory floor, in the office, in the hospital, in government, and so and on, productivity of blue- and white-collar workers will increase. This technology allows fewer people to do more work.

Building Quality into Products

For firms to remain competitive in today's global markets, they must produce high-quality products. To remain cost-competitive, organizations must find ways to improve product quality without increasing costs. Technological advances can lead to reduced costs, improved product performance, and enhanced quality. Enhancements in quality can result from applying new technology (such as advances in micro and robotic surgery), developing new materials (such as high-strength carbon fiber composite materials to replace steel), and improving operations through better management and training.

Highlight: Building a Culture of Quality: China and Japan

The importance of building quality into products is evident in a growing reluctance to purchase certain products, including food and toys from China because of well-publicized failures in China's production systems. For China to maintain and grow its economy through global trade, it must create a culture of quality that will root out these problems, and build products that customers will seek out and pay a price premium to obtain. This is the approach Japan has taken, beginning in the 1950s under the leadership of W. Edward Deming and Joseph Juran. Using their quality principles, Japan changed its perception from low-quality trinket producer after World War II to the maker of high-quality, high-technology products by the 1970s. However, even with this renewed perception, a long history of high-quality products can be damaged. For example, the substantial quality defects involving Toyota automobiles with unintended acceleration have had a significant and negative impact on sales. The quality defects and the impact of the 2011 tsunami on key suppliers' ability to deliver components have lowered Toyota from the number one spot in worldwide automobile sales, a position now occupied by General Motors (GM).

High Quality and Low Costs: The Ideal

At one time, many consumers believed the old adage "You get what you pay for." As a result, consumers thought they had to pay more to get high quality. Although this statement has intuitive appeal, history has shown that improvements in quality can be achieved while costs are held constant or even reduced. Consumer electronics such as flat panel televisions and home security systems have seen large improvements in quality while prices have remained the same or have dropped substantially. The flat panel televisions of today offer better picture quality and features for about a third of the price of those from 10 years ago. Research and development has helped to drive these improvements. Automobiles, which have risen in price over the past 30 years, have had substantial innovation and improvement, dramatically enhancing quality. Passenger safety, fuel economy, entertainment and navigation systems, and rear view cameras are now mainstay features. The price of today's vehicles compared with vehicles from 30 years ago is relative if prices are adjusted for inflation.

It is true that high quality can be achieved with high costs and that there will always be a market for exclusive products. But mass-market appeal requires the right combination of quality and lower costs, as illustrated in Figure 2.2. Organizations that can come closest to achieving this ideal product will have a tremendous advantage over the competition.



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During the past 30 years, substantial innovations have been made to enhance the quality of today's cars. Features include improved passenger safety, fuel economy, and entertainment and navigation systems.

Figure 2.2: Blending quality and costs

		Quality	
		High	Low
Cost	High	Limited market appeal because of cost	Complete failure
	Low	Ideal product	Limited market appeal because of quality

Moving Toward the Ideal Through Technology

To move toward the ideal of high quality and low costs, improvements in product and process technology should be considered. Recall from Chapter 1 that product technology refers to the way the product functions, and process technology refers to the way the product is made.

A look back at the evolution of television provides a perspective on product technology's potential impact on quality and cost. In the mid-1950s, when color television was first introduced, televisions had a large picture tube and a dozen or more smaller tubes inside, and each unit cost about \$600. Minimum wage at the time was \$1.00/hour. Picture quality was poor and the life of a color television set was only a few years. Refinements in technology, including transistors and printed circuit boards, allowed producers to reduce costs and significantly improve quality. In 1982, a 25-inch color console television cost about \$500. With today's digital technology, a 50-inch, non-3D, flat panel television costs about \$600, and the minimum wage is now more than \$7.00/hour. Televisions are now an especially good bargain because these prices are not adjusted for inflation.

Process technology is the method of making a product, so it may not be possible to see the improvement in the product itself. For example, gall bladder surgery is routinely completed using microsurgery, which is less invasive, takes less time, and has a shorter recovery period than other methods. The product remains the same, removal of a non-performing gall bladder, but only the process and the quality change. In manufacturing, improvements in process may also include the use of machines to complete difficult and demanding jobs. It is likely that most vehicles currently on the road are held together with spot-welding completed by robots rather than people. Robots will not tire or fail to show up for work. Robots can complete high-quality welds and place them in the exact same location each time. By placing the weld in precisely the right place each time, fewer welds are needed to make a strong frame than if placed by humans. In most cases, mechanized welding of all types is a process improvement that leads to faster, cheaper, and stronger welds than manual welding.

Moving Toward the Ideal Through Better Management

Higher quality and lower costs can also be achieved through better management practices, including quality and cost-management programs that trim waste from operations, better training and motivation for employees, and greater attention to machine maintenance.

But which should be first: new technologies or improved management practices? Improved management practices should come first. Full benefits from implementing new technology will result when existing operations are well understood and running properly. Implementing new technology prior to correcting poor management systems usually leads to little, if any, return on the organization's investment. If managers are having difficulty with existing operations processes, it is unlikely that they will be able to understand and control more sophisticated technology and operations.

Time

Competing on time has become an important way to build competitive advantage because rapid market changes place a premium on quick response. Time-based competition is a strategy of seeking competitive advantage by quickening the pace of critical organizational processes, such as product development, order entry, production, distribution, and service. The emphasis is on end-to-end time (i.e., aggregate time) from the generation of new product concepts to the delivery of finished products, rather than the time to perform specific tasks or functions. Time is a fundamental business performance variable. Time, therefore, becomes one of the critical objectives for organizations redesigning their business processes. Organizations such as Hewlett-Packard, L.L. Bean, and GE are competing on time. Each company is quickly introducing new products. These companies, and many others, are reducing time from product development as well as order fulfillment.

E-Business

E-business (i.e., electronic business) often means different things to different people. **E-business** involves the use of electronic platforms to conduct company business. It means



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E-business is an electronic platform that enables fundamental changes in the way organizations, supply chains, and customers interact.

applying computer and information technology to design, plan, and manage operations and to track transactions between organizations and suppliers, and between an organization and its customers. Two decades ago, computer systems focused on reporting results and tracking performance. Today, computer technology has become a proactive tool for working with suppliers and customers. The primary reasons for the differences between the e-business systems of today and the computer systems of 20 years ago include advances in software development, and substantial

improvements in speed, power, size, and costs of hardware. Today, processing speeds, database capacity, telecommunications capability, networking, and handheld devices (among others) have improved exponentially while costs have dropped drastically. These improvements are powerful forces that enable e-business solutions to make fundamental changes in the ways that organizations, supply chains, and customers interact.

E-business can be divided into two elements: **business-to-business (B2B)**, or supply chains, and **business-to-consumer (B2C)**, or customer relationships. B2B refers to transactions between organizations in a supply chain, such as IBM selling computer services to Priceline.com or Boeing. B2C refers to transactions between an organization and its final customer, such as Amazon.com selling books or music to consumers via the Internet.

Supply Chain Management

Supply chains encompass all activities associated with the flow and transfer of goods and services, from raw material extraction, through use by the organization that sells to the final consumer. In oil refining, that includes everything from locating and pumping crude oil, to the sale of gasoline at the service station. Information flows in both directions along the supply chain while materials flow, at least ideally, in a consistent and orderly fashion toward the final consumer. Service providers play an essential role in helping organizations design, plan, and manage these information and material flows so that efficiency, speed, and on-time delivery are achieved. Engineering firms design and install material handling systems, transportation companies move materials between facilities, and computer-based companies design and implement information systems to help manage these activities.

Supply chain management is the integration of these activities through improved supplier relationships to achieve a sustainable competitive advantage for all members in the supply chain. It is an essential ingredient for competition. Progressive organizations have recognized that competition is no longer between individual firms, such as between Toyota and Ford, or between GM and Volkswagen, rather it is between their respective supply chains. The development, design, production, marketing, and delivery of a new car should be a coordinated effort that begins with extracting raw materials from the earth, continues through design, fabrication, and assembly, and ends with fit and finish in the dealer's showroom. When a customer purchases a car from Ford, for example, the customer chooses the output of the entire supply chain and pays all the participants in that chain. To be successful, Ford must develop methods to manage the supply chain beginning with basic materials, such as iron ore, sand, and crude oil, and ending with the dealer. That does not necessarily mean ownership or even direct control, but it does imply mechanisms that influence decision making and impact performance. These relationships should work to the benefit of all the participants. The impacts of supply chain and supply chain management are evident in two recent examples.

Highlight: Supply Chains Are Keys to Success

When Chrysler and General Motors faced bankruptcy in late-2008 and 2009, there was grave concern for what would happen to the supply chain. Many of Chrysler's and General Motors' suppliers were also suppliers to Ford, Honda, Toyota, and other assembly plants in the United States. Bankruptcy of Chrysler and General Motors would most likely lead to bankruptcy of key suppliers, which could create problems with the entire automobile industry in the United States. To resolve this issue, the bankruptcies were orchestrated so the two automakers and their suppliers continued business. The automakers exited bankruptcy stronger and more likely to succeed. The recent successes of Chrysler and General Motors, as well as Ford (which did not file for bankruptcy) illustrate the success of these efforts.

The tsunami that hit Japan in 2011 created significant damage to key automotive suppliers in Japan, and forced Toyota to scale back production. Many of these suppliers were located in the vicinity of the tsunami, and product facilities were damaged and buildings were without power, making cleanup and production difficult. Despite the comprehensive and effective contingency plans in place, the magnitude of the disaster was so large that Toyota could not maintain worldwide production.

Customer Relationship Management

Customer relationship management (CRM) is a process to create, maintain, and enhance strong, value-laden associations with customers (both individuals and organizations) that purchase products. CRM moves beyond short-term transactions to build long-term relationships with valued customers, distributors, and dealers. Firms using CRM attempt to build strong economic and social connections by promising and delivering high-quality goods and services at a fair price and in a timely manner. Increasingly, firms are focusing on building mutually beneficial relationships with customers, distributors, and dealers instead of working to maximize the profit on any individual transaction. Firms can use the following ideas to develop stronger relationships with customers.

- *Financial benefits*—Firms can build value and satisfaction by adding financial benefits. For example, airlines offer frequent flyer programs, hotels provide room upgrades to guests with a certain number of visits, and supermarkets give preferred customers discounts on items.
- *Social benefits*—Firms can build allegiance by increasing their social bonds with customers by learning individual needs and then personalizing service. Ritz-Carlton hotel employees treat customers as individuals by attempting to learn and use their names. The hotel records specific information about customer preferences in a database, and other Ritz-Carlton hotels around the world use this information. Customers with a special request in one hotel should find that request met the next time they stay at a Ritz-Carlton hotel, even if it is in another city or country.
- *Structural ties*—Firms can add value by creating additional support services that make it easier to buy products from them. A business might supply customers with special equipment or online links that help them manage their orders. For example, Dell creates personalized websites for its large commercial customers that provide most of the information and support the customer may need. In addition to handling purchases, the site also supplies tailored technical support, diagnostic tools, and other features designed for the customer.

Real World Scenarios: Amazon Makes It Easy

Amazon.com started as an online bookseller about 20 years ago, stating that its goal was to become the largest bookseller in the world. The company grew rapidly for several years before it encountered very challenging times when the dot-com bubble burst. Amazon understood that its competitive advantage was access to a large, growing, loyal customer base, so it expanded its services to include a wide variety of products. Amazon also decided to provide brokerage services to other companies, so its customers could have access to a wider selection of products. Items found on Amazon's website may be owned, warehoused, and shipped by Amazon's partner company. Amazon receives a portion of the selling price without any associated costs except listing the items on its website. Amazon is often the first place that many online shoppers search when buying almost any product. This growth in business has driven Amazon's stock price from single digits after the dot-com bust to nearly \$200/share. It also has driven many brick and mortar book stores out of business and nearly forced others into bankruptcy.

2.4 Designing Business Processes That Build Competitive Capabilities

Organizations do not control customer satisfaction directly. When a customer purchases a product, it is through the consumption of the product that customer satisfaction is achieved. As shown in Figure 2.1, focusing on business processes is a critical factor in achieving competitive capabilities, which leads to customer satisfaction, which, in turn, leads to organizational success. An organization may have several different processes and many sub-processes within each process. The discussion here is limited to four key processes that most organizations have, and that are substantially impacted by operations: strategy development, product development, development of systems to produce services and goods, and order fulfillment.

Strategy Development

As described in Chapter 1, strategy should drive an organization toward its ultimate objective. A strategy considers the threats and opportunities in the environment, and it measures the strengths and weaknesses of the organization. Strengths, weaknesses, opportunities, and threats represent inputs to strategy development. The strategic planning process provides a path toward the organization's



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The lunar landing required a cooperative effort of several teams. This feat would have been impossible to achieve if only one team had been working toward this goal.

objectives. This path includes setting goals, developing action plans for achieving the goals, and determining resource requirements. Developing a strategy requires a team with specialized knowledge from different functional areas or disciplines. When operational plans are linked to financial, marketing, engineering, and information systems development plans, synergy can result. Synergy involves cooperative actions (teamwork) in which the total effect of the actions is greater than the sum of the individual effects (i.e., the whole is greater than the sum of its parts). For example, putting a man on the moon is a feat that required a cooperative effort no single part of the team could have achieved, no matter how long and hard it worked. A brief description of the process for strategy development is provided later in this chapter.

Product Development

Product development is a teamwork-oriented process that begins with the organization's strategy and analysis of the markets as inputs. The team develops a product concept, generates a product design, and provides a process design for producing the service or good, which are the outputs. Knowledge regarding customer preferences, technology, operating capabilities, financial constraints, distribution systems, and so on, should be available from specialists in accounting, finance, marketing, research and development, engineering, information systems, and operations.

Developing Systems to Produce Services and Goods

Developing systems to produce the services and goods designed in the product development process requires firms to assemble resources—people, facilities and equipment, and material and energy. These resources may be part of the organization, or they may be contracted by another firm. Important knowledge inputs needed to develop an effective production system are the product and process designs created in the product development process. These designs help to guide decision making.

Traditionally, these topics are included in operations management, but organizations that want to ensure success recognize the interdisciplinary nature of these tasks. Accounting and financial information is necessary for decision making, and human resources are necessary to make the system work. Engineering principles, especially industrial engineering, are an important foundation of this design for both services and goods. More is covered on this topic later in the book.

Order Fulfillment

This process involves all the steps required to satisfy a customer's order, from obtaining an order and entering it into the organization's information system, to delivering the order. The primary inputs are from the customer, marketing, and the people responsible for designing the facility that will produce the service or good. The desired output is a satisfied customer, not the delivered product. While this difference may seem small, it is important to remember that an organization is only successful when customers are satisfied. Order fulfillment should be a highly integrative teamwork-oriented process that includes many disciplines and activities, such as sales, credit verification, analysis of working capital needs, and selecting shipping routes and transportation alternatives. Producing the services and goods intended to satisfy customer requirements is an important part of order fulfillment. This execution is dependent upon the organization's ability

to plan and manage operations, including production planning, scheduling, inventory control, purchasing and material management, and project management. These activities influence and are affected by activities carried out in other parts of the order fulfillment process. Details of the order fulfillment process from the operations management perspective are provided later in the book.

2.5 Strategy Development and Operations

Strategy begins with the organization's goals and includes the key policies that are established to direct actions toward meeting those goals. As an organization defines its corporate strategy, a framework is created that enables the firm to develop a set of functional strategies consistent with and integrated to the corporate objectives. Research and development, marketing, engineering, operations, and other functional areas need to develop objectives, plans, and programs that are consistent with corporate goals.

An advantage that can be achieved by improving operations should be pursued because it fits the organization's overall goals, not because it fits a narrowly defined operating objective, such as minimizing transportation costs. Minimizing transportation costs, for example, may not be in the best interests of an organization if inventory holdings or other costs would increase too much, or if product quality or on-time delivery would be negatively affected. Operational goals should be important only when they help the organization reach its objectives. The following sections describe how corporate strategy is linked to operating strategy.

Linking Corporate Strategy to Operations

Corporate strategy and operating strategy must be carefully linked. Operations can become a positive factor contributing to organizational success, rather than a negative or neutral factor. To make this happen, facilities, equipment, and training should be viewed as a means to achieve organizational, rather than operational, objectives.

Real World Scenarios: Midas and Genoa Ford, Same Service but Not Competitors

A typical Midas shop and the service center at a dealership such as Genoa Ford provide the same service, but are they really competitors? Each has adopted different strategies and tailored their operations to fit those strategies.

Midas is in the automotive repair business. Its strategy is to provide a narrow range of services at low cost. National advertising is used to develop wide geographical coverage. The company is not a full service repair shop, but concentrates on muffler repair, brakes, and shock absorbers. It is successful because it quickly delivers quality services at low cost. How are operations important to Midas?

1. Limited service requires a limited inventory that allows convenient storage close to where materials are needed to perform operations.
2. Multiple shops and limited service permit careful engineering of the necessary hand tools and work procedures. These special tools and work procedures make shop employees more efficient. Midas can apply the same tools and methods to a large number of shops, ensuring that initial engineering costs are easily covered.

(continued)

Real World Scenarios: Midas and Genoa Ford, Same Service but Not Competitors (continued)

3. Because employees have few variations in service, they learn how to perform these jobs more quickly.
4. Workers' skill levels and knowledge requirements focus on a limited area of service so they quickly become experts in a particular area.

As part of a Ford dealership, Genoa Ford's Service Center provides a full line of automotive repairs. In contrast to Midas, this service operation competes without advertising or national appeal. It also has a different operating strategy. In order to maintain the dealership, Genoa Ford must be able to satisfy a wide variety of customer needs. It offers transmission work, body work, engine repairs, and other tasks in addition to working on brakes, shocks, and mufflers as Midas does. Genoa Ford designs its operations to match its objectives.

1. The facility is adaptable to changing needs. For example, on one day, a single repair stall may be used to wash a new car, repair a door lock, fix an air conditioning leak, or tune an engine.
2. Genoa Ford has more tools than a specialist like Midas does because Genoa Ford offers a greater variety of jobs.
3. There is some job specialization among workers. All employees will not be able to do everything, but employees still need a wide range of skills because Genoa Ford does not have enough of one particular job to allow personnel to specialize. Cross-training is necessary.
4. The workers' skill levels and pay rates are higher than workers at Midas.
5. A significant inventory of many different parts is maintained. These parts are physically separated from the repair stalls and controlled by specialists in parts.

As a result of its strategy, Genoa Ford has higher costs and charges higher prices than Midas does for comparable work. When a car needs routine exhaust system work, it can be taken to a national chain such as Midas. Generalists, such as Genoa Ford, can complete more difficult jobs and repair work that is paid for by Ford as part of its new car warrantee program.

Analyzing, Appraising, and Designing

Management needs a strategic, top-down view of operations to successfully link corporate strategy and operating strategy. This process begins with analyzing the competitive environment, step 1 in the list, and ends with managing and controlling operations, step 7. Some important questions that define the process are provided in Table 2.1.

1. Analyzing the competitive environment (external environment—threats and opportunities)
2. Appraising the organization's skills and resources (internal environment—strengths and weaknesses)
3. Formulating corporate strategy
4. Determining the implications of corporate strategy for operating strategy
5. Examining the limitations economics and technology place on operations
6. Designing systems for operations
7. Planning and managing operations

Table 2.1: Analyzing, appraising, and designing

Stage of linking strategy	Key questions
Analyzing	In what market(s) is the organization planning to compete? Who are the present competitors, and what are their strengths? Who are the potential entrants? What changes in government regulations or business conditions may alter the competitive environment?
Appraising	What strengths does an organization possess? How may these strengths be used to take advantage of certain opportunities in the environment? What technological expertise and production capabilities are available? What markets or channels of distribution are open?
Formulating	What are the goals and objectives of the organization? What are the key policies for achieving goals? What policies will be set for minimizing security risks? How can customers be identified? Who are the competitors?
Determining	What are the strategic operating decisions? Where should the facility be located to provide rapid response to customer needs at an acceptable cost? What process technology will be employed and at what capacity? What is the level of product quality? Is there a trade-off between product cost and quality? What level of flexibility is required to produce services and goods for this market? Is the market likely to change, making flexibility important?
Examining	What are the specific limitations of the existing operations? What resources need to be improved or obtained in order to meet organizational objectives? How large will a particular facility be? How should the production resources be distributed? Should there be only a few large facilities with their associated economies of scale? Would several smaller facilities that are easier to manage be better?
Designing	How should operations be designed in order to meet the organization's objectives? How can flexibility be designed within the system to anticipate changing needs? What are the information-processing capabilities necessary to provide management with useful information for decision making?
Planning	How can the organization use the resources available to meet present and projected customer needs? How might those resources be changed through additional capital expenditures to satisfy changing demands? How well has the operations function performed in meeting the established plans? Has it been successful at moving the organization toward its short- and long-term objectives? Has operations made the organization stronger and given it a competitive advantage by making better quality products, providing improved service and shorter delivery lead times, or reducing costs?

All organizations operate within an environment that is shaped by external factors and forces over which there is limited control. These factors include the level of technology, labor supply, social and political environment, and an array of competitors and potential competitors, both domestic and international. Environmental legislation may dramatically alter an organization's cost of doing business in a way that does not affect competitors. New entrants into the market may possess strengths that provide a competitive advantage over firms already in the market. To be successful, an organization should know about the market in which it will compete as well as its environment.

2.6 The Role of Information Technology

The use of computers in service and manufacturing operations is not new. In accounting, computers are used to perform payroll, accounts receivable, and accounts payable functions. Computers are key to monitoring inventory levels and controlling quality. Airlines and hotels use computers to take reservations and to schedule flight crews and housekeeping. Computer technology is used to monitor flow process in paper-making and oil refining and to control metal-cutting machines that shape parts needed in automobile engines and refrigerator compressors. In these situations, computers provide feedback on operations and can take corrective action.



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Airlines and hotels use computers connected to the Internet to take reservations and to schedule flight crews and housekeeping.

In addition to these applications, which have been used for many years, computer and information technology is being applied to other elements of business to create an information-rich environment. In turn, these technologies provide access to data via sophisticated, complex databases and the wealth of information on the Internet. Worldwide travel registration sites Travelocity and Expedia are good examples of sophisticated Internet databases. A short discussion of expert systems and decision support systems provides some basic understanding of these tools.

Expert Systems

An **expert system** employs human knowledge that has been stored in a computer to solve complex problems. To be considered an expert system, the system must have: (1) a method of acquiring knowledge, (2) a knowledge base (memory), and (3) an inference engine (brain) so it can reason. Knowledge acquisition is the accumulation, transfer, and transformation of problem-solving expertise from a source, usually a human expert. The expert may have more work than he or she can complete. The expert will eventually move on or retire, so the idea of capturing the person's

working knowledge in a computer-based expert system is very appealing. **Knowledge engineers** help the human expert structure the job by interpreting and integrating human answers, drawing analogies, posing examples, and identifying conceptual difficulties.

The knowledge base can be thought of as a powerful database that contains facts such as the problem situation and theory in the problem area, as well as special rules that direct the use of the knowledge. The inference engine is a computer program that provides a methodology for reasoning. This component makes decisions about how to use the knowledge in the system. The inference engine interprets rules, maintains control over the problem, and enforces consistency as the recommended solution emerges. There are many potential applications for expert systems, from generating orders for inventory, diagnosing patients, troubleshooting equipment failure, advising on tax-sheltered annuities, and scheduling production.

Decision Support Systems

A **decision support system (DSS)** is a model-based set of procedures for processing data to assist managers in decision making. A DSS allows managers easy access to stored information and provides easy-to-use tools for analysis. With these supporting tools, management has the information to more easily control complicated manufacturing and service operations. A DSS is different from an expert system because an expert system has a rule base and an inference engine for decision making and a DSS does not. Once an expert system has been constructed, it can make a decision. On the other hand, a DSS provides information to help managers make decisions. In a DSS, the manager provides the logic to structure the problem and ultimately makes the decision.

A DSS can help a manager relate the demand for a product to the correct quantities of materials to be ordered to make that product. If a manager has received an order for 10,000 hair dryers for next month, how does he or she know the number of electric motors, wire connectors, and plastic parts to order? How does the order fit into the production schedule? Does the organization have sufficient capacity? What are the impacts on cost and quality if the orders are processed on certain machines? It becomes necessary to link these decisions by using the computer as a tool.

Role in Manufacturing

Computer-based control systems can be combined with manufacturing technology, such as robots, machine tools, and automated guided vehicles, to improve manufacturing operations. In this role, the computer can assist in integrating these technologies into a lean and efficient factory capable of competing in world markets. Organizations such as Allen-Bradley, Black & Decker, and Boeing have used information technology and factory automation to improve manufacturing operations. This combination of information technology and factory automation is often called computer-integrated manufacturing.

Computer-integrated manufacturing (CIM) blends developments in manufacturing with information technology to achieve competitive advantage. When properly organized, CIM offers the opportunity to automate design, manufacturing, and production planning and control.

- Engineering design through computer-aided design (CAD) allows an organization to rapidly make high-quality specialized designs. The designs can be tailored to meet individual customer needs.
- Flexible manufacturing systems (FMSs) can quickly produce a variety of high-quality products efficiently. A FMS also allows an organization to produce highly specialized designs.
- Computer-based production planning and control systems allow an organization to cope with the complexity of managing facilities that produce a wide variety of specialized products without losing efficiency.

When properly combined, these components can yield synergistic results. An organization can have more flexible and integrated operations, be better equipped to manage complex operations, and exercise better control than a company that operates without CIM. To merge these components into one coordinated whole, IT staff should integrate engineering, manufacturing, and business databases into a cross-functional decision support system. Once accomplished, the flexibility to respond to customer demands with low-cost, high-quality specialized products becomes a powerful competitive advantage.

Role in Service Operations

Service, by its definition, does not have a physical component. However, many organizations classified as service providers produce both goods and services. These hybrid operations include: restaurants, which sell food (a good) and prepare it (a service); department stores, which sell products as well as provide retailing services; and shops that sell parts and offer repair services.

Real World Scenarios: Kroger

Kroger supermarket's automated warehousing provides its competitive advantage. Retail food is a competitive business with low profit margins. To remain price competitive, Kroger must cut inventories and warehousing costs and maintain adequate supplies of thousands of products. To achieve these goals, Kroger has implemented automated warehouses and point-of-sale inventory tracking. The process begins when a customer purchases an item. An electronic scanner reads the bar code on the product. The cash register, which is really a computer terminal, records the sale of that item in the computer's database. At any time, a store manager can tabulate sales by product. In addition, orders can be sent electronically to the automated warehouse. The orders are filled using automated stock pickers and shipped the next day. At the warehouse, computers help to track shipments to individual stores and place orders to suppliers, so that inventory costs in the warehouse are low, and product availability is kept high.

For many services, the tangible part of a product is not significant. Within these operations, managers cannot buffer customer demand from the production process with finished-goods inventory. Managers in service operations must find other ways to provide better and faster customer service. Implementing information systems that provide up-to-date and accurate information about availability of the service and how customers can acquire it is one way to do this. Many opportunities exist for using computers and information technology to improve service operations and to gain competitive advantage. In order to remain competitive, future managers should understand this technology and be capable of implementing it successfully. Tomorrow's managers will be expected to be more efficient and increase the quality of their work with these tools for improvement.



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Several supermarkets use automated warehouses and point-of-sale inventory systems to keep inventory costs low and product availability high.

Real World Scenarios: BNY Mellon and Merck & Co.

BNY Mellon bank and others are using an expert system to successfully battle credit card fraud, which is a multibillion dollar problem in the United States. The computer-based expert system examines 1.2 million accounts each day for many factors, such as an unusual number of transactions, charging large amounts, and changing patterns of expenditures. The system identifies nearly 100 cases each day that require more investigation. Mellon paid approximately \$1 million for the software, and predicted that it will pay for itself in 6 months.

Merck & Co., one of the largest drug companies in the world, decided to completely revamp its benefits system. To enroll more than 15,000 salaried employees using printed forms would have required Merck to double its personnel staff. Instead, the company spent \$1 million to write computer software and install 24 machines (similar to the ATMs at banks) to enroll its employees. Enrollment took only 5 weeks and not one person was added to the personnel staff. Merck is using similar systems to allow employees to adjust withholding allowances and reallocate their investment plan without speaking to personnel in payroll. Merck's software prevents employees from selecting options for which they are not eligible.

Chapter Summary

- Satisfying customer requirements means building competitive capabilities, such as flexibility, productivity, quality, and time.
- Competitive capabilities are the results of good business processes.
- Operations should be viewed by top management as an opportunity to develop competitive advantage. When properly designed, operations can increase an organization's flexibility, reduce costs, enhance quality, and improve productivity.
- Operations are strategically important to an organization's success. Without this strategic view, an organization can never reach its full potential.
- Links that connect operations to an organization's strategy begin with analysis of the competitive environment and include an appraisal of the organization's skills, the implications of corporate strategy for operations, and the economic and technological limits of operations.
- Computer and information technology helps an organization to achieve a competitive advantage. These systems provide information to enhance decision making and improve control by integrating various parts of the production process.
- Applying information technology to service operations is one way to achieve a competitive advantage.

Case Study

Midas

Assume that Midas is deciding whether it should add engine tune-ups to its existing product line. Top management has called you in as a consultant to help it to analyze this opportunity. The first thing the consultant asks you to do is read the Midas and Genoa Ford Feature in this chapter.

Management is concerned about the impact that this new service will have on existing operations. Presently, the company has a policy that customers will not wait longer than 30 minutes for muffler service. How can Midas maintain that pledge? What methods for scheduling tune-up service might make it easier for Midas to keep its pledge? If reaction to the new service is great, the shops may not have the capacity to satisfy demand. Should the company add capacity to existing shops to take the extra load, or should it add more shops? How will the shop owners react to the new proposal? Assume that most of the shops are very profitable. Will the owners want higher profits?

Midas's management is looking for help in organizing its thinking and has asked you to respond to the following questions in a two-page report. Your responses should include the critical issues raised in the previous paragraph.

1. What are the anticipated impacts upon operating efficiency? How would you attempt to minimize the negative impacts?
2. Should some operating practices be changed to accommodate the tune-ups?
3. Should input be gathered from the shop owners? If so, what?
4. If Midas decides to launch this new program, how should it begin?

Discussion Questions

1. To be successful, organizations should focus on customer requirements. List the ways operations can help satisfy customer requirements, and discuss each briefly.
2. How can the following attributes help an organization achieve competitive advantage?
 - a. Flexibility
 - b. Productivity
 - c. Quality
 - d. Supply chain management
 - e. Customer relationship management
3. Why are the following business processes important?
 - a. Strategy development
 - b. Product development
 - c. Systems to produce goods and services
 - d. Order fulfillment
4. How and why are operations strategically important?
5. How can an organization link corporate strategy and operations? Describe the process.
6. Describe the role of computer and information technology in improving operations.
7. Describe some ways that manufacturing operations can use computer and information technology to gain competitive advantage.
8. Describe some ways that service operations can use computer and information technology to gain competitive advantage. Why are these methods different from those used by manufacturers?

Key Terms

business-to-business (B2B) Business to business Internet transactions; these are supply chain transactions.

business-to-consumer (B2C) Business to consumer Internet transactions; these help firms manage customer relationships.

competitive advantage An organization's special abilities, such as shorter delivery lead-times or higher quality products, which customers value and which gives the organization an edge on its competition.

computer integrated manufacturing (CIM) Blends recent developments in manufacturing with information technology to achieve a competitive advantage.

customer relationship management (CRM) A process to create, maintain, and enhance strong, value-laden associations with people and organizations that buy products.

decision support systems (DSS) Systems that allow managers to easily access information stored in a database and provide easy-to-use tools for analysis.

e-business Involves the use of electronic platforms to conduct company business. It has two types of transactions: business-to-business and business-to-consumer.

expert system A computer-based approach that uses knowledge and inference procedures to solve problems that are difficult enough to require significant human expertise for their solution. The knowledge and the inference procedures are attempts to create a model of the best practitioners in the field.

flexibility The ability to modify production from one product to another in response to customer demands, with minimal costs and delays.

knowledge engineer One who helps human experts structure the problem by interpreting and integrating human answers, drawing analogies, posing examples, and identifying conceptual differences.

market share An organization's sales in a market divided by the total sales for that market.

productivity Output from an activity divided by total input to the activity.

