

INTERACTIVE SESSION: MANAGEMENT

The Mobile Pocket Office

Can you run your company out of your pocket? Perhaps not entirely, but there are many business functions today that can be performed using an iPhone, iPad, or Android mobile handheld device. The smartphone has been called the “Swiss Army knife of the digital age.” A flick of the finger turns it into a web browser, a telephone, a camera, a music or video player, an e-mail and messaging machine, and, increasingly, a gateway into corporate systems. New software applications for document sharing, collaboration, sales, order processing, inventory management, and production monitoring make these devices even more versatile business tools. Mobile pocket offices that fit into a purse or coat pocket are helping to run companies large and small.

Sonic Automotive is one of the largest automotive retailers in the United States with more than 100 dealerships in 14 states. Every year Sonic sells 250,000 new and used cars from approximately 25 different automotive brands, and it also sells auto parts and maintenance, warranty, collision, and vehicle financing services. Sonic Automotive managers and employees do much of their work on the iPhone and iPad.

Sonic developed several custom iPhone and iPad applications to speed up sales and service. Virtual Lot, a dealer inventory app, lets sales associates quickly search for vehicles held in inventory by all Sonic dealerships. They have immediate access to vehicle information, pricing, trade-in values, interest rates, special promotions, financing, and what competitors are charging for identical vehicles. The associates can quickly find the best selection for each customer and often offer far more choices than the competition. Dealers are not limited to selling only their own inventory.

A mobile app called the Sonic Inventory Management System (SIMS) has speeded up and simplified trade-in appraisals and pricing. Sonic staff use their iPhones or iPads to take photos of a car, input the vehicle identification number (VIN) and mileage, and note any issues. The data are transmitted to corporate headquarters, which can quickly appraise the car. A Service Pad app simplifies the steps in repair and warranty work. In the past, customers with cars requiring repairs had to go inside the dealership and sit at a desk with a Sonic staff member who wrote up the repair order by hand. Now the Sonic staff

members go outside to the customer's vehicle and enter the repair order on an iPad on the spot.

SKF is a global engineering company headquartered in Gothenburg, Sweden, with 140 manufacturing sites in 32 countries and 48,500 employees worldwide. SKF produces bearings, seals, lubrication systems, and services used in more than 40 industries, including mining, transportation, and manufacturing. SKF has developed more than 30 custom iPhone and iPad applications for streamlining workflows and accessing critical corporate data from anywhere in the world.

For example, a virtual reality app uses the iPhone or iPad camera to identify a factory machine and produce a 3-D overlay of the SKF parts it contains. A sensor-driven app called Shaft Align is used by SKF service teams and customers in the field. Shaft Align connects via wireless Bluetooth sensors to a piece of machinery such as a motor-driven fan to ensure that the drive shaft is running in proper alignment. If not, the app generates step-by-step instructions and a 3-D rendering to show how to manually align the motor. Then it checks the work and produces a report.

A mobile app called MOST enables factory operators to monitor some SKF factory production lines. MOST links to the back-end systems running the machinery and provides operators with key pieces of data. Operators using this mobile app are able to use secure instant messaging to communicate with managers and each other, update maintenance logs, and track products in real time as they move through the factory line.

SKF's Shelf mobile app allows sales engineers and customers to access on demand more than 5,000 pieces of product literature, catalogs, product specifications, and interactive marketing materials. Sales teams can use Shelf to create custom “shelves” to organize, annotate, and share materials with customers right from their iPhones or iPads. The iPhone, iPad, and Shelf app save company sales engineers as much as 25 minutes per day on processes and paperwork, freeing them up to spend more time in the field supporting customers. This increase in productivity is equivalent to putting 200 more sales engineers in the field.

SKF auditors perform about 60 audits per year, and each audit used to take more than a month to complete. With the SKF Data Collect app, auditors

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are able to use their iPads to collect data and present customers with detailed reports instantly.

SKF Seals offers specifications and information about SKF's machined and injection-molded seals and plastic parts, while the Seal Select app helps users select seals and accessories using several different input parameters to find the right solution for their needs.

Sources: "Sonic Automotive: Driving Growth with iPhone and iPad" and "Driving Innovation in the Factory and in the Field with iOS," iPhone in Business, www.apple.com, accessed March 31, 2016; www.skf.com, accessed March 31, 2016; www.sonicautomotive.com, accessed March 31, 2016; and "Why the Mobile Pocket Office Is Good For Business," ITBusinessEdge.com, accessed March 6, 2015.

CASE STUDY QUESTIONS

1. What kinds of applications are described here? What business functions do they support? How do they improve operational efficiency and decision making?
2. Identify the problems that businesses in this case study solved by using mobile digital devices.
3. What kinds of businesses are most likely to benefit from equipping their employees with mobile digital devices such as iPhones and iPads?
4. One company deploying iPhones has said, "The iPhone is not a game changer, it's an industry changer. It changes the way that you can interact with your customers" and "with your suppliers." Discuss the implications of this statement.

Information Systems in Global Business Today

Learning Objectives

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

- 1-1 How are information systems transforming business, and why are they so essential for running and managing a business today?
- 1-2 What is an information system? How does it work? What are its management, organization, and technology components? Why are complementary assets essential for ensuring that information systems provide genuine value for organizations?
- 1-3 What academic disciplines are used to study information systems, and how does each contribute to an understanding of information systems?

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CHAPTER CASES

The Grocery Store of the Future: Look at Kroger
The Mobile Pocket Office
UPS Competes Globally with Information Technology
Are Farms Becoming Digital Firms?

VIDEO CASES

Business in the Cloud: Facebook and eBay Data Centers
UPS Global Operations with the DIAD
Instructional Video:
Tour IBM's Raleigh Data Center

The Grocery Store of the Future: Look at Kroger

If you were to step into the grocery store of the future, what would it look like? Well, you can get a glimpse by visiting a Kroger supermarket. Kroger Company, headquartered in Cincinnati, Ohio, is the largest U.S. supermarket chain by revenue (with fiscal 2015 sales of \$109.8 billion) and the second-largest general retailer (after Walmart). Kroger operates 2,800 supermarkets and multi-department stores in 34 states. It's also a leading-edge user of information systems.

Every time you walk into a Kroger store, infrared sensors note your arrival. Kroger uses its knowledge of how many customers are in that store to predict when long lines will pop up and where cashiers should be allocated to prevent pileups from happening. Data collected over time about customer shopping patterns, purchase transactions, staffing levels, and store layouts are fed into analytics software to help Kroger predict what is likely to happen on certain days of the week or month and how many registers should be open. For example, a Saturday afternoon shopper is likely to spend a longer amount of time in the store than someone shopping at 5:30 on a Wednesday evening. A screen at the front of the store lets employees know when to open up or close down an additional lane. This system, called QueVision, has cut the average wait time at a Kroger store from four minutes to less than 30 seconds. The sensors do not photograph or identify shoppers, and they are only located at checkout lines and store entrances—not throughout the entire store.

Kroger also uses temperature sensors to monitor cold food storage temperature changes. The company equipped refrigerated containers with sensors that check temperatures every 30 minutes and alert store managers and facilities engineers if temperatures hit unsafe levels for cold storage. A typical Kroger store temperature monitoring system has more than 220 radio frequency identification (RFID) tags connected to a wireless network. Before sensors were installed, Kroger employees had to manually check food storage thermometers twice a day. This process ran up costs if food spoiled or staff made measurement mistakes. The new sensor-based system for reporting



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temperature changes cuts down on the number of cold products that go bad and have to be thrown out, reduces labor, and saves energy.

Kroger started its own online ordering service called Click List, which allows customers to order groceries online, then pay for and collect their goods at a pickup window at an appointed time without having to leave their car. The fee for this service is \$4.95. Traditional e-commerce services tend to attract shoppers purchasing just a few items, but Kroger's service appeals to convenience-minded customers purchasing many grocery items at once as a means of speeding up their regular shopping trips.

Kroger also found that customers wanted to integrate their mobile devices into their shopping experience to view store maps, create grocery lists, pay for goods, and earn loyalty points. Kroger developed a mobile app that features localized shopping lists, targeted ads, and, in select areas, the ability to scan and bag items while shopping. This app has been downloaded 9 million times.

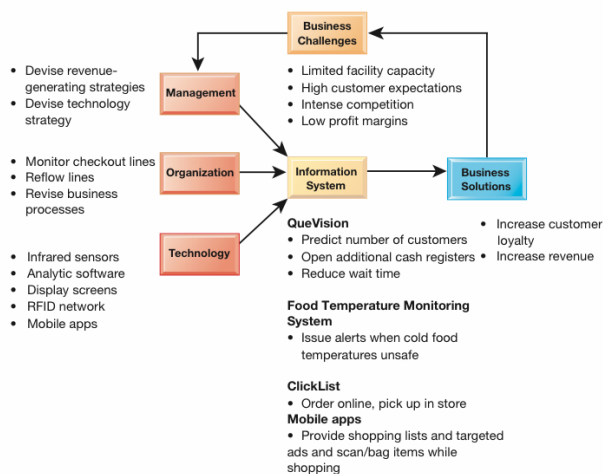
According to Brett Bonner, Kroger's senior director of research and development, the key business metric is higher customer satisfaction levels. Kroger surveys have found that what bothers people the most about grocery shopping is the dreaded wait at the checkout line. Technology is eliminating that problem at Kroger stores and providing customers with a better shopping experience. The grocery business is extremely competitive and low-margin, with profits of only a few cents per dollar. Customer loyalty is especially critical, and Kroger's systems for making shopping easier and more pleasant are a major source of competitive advantage.

With mobile and online e-commerce tools, will there even be grocery stores in the future, or will everyone just order online? Experts feel that grocery stores won't disappear. Shoppers like to see and feel products before they buy. But expect more stores to follow Kroger's lead and more technology innovation from Krogers to keep ahead of the pack.

Sources: www.thekrogerco.com, accessed April 2, 2016; Dimitrios Kalogeropoulos, "How Kroger Co. Plans to Spend \$4 Billion This Year," *Fox Business*, March 10, 2016; Kate Taylor, "Kroger Is Building the Grocery Store of the Future," *Business Insider*, November 8, 2015; Tom Kaneshige, "The Internet of Things Now Includes the Grocer's Frozen Food Aisle," *CIO*, July 31, 2015; and Laurianne McLaughlin, "Kroger Solves Top Customer Issue: Long Lines," *Information Week*, April 2, 2014.

The challenges facing Kroger show why information systems are so essential today. Kroger operates in a highly competitive industry with ultra-thin profit margins of only 1 or 2 percent. There is a limit to the number of customers each Kroger store can handle at one time, and long checkout lines will appear if there are too many people and too few available registers. Surveys have shown that eliminating long checkout lines makes customers very happy and is the best predictor of whether they will return and purchase again. Kroger used leading-edge information systems to shorten checkout lines, reduce food spoilage costs, and make the customer buying experience more pleasant and convenient. The use of networked sensors linked to the Internet (known as the Internet of Things) and powerful analytics to drive business operations and management decisions are key topics today in the MIS world and will be discussed throughout this text.





The chapter-opening diagram calls attention to important points raised by this case and this chapter. To remain profitable in a hypercompetitive industry, Kroger management chose to use information technology to improve the customer experience. Kroger stores use infrared sensors, wireless networks, and powerful analytic software to predict customer levels, calculate checkout times, and provide information on when and where to open additional checkout stations to reduce waiting times and checkout lines. Kroger also uses wireless sensor systems to monitor the status of cold food storage devices as well as mobile technology to help customers plan for and expedite their shopping.

It is also important to note that deploying these new information systems has changed the way Kroger runs its business. To effectively use its sensor-driven and mobile systems, Kroger had to redesign jobs and procedures for allocating checkout lines, bagging groceries, and monitoring food temperatures. These changes had to be carefully planned to make sure they enhanced service, efficiency, and profitability.

Here are some questions to think about: How are information systems improving operations and customer service at Kroger stores? Give examples of two management decisions that are facilitated by Kroger's information systems. How much of an advantage does Kroger have over its competitors?

1-1 How are information systems transforming business, and why are they so essential for running and managing a business today?

It's not business as usual in America or the rest of the global economy anymore. In 2015, American businesses spent about \$1 trillion on information systems hardware, software, and telecommunications equipment. In addition,



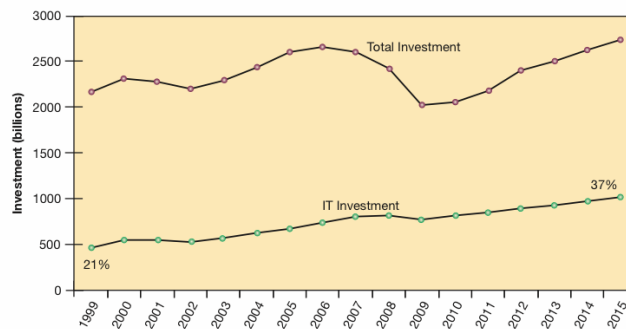
they spent another \$143 billion on business and management consulting and services—much of which involves redesigning firms' business operations to take advantage of these new technologies. In fact, most of the business value of IT investment derives from these organizational, management, and cultural changes inside firms (Saunders and Brynjolfsson, 2016). Figure 1.1 shows that between 1999 and 2015, private business investment in information technology consisting of hardware, software, and communications equipment grew from 21 to 37 percent of all invested capital.

As managers, most of you will work for firms that are intensively using information systems and making large investments in information technology. You will certainly want to know how to invest this money wisely. If you make wise choices, your firm can outperform competitors. If you make poor choices, you will be wasting valuable capital. This book is dedicated to helping you make wise decisions about information technology and information systems.

How Information Systems Are Transforming Business

You can see the results of this large-scale spending around you every day by observing how people conduct business. Changes in technology and new innovative business models have transformed social life and business practices. More than 258 million Americans have mobile phones (80 percent of the population), and 194 million of these people access the Internet using smartphones and tablets. Forty-nine percent of the entire population now uses tablet computers, whose sales have soared. One hundred eighty million Americans use online social networks; 157 million use Facebook, while 53 million use Twitter. Smartphones, social networking, texting, e-mailing, and webinars have all become essential tools of business because that's

FIGURE 1.1 INFORMATION TECHNOLOGY CAPITAL INVESTMENT



Information technology capital investment, defined as hardware, software, and communications equipment, grew from 21 to 37 percent of all invested capital between 1999 and 2015.

Source: Based on data in U.S. Department of Commerce, Bureau of Economic Analysis, *National Income and Product Accounts*, Table 5.3.6. Real Private Fixed Investment by Type, Chained Dollars (2016).



where your customers, suppliers, and colleagues can be found (eMarketer Chart, 2016).

By June 2015, more than 150 million businesses worldwide had dot-com Internet sites registered (Curtis, 2015). Today, 205 million Americans shop online, and 171 million will purchase online. Every month about 219 million Americans go online to research a product or service. In 2015, FedEx moved about 11.5 million packages daily in 220 countries and territories around the world, mostly overnight, and the United Parcel Service (UPS) moved more than 18 million packages daily. Businesses are using information technology to sense and respond to rapidly changing customer demand, reduce inventories to the lowest possible levels, and achieve higher levels of operational efficiency. Supply chains have become more fast-paced, with companies of all sizes depending on just-in-time inventory to reduce their overhead costs and get to market faster.

As newspaper print readership continues to decline, in 2015 more than 180 million people read a newspaper online, and millions more read other news sites (Conaghan, 2015). Online digital newspaper readership is growing at 10 percent annually, about twice as fast as the Internet itself. About 90 million people watch a video online every day, 80 million read a blog, and 28 million post to blogs, creating an explosion of new writers and new forms of customer feedback that did not exist five years ago (eMarketer, 2016). Social networking site Facebook attracted 156 million monthly visitors in 2015 in the United States and more than 1.4 billion worldwide. Businesses are using social networking tools to connect their employees, customers, and managers worldwide. Most *Fortune* 500 companies now have Facebook pages, Twitter accounts, and Tumblr sites.

E-commerce and Internet advertising continue to expand. Google's online ad revenues surpassed \$67 billion in 2015, and Internet advertising continues to grow at more than 15 percent a year, reaching more than \$58 billion in revenues in 2015 (eMarketer, 2015).

New federal security and accounting laws requiring many businesses to keep e-mail messages for five years, coupled with existing occupational and health laws requiring firms to store employee chemical exposure data for up to 60 years, are spurring the annual growth of digital information at the estimated rate of 5 exabytes annually, equivalent to 37,000 new Libraries of Congress.

What's New in Management Information Systems

Plenty. In fact, there's a whole new world of doing business using new technologies for managing and organizing. What makes the MIS field the most exciting area of study in schools of business is the continuous change in technology, management, and business processes. Five changes are of paramount importance.

IT Innovations. A continuing stream of information technology innovations is transforming the traditional business world. Examples include the emergence of cloud computing, the growth of a mobile digital business platform based on smartphones and tablet computers, big data, business analytics, and the use of social networks by managers to achieve business objectives. Most of these changes have occurred in the past few years. These innovations are enabling entrepreneurs and innovative traditional firms to create new products and



services, develop new business models, and transform the day-to-day conduct of business. In the process, some old businesses, even industries, are being destroyed while new businesses are springing up.

New Business Models. For instance, the emergence of online video services like Netflix for streaming, Apple iTunes, Amazon, and many others for downloading video has forever changed how premium video is distributed and even created. Netflix in 2016 attracted more than 75 million subscribers worldwide to what it calls the “Internet TV” revolution.” Netflix has moved into premium TV show production with 30 original shows such as *Fast and Furious*, *No Country For Old Men*, *House of Cards*, and *Orange Is the New Black*, challenging cable and broadcast producers of TV shows, and potentially disrupting cable network dominance of TV show production. Apple’s iTunes now accounts for 67 percent of movie and TV show downloads and has struck deals with major Hollywood studios for recent movies and TV shows. A growing trickle of viewers are unplugging from cable and using only the Internet for entertainment.

E-commerce Expanding. E-commerce generated about \$600 billion in revenues in 2016 and is estimated to grow to nearly \$900 billion by 2020. E-commerce is changing how firms design, produce, and deliver their products and services. E-commerce has reinvented itself again, disrupting the traditional marketing and advertising industry and putting major media and content firms in jeopardy. Facebook and other social networking sites such as YouTube, Twitter, and Tumblr along with Netflix, Apple Beats music service, and many other media firms exemplify the new face of e-commerce in the twenty-first century. They sell services. When we think of e-commerce, we tend to think of selling physical products. While this iconic vision of e-commerce is still very powerful and the fastest-growing form of retail in the United States, growing up alongside is a whole new value stream based on selling services, not goods. It’s a services model of e-commerce. Growth in social commerce is spurred by powerful growth of the mobile platform: 80 percent of Facebook’s users access the service from mobile phones and tablets. Information systems and technologies are the foundation of this new services-based e-commerce. Mobile e-commerce hit \$130 billion in 2016 and is growing at more than 30 percent a year.

Management Changes. The management of business firms has changed: With new mobile smartphones, high-speed wireless Wi-Fi networks, and tablets, remote salespeople on the road are only seconds away from their managers’ questions and oversight. Business is going mobile, along with consumers. Managers on the move are in direct, continuous contact with their employees. The growth of enterprise-wide information systems with extraordinarily rich data means that managers no longer operate in a fog of confusion but instead have online, nearly instant access to the really important information they need for accurate and timely decisions. In addition to their public uses on the web, wikis and blogs are becoming important corporate tools for communication, collaboration, and information sharing.

Changes in Firms and Organizations. Compared to industrial organizations of the previous century, new fast-growing twenty-first-century business firms put less emphasis on hierarchy and structure and more emphasis on employees taking on multiple roles and tasks and collaborating with others on a team.



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They put greater emphasis on competency and skills rather than position in the hierarchy. They emphasize higher speed and more accurate decision making based on data and analysis. They are more aware of changes in technology, consumer attitudes, and culture. They use social media to enter into conversations with consumers and demonstrate a greater willingness to listen to consumers, in part because they have no choice. They show better understanding of the importance of information technology in creating and managing business firms and other organizations. To the extent organizations and business firms demonstrate these characteristics, they are twenty-first-century digital firms.

iPhone and iPad Applications for Business

1. Salesforce1
2. Cisco WebEx Meetings
3. SAP Business One
4. iWork
5. Evernote
6. Adobe Acrobat Reader
7. Oracle Business Intelligence Mobile
8. Dropbox



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Whether it's attending an online meeting, checking orders, working with files and documents, or obtaining business intelligence, Apple's iPhone and iPad offer unlimited possibilities for business users. A stunning multi-touch display, full Internet browsing, and capabilities for messaging, video and audio transmission, and document management make each an all-purpose platform for mobile computing.



Result 1 of 1



You can see some of these trends at work in the Interactive Session on Management. Millions of managers rely heavily on the mobile digital platform to coordinate suppliers and shipments, satisfy customers, and manage their employees. A business day without these mobile devices or Internet access would be unthinkable.

Globalization Challenges and Opportunities: A Flattened World

In 1492, Columbus reaffirmed what astronomers were long saying: the world was round and the seas could be safely sailed. As it turned out, the world was populated by peoples and languages living in isolation from one another, with great disparities in economic and scientific development. The world trade that ensued after Columbus's voyages has brought these peoples and cultures closer. The "industrial revolution" was really a worldwide phenomenon energized by expansion of trade among nations and the emergence of the first global economy.

In 2005, journalist Thomas Friedman wrote an influential book declaring the world was now "flat," by which he meant that the Internet and global communications had greatly reduced the economic and cultural advantages of developed countries. Friedman argued that the United States and European countries were in a fight for their economic lives, competing for jobs, markets, resources, and even ideas with highly educated, motivated populations in low-wage areas in the less developed world (Friedman, 2007). This "globalization" presents both challenges and opportunities for business firms.

A significant percentage of the economy of the United States and other advanced industrial countries in Europe and Asia depends on imports and exports. In 2015, about 30 percent of the \$19 trillion U.S. economy resulted from foreign trade, both imports and exports. In Europe and Asia, the number exceeded 50 percent. Many *Fortune* 500 U.S. firms derive more than half their revenues from foreign operations. Tech companies are particularly dependent on offshore revenue: 85 percent of Intel's revenues in 2015 came from overseas sales of its microprocessors, while Apple got 60 percent of its revenue outside of the United States. Eighty percent of the toys sold in the United States are manufactured in China, while about 90 percent of the PCs manufactured in China use American-made Intel or Advanced Micro Design (AMD) chips. The microprocessor chips are shipped from the United States to China for assembly into devices.

It's not just goods that move across borders. So too do jobs, some of them high-level jobs that pay well and require a college degree. In the past decade, the United States lost several million manufacturing jobs to offshore, low-wage producers. But manufacturing is now a very small part of U.S. employment (less than 12 percent of the labor force and declining). In a normal year, about 300,000 service jobs move offshore to lower-wage countries. Many of the jobs are in less-skilled information system occupations, but some are "tradable service" jobs in architecture, financial services, customer call centers, consulting, engineering, and even radiology.

On the plus side, the U.S. economy creates more than 3.5 million new jobs in a normal, non-recessionary year. Although only 1.1 million private sector jobs were created due to slow recovery in 2011, by 2015 the U.S. economy was adding more than 2 million new jobs annually for the third straight year. Employment in information systems and the other service occupations is expanding, and wages are stable. Outsourcing may have accelerated the development of new systems in the United States and worldwide as new systems could be



maintained and developed in low-wage countries. In part this explains why the job market for MIS and computer science graduates is growing rapidly in the United States.

The challenge for you as a business student is to develop high-level skills through education and on-the-job experience that cannot be outsourced. The challenge for your business is to avoid markets for goods and services that can be produced offshore much less expensively. The opportunities are equally immense. Throughout this book, you will find examples of companies and individuals who either failed or succeeded in using information systems to adapt to this new global environment.

What does globalization have to do with management information systems? That's simple: everything. The emergence of the Internet into a full-blown international communications system has drastically reduced the costs of operating and transacting on a global scale. Communication between a factory floor in Shanghai and a distribution center in Rapid City, South Dakota, is now instant and virtually free. Customers can now shop in a worldwide marketplace, obtaining price and quality information reliably 24 hours a day. Firms producing goods and services on a global scale achieve extraordinary cost reductions by finding low-cost suppliers and managing production facilities in other countries. Internet service firms, such as Google and eBay, are able to replicate their business models and services in multiple countries without having to redesign their expensive fixed-cost information systems infrastructure. Briefly, information systems enable globalization.

The Emerging Digital Firm

All of the changes we have just described, coupled with equally significant organizational redesign, have created the conditions for a fully digital firm. A digital firm can be defined along several dimensions. A **digital firm** is one in which nearly all of the organization's *significant business relationships* with customers, suppliers, and employees are digitally enabled and mediated. *Core business processes* are accomplished through digital networks spanning the entire organization or linking multiple organizations.

Business processes refer to the set of logically related tasks and behaviors that organizations develop over time to produce specific business results and the unique manner in which these activities are organized and coordinated. Developing a new product, generating and fulfilling an order, creating a marketing plan, and hiring an employee are examples of business processes, and the ways organizations accomplish their business processes can be a source of competitive strength. (A detailed discussion of business processes can be found in Chapter 2.)

Key corporate assets—intellectual property, core competencies, and financial and human assets—are managed through digital means. In a digital firm, any piece of information required to support key business decisions is available at any time and anywhere in the firm.

Digital firms sense and respond to their environments far more rapidly than traditional firms, giving them more flexibility to survive in turbulent times. Digital firms offer extraordinary opportunities for more flexible global organization and management. In digital firms, both time shifting and space shifting are the norm. *Time shifting* refers to business being conducted continuously, 24/7, rather than in narrow “work day” time bands of 9 a.m. to 5 p.m. *Space shifting* means that work takes place in a global workshop as well as within national boundaries. Work is accomplished physically wherever in the world it is best accomplished.



Many firms, such as Cisco Systems, 3M, and GE (see the Chapter 12 ending case), are close to becoming digital firms, using the Internet to drive every aspect of their business. Most other companies are not fully digital, but they are moving toward close digital integration with suppliers, customers, and employees.

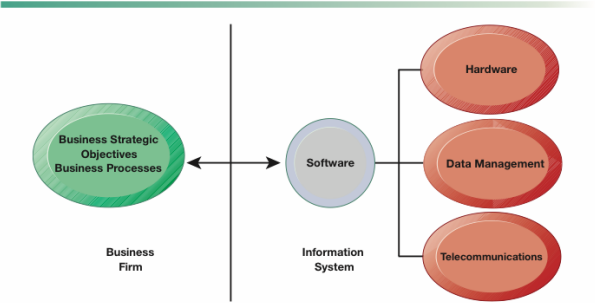
Strategic Business Objectives of Information Systems

What makes information systems so essential today? Why are businesses investing so much in information systems and technologies? In the United States, more than 57 million managers and 120 million workers in the information and knowledge sectors in the labor force rely on information systems to conduct business. Information systems are essential for conducting day-to-day business in the United States and most other advanced countries as well as achieving strategic business objectives.

Entire sectors of the economy are nearly inconceivable without substantial investments in information systems. E-commerce firms such as Amazon, eBay, Google, and E*Trade simply would not exist. Today's service industries—finance, insurance, and real estate as well as personal services such as travel, medicine, and education—could not operate without information systems. Similarly, retail firms such as Walmart and Sears and manufacturing firms such as General Motors and GE require information systems to survive and prosper. Just as offices, telephones, filing cabinets, and efficient tall buildings with elevators were once the foundations of business in the twentieth century, information technology is a foundation for business in the twenty-first century.

There is a growing interdependence between a firm's ability to use information technology and its ability to implement corporate strategies and achieve corporate goals (see Figure 1.2). What a business would like to do in five years often depends on what its systems will be able to do. Increasing market share, becoming the high-quality or low-cost producer, developing new products, and

FIGURE 1.2 THE INTERDEPENDENCE BETWEEN ORGANIZATIONS AND INFORMATION SYSTEMS



In contemporary systems, there is a growing interdependence between a firm's information systems and its business capabilities. Changes in strategy, rules, and business processes increasingly require changes in hardware, software, databases, and telecommunications. Often, what the organization would like to do depends on what its systems will permit it to do.



increasing employee productivity depend more and more on the kinds and quality of information systems in the organization. The more you understand about this relationship, the more valuable you will be as a manager.

Specifically, business firms invest heavily in information systems to achieve six strategic business objectives: operational excellence; new products, services, and business models; customer and supplier intimacy; improved decision making; competitive advantage; and survival.

Operational Excellence

Businesses continuously seek to improve the efficiency of their operations in order to achieve higher profitability. Information systems and technologies are some of the most important tools available to managers for achieving higher levels of efficiency and productivity in business operations, especially when coupled with changes in business practices and management behavior.

Walmart, the largest retailer on earth, exemplifies the power of information systems coupled with state of the art business practices and supportive management to achieve world-class operational efficiency. In fiscal year 2016, Walmart achieved \$499 billion in sales—nearly one-tenth of retail sales in the United States—in large part because of its Retail Link system, which digitally links its suppliers to every one of Walmart's stores. As soon as a customer purchases an item, the supplier monitoring the item knows to ship a replacement to the shelf. Walmart is the most efficient retail store in the industry, achieving sales of more than \$600 per square foot, compared with its closest competitor, Target, at \$425 a square foot and other large general merchandise retail firms producing less than \$200 a square foot.

New Products, Services, and Business Models

Information systems and technologies are a major enabling tool for firms to create new products and services as well as entirely new business models. A **business model** describes how a company produces, delivers, and sells a product or service to create wealth.

Today's music industry is vastly different from the industry a decade ago. Apple Inc. transformed an old business model of music distribution based on vinyl records, tapes, and CDs into an online, legal distribution model based on its own iPod technology platform. Apple has prospered from a continuing stream of innovations, including the iTunes music service, the iPad, and the iPhone.

Customer and Supplier Intimacy

When a business really knows its customers and serves them well, the customers generally respond by returning and purchasing more. This raises revenues and profits. Likewise with suppliers, the more a business engages its suppliers, the better the suppliers can provide vital inputs. This lowers costs. How to really know your customers or suppliers is a central problem for businesses with millions of offline and online customers.

The Mandarin Oriental in Manhattan and other high-end hotels exemplify the use of information systems and technologies to achieve customer intimacy. These hotels use computers to keep track of guests' preferences, such as their preferred room temperature, check-in time, frequently dialed telephone numbers, and television programs, and store these data in a large data repository. Individual rooms in the hotels are networked to a central network server computer so that they can be remotely monitored and controlled. When a customer arrives at one of these hotels, the system automatically changes the room



conditions, such as dimming the lights, setting the room temperature, or selecting appropriate music, based on the customer's digital profile. The hotels also analyze their customer data to identify their best customers and to develop individualized marketing campaigns based on customers' preferences.

JCPenney exemplifies the benefits of information systems-enabled supplier intimacy. Every time a dress shirt is bought at a JCPenney store in the United States, the record of the sale appears immediately on computers in Hong Kong at the TAL Apparel Ltd. supplier, a contract manufacturer that produces one in eight dress shirts sold in the United States. TAL runs the numbers through a computer model it developed and then decides how many replacement shirts to make and in what styles, colors, and sizes. TAL then sends the shirts to each JCPenney store, bypassing completely the retailer's warehouses. In other words, JCPenney's shirt inventory is near zero, as is the cost of storing it.

Improved Decision Making

Many business managers operate in an information fog bank, never really having the right information at the right time to make an informed decision. Instead, managers rely on forecasts, best guesses, and luck. The result is over- or underproduction of goods and services, misallocation of resources, and poor response times. These poor outcomes raise costs and lose customers. In the past decade, information systems and technologies have made it possible for managers to use real-time data from the marketplace when making decisions.

For instance, Verizon Corporation, one of the largest telecommunications companies in the United States, uses a web-based digital dashboard to provide managers with precise real-time information on customer complaints, network performance for each locality served, and line outages or storm-damaged lines. Using this information, managers can immediately allocate repair resources to affected areas, inform consumers of repair efforts, and restore service fast.

Competitive Advantage

When firms achieve one or more of these business objectives—operational excellence; new products, services, and business models; customer/supplier intimacy; and improved decision making—chances are they have already achieved a competitive advantage. Doing things better than your competitors, charging less for superior products, and responding to customers and suppliers in real time all add up to higher sales and higher profits that your competitors cannot match. Apple Inc., Walmart, and UPS, described later in this chapter, are industry leaders because they know how to use information systems for this purpose.

Survival

Business firms also invest in information systems and technologies because they are necessities of doing business. Sometimes these "necessities" are driven by industry-level changes. For instance, after Citibank introduced the first automated teller machines (ATMs) in the New York region in 1977 to attract customers through higher service levels, its competitors rushed to provide ATMs to their customers to keep up with Citibank. Today, virtually all banks in the United States have regional ATMs and link to national and international ATM networks, such as CIRRUS. Providing ATM services to retail banking customers is simply a requirement of being in and surviving in the retail banking business.

There are many federal and state statutes and regulations that create a legal duty for companies and their employees to retain records, including digital records. For instance, the Toxic Substances Control Act (1976), which regulates the exposure of U.S. workers to more than 75,000 toxic chemicals, requires firms



to retain records on employee exposure for 30 years. The Sarbanes-Oxley Act (2002), which was intended to improve the accountability of public firms and their auditors, requires certified public accounting firms that audit public companies to retain audit working papers and records, including all e-mails, for five years. The Dodd-Frank Wall Street Reform and Consumer Protection Act (2010), which was intended to strengthen regulation of the banking industry, requires firms to retain all records for 10 years. Many other pieces of federal and state legislation in health care, financial services, education, and privacy protection impose significant information retention and reporting requirements on U.S. businesses. Firms turn to information systems and technologies to provide the capability to respond to these challenges.

1-2 What is an information system? How does it work? What are its management, organization, and technology components? Why are complementary assets essential for ensuring that information systems provide genuine value for organizations?

So far we've used *information systems* and *technologies* informally without defining the terms. **Information technology (IT)** consists of all the hardware and software that a firm needs to use in order to achieve its business objectives. This includes not only computer machines, storage devices, and handheld mobile devices but also software, such as the Windows or Linux operating systems, the Microsoft Office desktop productivity suite, and the many thousands of computer programs that can be found in a typical large firm. "Information systems" are more complex and can be best understood by looking at them from both a technology and a business perspective.

What Is an Information System?

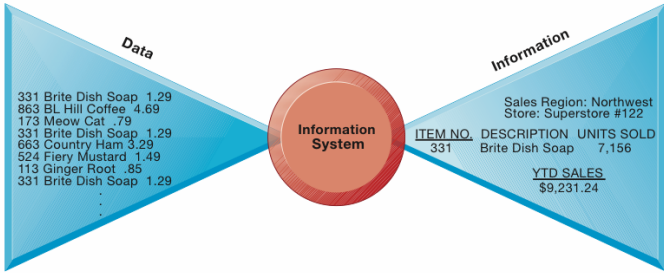
An **information system** can be defined technically as a set of interrelated components that collect (or retrieve), process, store, and distribute information to support decision making and control in an organization. In addition to supporting decision making, coordination, and control, information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

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

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



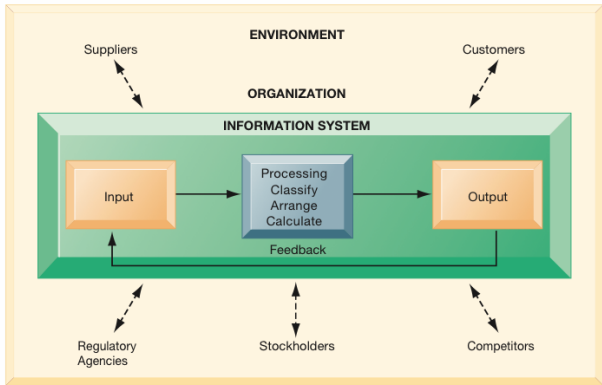
FIGURE 1.3 DATA AND INFORMATION



Raw data from a supermarket checkout counter can be processed and organized to produce meaningful information, such as the total unit sales of dish detergent or the total sales revenue from dish detergent for a specific store or sales territory.

Three activities in an information system produce the information that organizations need to make decisions, control operations, analyze problems, and create new products or services. These activities are input, processing, and output (see Figure 1.4). **Input** captures or collects raw data from within the organization or from its external environment. **Processing** converts this

FIGURE 1.4 FUNCTIONS OF AN INFORMATION SYSTEM



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



raw input into a meaningful form. **Output** transfers the processed information to the people who will use it or to the activities for which it will be used. Information systems also require **feedback**, which is output that is returned to appropriate members of the organization to help them evaluate or correct the input stage.

In the Kroger system for monitoring cold food storage temperatures, the raw input consists of RFID sensor-generated data on stored food items, such as the item's identification number, item description, storage location, temperature, and time of day. Computers store these data and process them to calculate how much each food item registers above or below its ideal storage temperature. The system output consists of indicators flagging items not stored at the proper temperature that might spoil or be damaged. The system provides meaningful information, such as food items flagged for storage, total number of food items with storage temperature problems, and location of those items.

Although computer-based information systems use computer technology to process raw data into meaningful information, there is a sharp distinction between a computer and a computer program on the one hand and an information system on the other. Computers and related software programs are the technical foundation, the tools and materials, of modern information systems. Computers provide the equipment for storing and processing information. Computer programs, or software, are sets of operating instructions that direct and control computer processing. Knowing how computers and computer programs work is important in designing solutions to organizational problems, but computers are only part of an information system.

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

Dimensions of Information Systems

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

The field of **management information systems (MIS)** tries to achieve this broader information systems literacy. MIS deals with behavioral issues as well as technical issues surrounding the development, use, and impact of information systems used by managers and employees in the firm.

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



FIGURE 1.5 INFORMATION SYSTEMS ARE MORE THAN COMPUTERS



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

Organizations

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

Organizations have a structure that is composed of different levels and specialties. Their structures reveal a clear-cut division of labor. Authority and responsibility in a business firm are organized as a hierarchy, or a pyramid structure. The upper levels of the hierarchy consist of managerial, professional, and technical employees, whereas the lower levels consist of operational personnel.

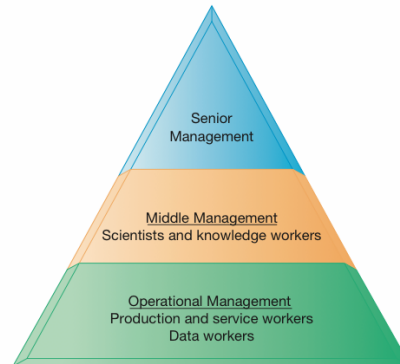
Senior management makes long-range strategic decisions about products and services as well as ensures financial performance of the firm. **Middle management** carries out the programs and plans of senior management, and **operational management** is responsible for monitoring the daily activities of the business. **Knowledge workers**, such as engineers, scientists, or architects, design products or services and create new knowledge for the firm, whereas **data workers**, such as secretaries or clerks, assist with scheduling and communications at all levels of the firm. **Production or service workers** actually produce the product and deliver the service (see Figure 1.6).

Experts are employed and trained for different business functions. The major **business functions**, or specialized tasks performed by business organizations, consist of sales and marketing, manufacturing and production, finance and accounting, and human resources (see Table 1.1). Chapter 2 provides more detail on these business functions and the ways in which they are supported by information systems.

An organization coordinates work through its hierarchy and through its *business processes*. Most organizations' business processes include formal rules



FIGURE 1.6 LEVELS IN A FIRM



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

that have been developed over a long time for accomplishing tasks. These rules guide employees in a variety of procedures, from writing an invoice to responding to customer complaints. Some of these business processes have been written down, but others are informal work practices, such as a requirement to return telephone calls from coworkers or customers, that are not formally documented. Information systems automate many business processes. For instance, how a customer receives credit or how a customer is billed is often determined by an information system that incorporates a set of formal business processes.

Each organization has a unique **culture**, or fundamental set of assumptions, values, and ways of doing things, that has been accepted by most of its members. You can see organizational culture at work by looking around your university or college. Some bedrock assumptions of university life are that professors know more than students, that the reason students attend college is to learn, and that classes follow a regular schedule.

TABLE 1.1 MAJOR BUSINESS FUNCTIONS

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



Result 1 of 1



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

Different levels and specialties in an organization create different interests and points of view. These views often conflict over how the company should be run and how resources and rewards should be distributed. Conflict is the basis for organizational politics. Information systems come out of this cauldron of differing perspectives, conflicts, compromises, and agreements that are a natural part of all organizations. In Chapter 3, we examine these features of organizations and their role in the development of information systems in greater detail.

Management

Management's job is to make sense out of the many situations faced by organizations, make decisions, and formulate action plans to solve organizational problems. Managers perceive business challenges in the environment, they set the organizational strategy for responding to those challenges, and they allocate the human and financial resources to coordinate the work and achieve success. Throughout, they must exercise responsible leadership. The business information systems described in this book reflect the hopes, dreams, and realities of real-world managers.

But managers must do more than manage what already exists. They must also create new products and services and even re-create the organization from time to time. A substantial part of management responsibility is creative work driven by new knowledge and information. Information technology can play a powerful role in helping managers design and deliver new products and services and redirecting and redesigning their organizations. Chapter 12 treats management decision making in detail.

Information Technology

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

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

Computer software consists of the detailed, preprogrammed instructions that control and coordinate the computer hardware components in an information system. Chapter 5 describes the contemporary software and hardware platforms used by firms today in greater detail.

Data management technology consists of the software governing the organization of data on physical storage media. More detail on data organization and access methods can be found in Chapter 6.

Networking and telecommunications technology, consisting of both physical devices and software, links the various pieces of hardware and transfers data from one physical location to another. Computers and communications equipment can be connected in networks for sharing voice, data, images, sound, and video. A **network** links two or more computers to share data or resources, such as a printer.

The world's largest and most widely used network is the **Internet**. The Internet is a global "network of networks" that uses universal standards (described in Chapter 7) to connect millions of networks in more than 230 countries around the world.



The Internet has created a new “universal” technology platform on which to build new products, services, strategies, and business models. This same technology platform has internal uses, providing the connectivity to link different systems and networks within the firm. Internal corporate networks based on Internet technology are called **intranets**. Private intranets extended to authorized users outside the organization are called **extranets**, and firms use such networks to coordinate their activities with other firms for making purchases, collaborating on design, and other interorganizational work. For most business firms today, using Internet technology is both a business necessity and a competitive advantage.

The **World Wide Web** is a service provided by the Internet that uses universally accepted standards for storing, retrieving, formatting, and displaying information in a page format on the Internet. Web pages contain text, graphics, animations, sound, and video and are linked to other web pages. By clicking on highlighted words or buttons on a web page, you can link to related pages to find additional information and links to other locations on the web. The web can serve as the foundation for new kinds of information systems such as UPS’s web-based package tracking system described in the following Interactive Session.

All of these technologies, along with the people required to run and manage them, represent resources that can be shared throughout the organization and constitute the firm’s **information technology (IT) infrastructure**. The IT infrastructure provides the foundation, or *platform*, on which the firm can build its specific information systems. Each organization must carefully design and manage its IT infrastructure so that it has the set of technology services it needs for the work it wants to accomplish with information systems. Chapters 5 through 8 of this book examine each major technology component of information technology infrastructure and show how they all work together to create the technology platform for the organization.

The Interactive Session on Technology describes some of the typical technologies used in computer-based information systems today. UPS invests heavily in information systems technology to make its business more efficient and customer oriented. It uses an array of information technologies, including bar code scanning systems, wireless networks, large mainframe computers, handheld computers, the Internet, and many different pieces of software for tracking packages, calculating fees, maintaining customer accounts, and managing logistics.

Let’s identify the organization, management, and technology elements in the UPS package tracking system we have just described. The organization element anchors the package tracking system in UPS’s sales and production functions (the main product of UPS is a service—package delivery). It specifies the required procedures for identifying packages with both sender and recipient information, taking inventory, tracking the packages en route, and providing package status reports for UPS customers and customer service representatives.

The system must also provide information to satisfy the needs of managers and workers. UPS drivers need to be trained in both package pickup and delivery procedures and in how to use the package tracking system so that they can work efficiently and effectively. UPS customers may need some training to use UPS in-house package tracking software or the UPS website.

UPS’s management is responsible for monitoring service levels and costs and for promoting the company’s strategy of combining low cost and superior service. Management decided to use computer systems to increase the ease of sending a package using UPS and of checking its delivery status, thereby reducing delivery costs and increasing sales revenues.



INTERACTIVE SESSION: TECHNOLOGY

UPS Competes Globally with Information Technology

United Parcel Service (UPS) started out in 1907 in a closet-sized basement office. Jim Casey and Claude Ryan—two teenagers from Seattle with two bicycles and one phone—promised the “best service and lowest rates.” UPS has used this formula successfully for more than a century to become the world’s largest ground and air package-delivery company. It’s a global enterprise with nearly 444,000 employees, 104,398 vehicles, and the world’s ninth-largest airline.

Today UPS delivers 18.3 million packages and documents each day in the United States and more than 220 other countries and territories. The firm has been able to maintain leadership in small-package delivery services despite stiff competition from FedEx and DHL by investing heavily in advanced information technology. UPS spends more than \$1 billion each year to maintain a high level of customer service while keeping costs low and streamlining its overall operations.

It all starts with the scannable bar-coded label attached to a package, which contains detailed information about the sender, the destination, and when the package should arrive. Customers can download and print their own labels using special software provided by UPS or by accessing the UPS website. Before the package is even picked up, information from the “smart” label is transmitted to one of UPS’s computer centers in Mahwah, New Jersey, or Alpharetta, Georgia, and sent to the distribution center nearest its final destination.

Dispatchers at this center download the label data and use special routing software called ORION to create the most efficient delivery route for each driver that considers traffic, weather conditions, and the location of each stop. Each UPS driver makes an average of 120 stops per day. In a network with 55,000 routes in the United States alone, shaving even one mile off each driver’s daily route translates into big savings: \$50 million per year. These savings are critical as UPS tries to boost earnings growth as more of its business shifts to less-profitable e-commerce deliveries. UPS drivers who used to drop off several heavy packages a day at one retailer now make several stops scattered across residential neighborhoods, delivering one lightweight package per household. The shift requires more fuel and more time, increasing the cost to deliver each package.

The first thing a UPS driver picks up each day is a handheld computer called a Delivery Information Acquisition Device (DIAD), which can access a wireless cell phone network. As soon as the driver logs on, his or her day’s route is downloaded onto the handheld. The DIAD also automatically captures customers’ signatures along with pickup and delivery information. Package tracking information is then transmitted to UPS’s computer network for storage and processing. From there, the information can be accessed worldwide to provide proof of delivery to customers or to respond to customer queries. It usually takes less than 60 seconds from the time a driver presses “complete” on the DIAD for the new information to be available on the web.

Through its automated package tracking system, UPS can monitor and even reroute packages throughout the delivery process. At various points along the route from sender to receiver, bar code devices scan shipping information on the package label and feed data about the progress of the package into the central computer. Customer service representatives are able to check the status of any package from desktop computers linked to the central computers and respond immediately to inquiries from customers. UPS customers can also access this information from the company’s website using their own computers or mobile phones. UPS now has mobile apps and a mobile website for iPhone, BlackBerry, and Android smartphone users.

Anyone with a package to ship can access the UPS website to track packages, check delivery routes, calculate shipping rates, determine time in transit, print labels, and schedule a pickup. The data collected at the UPS website are transmitted to the UPS central computer and then back to the customer after processing. UPS also provides tools that enable customers, such as Cisco Systems, to embed UPS functions, such as tracking and cost calculations, into their own websites so that they can track shipments without visiting the UPS site.

A web-based Post Sales Order Management System (OMS) manages global service orders and inventory for critical parts fulfillment. The system enables high-tech electronics, aerospace, medical equipment, and other companies anywhere in the world that ship critical parts to quickly assess their critical parts inventory, determine the most optimal routing



strategy to meet customer needs, place orders online, and track parts from the warehouse to the end user. An automated e-mail or fax feature keeps customers informed of each shipping milestone and can provide notification of any changes to flight schedules for commercial airlines carrying their parts.

UPS is now leveraging its decades of expertise managing its own global delivery network to manage logistics and supply chain activities for other companies. It created a UPS Supply Chain Solutions division that provides a complete bundle of standardized services to subscribing companies at a fraction of what it would cost to build their own systems and infrastructure. These services include supply chain design and management, freight forwarding, customs brokerage, mail services, multimodal transportation, and financial services in addition to logistics services.

For example, UPS handles fulfillment and distribution for Plasticard Locktech International (PLI), the world's largest manufacturer of key cards, including

hotel key cards, gift cards, and customer loyalty program cards. PLI's customers require quick delivery. Although PLI had no problem fulfilling orders, shipping internationally from its Asheville, North Carolina, manufacturing and distribution location was too costly. PLI now stores inventory at UPS locations in Canada, the United Arab Emirates, and the Netherlands and will soon ship from a Hong Kong facility as well. It would have cost PLI millions to provide its own services for opening a warehouse, staffing, insurance, and logistics. In addition to reducing international shipping costs, PLI realized savings of \$200,000 per year by switching to UPS Customs Brokerage Services.

Sources: www.ups.com, accessed March 25, 2016; Steven Rosenbush and Laura Stevens, "At UPS, Algorithm Is the Driver," *Wall Street Journal*, February 16, 2015; and "Keys to Success," UPS Compass, Winter 2015.

CASE STUDY QUESTIONS

1. What are the inputs, processing, and outputs of UPS's package tracking system?
2. What technologies are used by UPS? How are these technologies related to UPS's business strategy?
3. What strategic business objectives do UPS's information systems address?
4. What would happen if UPS's information systems were not available?

The technology supporting this system consists of handheld computers, bar code scanners, desktop computers, wired and wireless communications networks, UPS's data center, storage technology for the package delivery data, UPS in-house package tracking software, and software to access the World Wide Web. The result is an information system solution to the business challenge of providing a high level of service with low prices in the face of mounting competition.

It Isn't Just Technology: A Business Perspective on Information Systems

Managers and business firms invest in information technology and systems because they provide real economic value to the business. The decision to build or maintain an information system assumes that the returns on this investment will be superior to other investments in buildings, machines, or other assets. These superior returns will be expressed as increases in productivity, as increases in revenues (which will increase the firm's stock market value), or perhaps as superior long-term strategic positioning of the firm in certain markets (which produce superior revenues in the future).

We can see that from a business perspective, an information system is an important instrument for creating value for the firm. Information systems





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Using a handheld computer called a Delivery Information Acquisition Device (DIAD), UPS drivers automatically capture customers' signatures along with pickup, delivery, and time card information. UPS information systems use these data to track packages while they are being transported.

enable the firm to increase its revenue or decrease its costs by providing information that helps managers make better decisions or that improves the execution of business processes. For example, the information system for analyzing supermarket checkout data illustrated in Figure 1.3 can increase firm profitability by helping managers make better decisions as to which products to stock and promote in retail supermarkets.

Every business has an information value chain, illustrated in Figure 1.7, in which raw information is systematically acquired and then transformed through various stages that add value to that information. The value of an information system to a business, as well as the decision to invest in any new information system, is, in large part, determined by the extent to which the system will lead to better management decisions, more efficient business processes, and higher firm profitability. Although there are other reasons why systems are built, their primary purpose is to contribute to corporate value.

The business perspective calls attention to the organizational and managerial nature of information systems. An information system represents an organizational and management solution, based on information technology, to a challenge or problem posed by the environment. Every chapter in this book begins with a short case study that illustrates this concept. A diagram at the beginning of each chapter illustrates the relationship between a business challenge and resulting management and organizational decisions to use IT as a solution to challenges generated by the business environment. You can use this diagram as a starting point for analyzing any information system or information system problem you encounter.

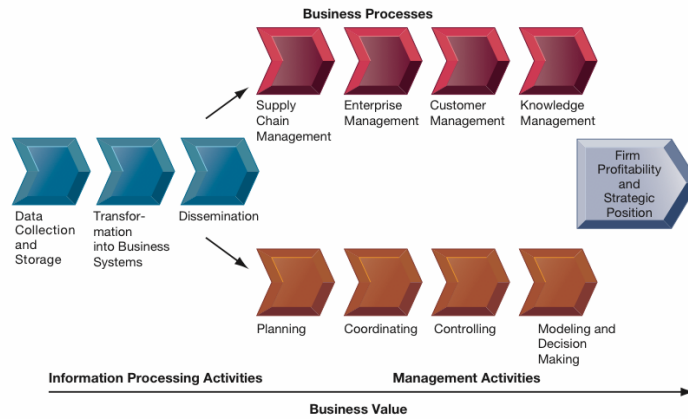
Review the diagram at the beginning of this chapter. The diagram shows how Kroger's systems solved the business problem presented by the need to retain customers and generate revenue in a highly competitive industry with razor-thin profit margins. These systems provided a solution that takes advantage of opportunities provided by new digital technology and the Internet. They opened up new channels for selling goods, increased quality, and improved the customer buying experience. These systems have been essential in improving



Result 1 of 1



FIGURE 1.7 THE BUSINESS INFORMATION VALUE CHAIN



From a business perspective, information systems are part of a series of value-adding activities for acquiring, transforming, and distributing information that managers can use to improve decision making, enhance organizational performance, and, ultimately, increase firm profitability.

Kroger's overall business performance. The diagram also illustrates how management, technology, and organizational elements work together to create the systems.

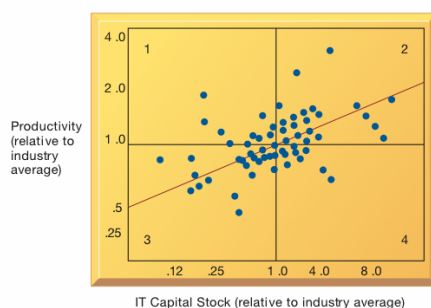
Complementary Assets: Organizational Capital and the Right Business Model

Awareness of the organizational and managerial dimensions of information systems can help us understand why some firms achieve better results from their information systems than others. Studies of returns from information technology investments show that there is considerable variation in the returns firms receive (see Figure 1.8). Some firms invest a great deal and receive a great deal (quadrant 2); others invest an equal amount and receive few returns (quadrant 4). Still other firms invest little and receive much (quadrant 1), whereas others invest little and receive little (quadrant 3). This suggests that investing in information technology does not by itself guarantee good returns. What accounts for this variation among firms?

The answer lies in the concept of complementary assets. Information technology investments alone cannot make organizations and managers more effective unless they are accompanied by supportive values, structures, and behavior patterns in the organization and other complementary assets. Business firms need to change how they do business before they can really reap the advantages of new information technologies.

Complementary assets are those assets required to derive value from a primary investment (Teece, 1998). For instance, to realize value from automobiles

FIGURE 1.8 VARIATION IN RETURNS ON INFORMATION TECHNOLOGY INVESTMENT



Although, on average, investments in information technology produce returns far above those returned by other investments, there is considerable variation across firms.

Source: Based on Brynjolfsson and Hitt (2000).

requires substantial complementary investments in highways, roads, gasoline stations, repair facilities, and a legal regulatory structure to set standards and control drivers.

Research indicates that firms that support their technology investments with investments in complementary assets, such as new business models, new business processes, management behavior, organizational culture, or training, receive superior returns, whereas those firms failing to make these complementary investments receive less or no returns on their information technology investments (Brynjolfsson, 2005; Brynjolfsson and Hitt, 2000; Laudon, 1974). These investments in organization and management are also known as **organizational and management capital**.

Table 1.2 lists the major complementary investments that firms need to make to realize value from their information technology investments. Some of this investment involves tangible assets, such as buildings, machinery, and tools. However, the value of investments in information technology depends to a large extent on complementary investments in management and organization.

Key organizational complementary investments are a supportive business culture that values efficiency and effectiveness, an appropriate business model, efficient business processes, decentralization of authority, highly distributed decision rights, and a strong information system (IS) development team.

Important managerial complementary assets are strong senior management support for change, incentive systems that monitor and reward individual innovation, an emphasis on teamwork and collaboration, training programs, and a management culture that values flexibility and knowledge.

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

Throughout the book we emphasize a framework of analysis that considers technology, management, and organizational assets and their interactions.



TABLE 1.2 COMPLEMENTARY SOCIAL, MANAGERIAL, AND ORGANIZATIONAL ASSETS REQUIRED TO OPTIMIZE RETURNS FROM INFORMATION TECHNOLOGY INVESTMENTS

Organizational assets	Supportive organizational culture that values efficiency and effectiveness Appropriate business model Efficient business processes Decentralized authority Distributed decision-making rights Strong IS development team
Managerial assets	Strong senior management support for technology investment and change Incentives for management innovation Teamwork and collaborative work environments Training programs to enhance management decision skills Management culture that values flexibility and knowledge-based decision making.
Social assets	The Internet and telecommunications infrastructure IT-enriched educational programs raising labor force computer literacy Standards (both government and private sector) Laws and regulations creating fair, stable market environments Technology and service firms in adjacent markets to assist implementation

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

1-3 What academic disciplines are used to study information systems, and how does each contribute to an understanding of information systems?

The study of information systems is a multidisciplinary field. No single theory or perspective dominates. Figure 1.9 illustrates the major disciplines that contribute problems, issues, and solutions in the study of information systems. In general, the field can be divided into technical and behavioral approaches. Information systems are sociotechnical systems. Though they are composed of machines, devices, and “hard” physical technology, they require substantial social, organizational, and intellectual investments to make them work properly.

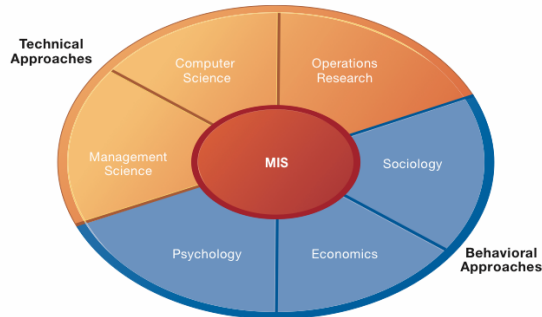
Technical Approach

The technical approach to information systems emphasizes mathematically based models to study information systems as well as the physical technology



Result 1 of 1



FIGURE 1.9 CONTEMPORARY APPROACHES TO INFORMATION SYSTEMS

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

and formal capabilities of these systems. The disciplines that contribute to the technical approach are computer science, management science, and operations research.

Computer science is concerned with establishing theories of computability, methods of computation, and methods of efficient data storage and access. Management science emphasizes the development of models for decision-making and management practices. Operations research focuses on mathematical techniques for optimizing selected parameters of organizations, such as transportation, inventory control, and transaction costs.

Behavioral Approach

An important part of the information systems field is concerned with behavioral issues that arise in the development and long-term maintenance of information systems. Issues such as strategic business integration, design, implementation, utilization, and management cannot be explored usefully with the models used in the technical approach. Other behavioral disciplines contribute important concepts and methods.

For instance, sociologists study information systems with an eye toward how groups and organizations shape the development of systems and also how systems affect individuals, groups, and organizations. Psychologists study information systems with an interest in how human decision makers perceive and use formal information. Economists study information systems with an interest in understanding the production of digital goods, the dynamics of digital markets, and how new information systems change the control and cost structures within the firm.

The behavioral approach does not ignore technology. Indeed, information systems technology is often the stimulus for a behavioral problem or issue. But the focus of this approach is generally not on technical solutions. Instead, it



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

Approach of This Text: Sociotechnical Systems

Throughout this book you will find a rich story with four main actors: suppliers of hardware and software (the technologists); business firms making investments and seeking to obtain value from the technology; managers and employees seeking to achieve business value (and other goals); and the contemporary legal, social, and cultural context (the firm's environment). Together these actors produce what we call *management information systems*.

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

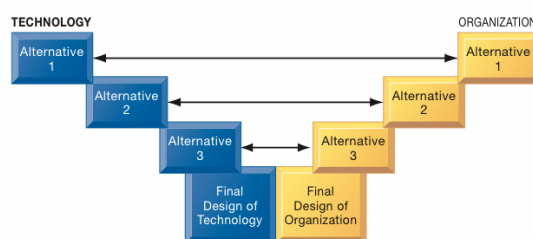
Our experience as academics and practitioners leads us to believe that no single approach effectively captures the reality of information systems. The successes and failures of information systems are rarely all technical or all behavioral. Our best advice to students is to understand the perspectives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

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

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

In this book, we stress the need to optimize the firm's performance as a whole. Both the technical and behavioral components need attention. This means that technology must be changed and designed in such a way as to fit organizational and individual needs. Sometimes, the technology may have to be "de-optimized" to accomplish this fit. For instance, mobile phone users adapt this technology to their personal needs, and as a result manufacturers quickly seek to adjust the technology to conform with user expectations. Organizations and individuals must also be changed through training, learning, and planned organizational change to allow the technology to operate and prosper. Figure 1.10 illustrates this process of mutual adjustment in a sociotechnical system.



FIGURE 1.10 A SOCIOTECHNICAL PERSPECTIVE ON INFORMATION SYSTEMS

In a sociotechnical perspective, the performance of a system is optimized when both the technology and the organization mutually adjust to one another until a satisfactory fit is obtained.

Review Summary

1-1 How are information systems transforming business, and why are they essential for running and managing a business today?

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

Information systems are a foundation for conducting business today. In many industries, survival and the ability to achieve strategic business goals are difficult without extensive use of information technology. Businesses today use information systems to achieve six major objectives: operational excellence; new products, services, and business models; customer/supplier intimacy; improved decision making; competitive advantage; and day-to-day survival.

1-2 What is an information system? How does it work? What are its management, organization, and technology components? Why are complementary assets essential for ensuring that information systems provide genuine value for organizations?

From a technical perspective, an information system collects, stores, and disseminates information from an organization's environment and internal operations to support organizational functions and decision making, communication, coordination, control, analysis, and visualization. Information systems transform raw data into useful information through three basic activities: input, processing, and output.

From a business perspective, an information system provides a solution to a problem or challenge facing a firm and represents a combination of management, organization, and technology elements. The management dimension of information systems involves issues such as leadership, strategy, and management behavior. The technology dimension consists of computer hardware, software, data management technology, and networking/telecommunications technology (including the Internet). The organization dimension of information systems involves issues such as the organization's hierarchy, functional specialties, business processes, culture, and political interest groups.



In order to obtain meaningful value from information systems, organizations must support their technology investments with appropriate complementary investments in organizations and management. These complementary assets include new business models and business processes, supportive organizational culture and management behavior, and appropriate technology standards, regulations, and laws. New information technology investments are unlikely to produce high returns unless businesses make the appropriate managerial and organizational changes to support the technology.

1-3 *What academic disciplines are used to study information systems, and how does each contribute to an understanding of information systems?*

The study of information systems deals with issues and insights contributed from technical and behavioral disciplines. The disciplines that contribute to the technical approach focusing on formal models and capabilities of systems are computer science, management science, and operations research. The disciplines contributing to the behavioral approach focusing on the design, implementation, management, and business impact of systems are psychology, sociology, and economics. A sociotechnical view of systems considers both technical and social features of systems and solutions that represent the best fit between them.

Key Terms

Business functions, 19
Business model, 14
Business processes, 12
Complementary assets, 26
Computer hardware, 21
Computer literacy, 18
Computer software, 21
Culture, 20
Data, 16
Data management technology, 21
Data workers, 19
Digital firm, 12
Extranets, 22
Feedback, 18
Information, 16
Information system, 16
Information systems literacy, 18
Information technology (IT), 16

Information technology (IT) infrastructure, 22
Input, 17
Internet, 21
Intranets, 22
Knowledge workers, 19
Management information systems (MIS), 18
Middle management, 19
Network, 21
Networking and telecommunications technology, 21
Operational management, 19
Organizational and management capital, 27
Output, 18
Processing, 17
Production or service workers, 19
Senior management, 19
Sociotechnical view, 30
World Wide Web, 22

MyMISLab

To complete the problems marked with the **MyMISLab**, go to the EOC Discussion Questions in MyMISLab.

Review Questions

- 1-1** How are information systems transforming business, and why are they so essential for running and managing a business today?
- Describe how information systems have changed the way businesses operate and their products and services.
 - Identify three major new information system trends.
 - Describe the characteristics of a digital firm.
 - Describe the challenges and opportunities of globalization in a “flattened” world.
- 1-2** List and describe six reasons why information systems are so important for business today.
- 1-2** What is an information system? How does it work? What are its management, organization, and technology components? Why are complementary assets essential for ensuring that information systems provide genuine value for organizations?
- Define an information system and describe the activities it performs.



- List and describe the organizational, management, and technology dimensions of information systems.
 - Distinguish between data and information and between information systems literacy and computer literacy.
 - Explain how the Internet and the World Wide Web are related to the other technology components of information systems.
 - Define complementary assets and describe their relationship to information technology.
 - Describe the complementary social, managerial, and organizational assets required to optimize returns from information technology investments.
- 1-3** What academic disciplines are used to study information systems, and how does each contribute to an understanding of information systems?
- List and describe each discipline that contributes to a technical approach to information systems.
 - List and describe each discipline that contributes to a behavioral approach to information systems.
 - Describe the sociotechnical perspective on information systems.

Discussion Questions

- 1-4** Information systems are too important to be left to computer specialists. Do you agree? Why or why not?
- 1-5** If you were setting up the website for a Major League Baseball team, what management, organization, and technology issues might you encounter?
- 1-6** What are some of the organizational, managerial, and social complementary assets that help make UPS's information systems so successful?

Hands-On MIS Projects

The projects in this section give you hands-on experience in analyzing financial reporting and inventory management problems, using data management software to improve management decision making about increasing sales, and using Internet software for researching job requirements. Visit MyMISLab's Multimedia Library to access this chapter's Hands-On MIS Projects.

Management Decision Problems

- 1-7** Snyders of Hanover, which sells about 80 million bags of pretzels, snack chips, and organic snack items each year, had its financial department use spreadsheets and manual processes for much of its data gathering and reporting. Hanover's financial analyst would spend the entire final week of every month collecting spreadsheets from the heads of more than 50 departments worldwide. She would then consolidate and reenter all the data into another spreadsheet, which would serve as the company's monthly profit-and-loss statement. If a department needed to update its data after submitting the spreadsheet to the main office, the analyst had to return the original spreadsheet, then wait for the department to resubmit its data before finally submitting the updated data in the consolidated document. Assess the impact of this situation on business performance and management decision making.
- 1-8** Dollar General Corporation operates deep-discount stores offering housewares, cleaning supplies, clothing, health and beauty aids, and packaged food, with most items selling for \$1. Its business model calls for keeping costs as low as possible. The company has no automated method for keeping track of inventory at each store. Managers know approximately how many cases of a particular product the store is supposed to receive when a delivery truck arrives, but the stores lack technology for scanning the cases or verifying the item count inside the cases. Merchandise losses from theft or other mishaps have been rising and now represent more than 3 percent of total sales. What decisions have to be made before investing in an information system solution?



Improving Decision Making: Using Databases to Analyze Sales Trends

Software skills: Database querying and reporting

Business skills: Sales trend analysis

1-9 In this project, you will start out with raw transactional sales data and use Microsoft Access database software to develop queries and reports that help managers make better decisions about product pricing, sales promotions, and inventory replenishment. In MyMISLab, you can find a Store and Regional Sales Database developed in Microsoft Access. The database contains raw data on weekly store sales of computer equipment in various sales regions. The database includes fields for store identification number, sales region, item number, item description, unit price, units sold, and the weekly sales period when the sales were made. Use Access to develop some reports and queries to make this information more useful for running the business. Sales and production managers want answers to the following questions:

- Which products should be restocked?
- Which stores and sales regions would benefit from a promotional campaign and additional marketing?
- When (what time of year) should products be offered at full price, and when should discounts be used?

You can easily modify the database table to find and report your answers. Print your reports and results of queries.

Improving Decision Making: Using the Internet to Locate Jobs Requiring Information Systems Knowledge

Software skills: Internet-based software

Business skills: Job searching

1-10 Visit a job-posting website such as Monster.com. Spend some time at the site examining jobs for accounting, finance, sales, marketing, and human resources. Find two or three descriptions of jobs that require some information systems knowledge. What information systems knowledge do these jobs require? What do you need to do to prepare for these jobs? Write a one- to two-page report summarizing your findings.

Collaboration and Teamwork Project

Selecting Team Collaboration Tools

1-11 Form a team with three or four classmates and review the capabilities of Google Drive and Google Sites for your team collaboration work. Compare the capabilities of these two tools for storing team documents, project announcements, source materials, work assignments, illustrations, electronic presentations, and web pages of interest. Learn how each works with Google Docs. Explain why Google Drive or Google Sites is more appropriate for your team. If possible, use Google Docs to brainstorm and develop a presentation of your findings for the class. Organize and store your presentation using the Google tool you have selected.

Are Farms Becoming Digital Firms?

CASE STUDY

Ohio farmer Mark Bryant raises corn, soybeans, and soft red winter wheat on 12,000 acres. But you'll hardly ever see him on a tractor because that isn't how farms work anymore. Bryant spends most of his time monitoring dashboards full of data gathered

from the 20 or so iPhones and five iPads he has supplied to employees who report on his acreage in real time. Using software from a Google-funded startup called Granular, Bryant analyzes the data along with data gathered from aircraft, self-driving tractors, and

