CHAPTER 1

The Importance of MIS

"Fired? You're firing me?"

"Well, *fired* is a harsh word, but … well, Falcon Security has no further need for your services."

"But, Joni, I don't get it. I really don't. I worked hard, and I did everything you told me to do."

"Jennifer, that's just it. You did everything *I* told you to do."

"I put in so many hours. How could you fire me?"

"Your job was to find ways to reduce our fleet costs using 3D printing."

"Right! And I did that."

"No, you didn't. You followed up on ideas *that I gave you*. But we don't need someone who can follow up on my plans. We need someone who can figure out what we need to do, create her own plans, and bring them back to me…. and others."

"How could you expect me to do that? I've only been here 6 months!"

"It's called teamwork. Sure, you're just learning our business, but I made sure all of our senior staff would be available to you …"

"I didn't want to bother them."

"Well, you succeeded. I asked Cam what she thought of the plans you're working on. Who's Jennifer?' she asked."

"But doesn't she work down at the hangar?"

"Right. She's the operations manager … and it would seem to be worth talking to her."

"I'll go do that!"

"Jennifer, do you see what just happened? I gave you an idea, and you said you'd do it. That's not what I need. I need you to find solutions on your own."

"I worked really hard. I put in a lot of hours. I've got all these reports written."

"Has anyone seen them?"

"I talked to you about some of them. But I was waiting until I was satisfied with them."

"Right. That's not how we do things here. We develop ideas and then kick them around with each other. Nobody has all the smarts. Our plans get better when we comment and rework them… I think I told you that."

"Maybe you did. But I'm just not comfortable with that."

"Well, it's a key skill here."

"I know I can do this job."

"Jennifer, you've been here almost 6 months; you have a degree in business. Several weeks ago, I asked you for your first idea for a process that would identify potential drones, or drone parts, that could be 3D-printed. Do you remember what you said?"

"Yes, I wasn't sure how to proceed. I didn't want to just throw something out that might not work."

"But how would you find out if it would work?"

"I don't want to waste money …"

"No, you don't. So, when you didn't get very far with that task, I backed up and asked you to send me a list of parts that could be printed based on our existing drones, a list of replacement repair parts we buy on a regular basis, the specifications for future drones that we might buy, and a description of how existing 3D-printed drones are made. Not details, just an overview."

"Yes, I sent you those part lists and specifications."

"Jennifer, they made no sense. Your lists included parts that can't be 3D-printed, and your list of potential future drones included models that can't even carry cameras."

"But today, they're not enough."

Image source: rommma/Fotolia

Study QUESTIONS

Q1-1 Why is Introduction to MIS the most important class in the business school?

Q1-2 How will MIS affect me?

Q1-3 What is MIS?

Q1-4 How can you use the five-component model?

Q1-5 What is information?

Q1-6 What are necessary data characteristics?

Q1-7 2027?

"I know which parts can be printed, I just wasn't sure which ones to include. But I'll try again!"

"Well, I appreciate that attitude, but we're a small company, really still a startup in many ways. Everyone needs to pull more than their own weight here. Maybe if we were a bigger company, I'd be able to find a spot for you, see if we could bring you along. But we can't afford to do that now."

"What about my references?"

"I'll be happy to tell anyone that you're reliable, that you work 40 to 45 hours a week, and that you're honest and have integrity."

"Those are important!"

"Yes, they are. But today, they're not enough."

Chapter PREVIEW

"But today, they're not enough."

Do you find that statement sobering? And if hard work isn't enough, what is? We'll begin this book by discussing the key skills that Jennifer (and you) need and explaining why this course is the single best course in the business school for teaching you those key skills.

You may find that last statement surprising. If you are like most students, you have no clear idea of what your MIS class will be about. If someone were to ask you, "What do you study in that class?" you might respond that the class has something to do with computers and maybe computer programming. Beyond that, you might be hard-pressed to say more. You might add, "Well, it has something to do with computers in business," or maybe, "We are going to learn to solve business problems with computers using spreadsheets and other programs." So, how could this course be the most important one in the business school?

We begin with that question. After you understand how important this class will be to your career, we will discuss fundamental concepts. We'll wrap up with some practice on one of the key skills you need to learn.

Q1-1 Why Is Introduction to MIS the Most Important Class in the Business School?

Introduction to MIS is the most important class in the business school. This wasn't always the case. A couple decades ago, majoring in "computers" was considered a nerdy thing do to. But things have changed—a lot. Now the hottest jobs are found in tech companies. People brag about working for tech startups. Apple Inc. is the largest corporation in the world with a market cap of $590B. The largest IPO offering in history ($25B) came from the online e-commerce giant Alibaba (Alibaba Holdings Group) in 2014.

But why? Why has information technology changed from a minor corporate support function to a primary driver of corporate profitability? Why are tech jobs some of the highest paid? Why is working for a tech company considered über cool?

The answer has to do with the way technology is fundamentally changing business.

The Digital Revolution

You've probably heard that we live in the **Information Age**, or a period in history where the production, distribution, and control of information is the primary driver of the economy. The Information Age started in the 1970s with the **Digital Revolution**, or the conversion from mechanical and analog devices to digital devices. This shift to digital devices meant monumental changes for companies, individuals, and our society as a whole.

The problem was, people couldn't really understand how, or even why, this shift was going to affect them. Much like people today, they based their future projections on past events. They knew factories, bureaucracies, mass production, and operational efficiency. But this knowledge didn't prepare them for the changes that were coming.

The Digital Revolution didn't just mean that new "digital" equipment was replacing old mechanical, or analog, equipment. These new digital devices could now be connected to other digital devices and share data among themselves. They could also work faster as processor speed increased. This was groundbreaking. In 1972, computer scientist Gordon Bell recognized that these digital devices would change the world as they evolved and became widely used. He formulated **Bell's Law**, which states that "a new computer class forms roughly each decade establishing a new industry."[1] In other words, digital devices will evolve so quickly that they will enable new platforms, programming environments, industries, networks, and information systems every 10 years.

And it has happened just as Bell predicted. About every 10 years since 1970, entirely new classes of digital devices have emerged. They have created entirely new industries, companies, and platforms. In the 1980s, we saw the rise of the personal computer (PC) and small local networks. In the 1990s, we saw the rise of the Internet and widespread adoption of cellular phones. In the 2000s, we saw a push toward making all "things" network-enabled. Social networking and cloud-based services really took off, creating a flurry of new companies. In the 2010s, so far, we've seen huge advances in 3D printing, drones, and digital reality devices (e.g., Microsoft Hololens).

The evolution of digital technology has fundamentally altered businesses and become a primary driver of corporate profitability. And it will probably continue to do so for at least the next few decades. The key to understanding how businesses will be affected by this digital evolution is understanding the forces pushing the evolution of these new digital devices.

Evolving Capabilities

To understand the fundamental forces pushing the evolution of digital devices, let's imagine your body is evolving at the same rate as digital devices. Suppose you can run 8 miles per hour today. That's about average. Now suppose, hypothetically, that your body is changing so quickly that you can run twice as fast every 18 months. In 18 months, you'd be able to run 16 mph. In another 18 months, you'd be at 32 mph. Then 64, 128, 256, and 512. Then, after 10 1/2 years of growth, you'd be running 1,024 mph—on foot! How would this change your life?

Well, you'd certainly give up your car. It would be much too slow. Air travel would also probably be a thing of the past. You could start a very profitable package delivery business and quickly corner the market. You could live outside of the city because your commute would be shorter. You'd also need new clothes and some really tough shoes! And this is the key point—not only would *you* change, but *what* you do and *how* you do it would also change. This is Bell's Law. This same thing is happening to digital devices.

This example may seem silly at first, but it helps you understand how exponential change is affecting digital devices. Processing power, interconnectivity of devices, storage capacity, and bandwidth are all increasing extremely rapidly—so rapidly that it's changing how these devices are used. Let's explore some of these forces by looking at the laws that describe them.

Moore's Law

In 1965, Gordon Moore, cofounder of Intel Corporation, stated that because of technology improvements in electronic chip design and manufacturing, "The number of transistors per square inch on an integrated chip doubles every 18 months." This became known as **Moore's Law**. His statement has been commonly misunderstood to be "The speed of a computer doubles every 18 months," which is incorrect but captures the sense of his principle.

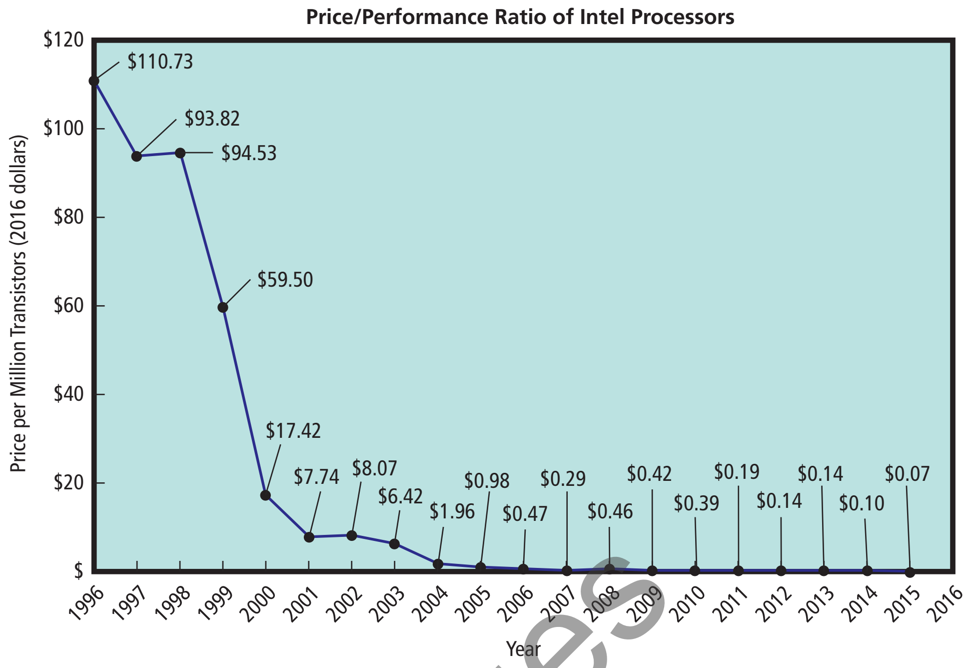

FIGURE 1-1

Computer Price/Performance Ratio Decreases

Source: © Based on data from Internet Transit Prices- Historical and Projected, DrPeering International. http://drpeering.net/white-papers/Internet-Transit-Pricing-Historical-And-Projected.php

Because of Moore's Law, the ratio of price to performance of computer processors has fallen dramatically. In 1996, when the Internet was really starting to take off, a standard CPU cost about $110 per million transistors. By 2015 that price had fallen to $0.07 per million transistors.[2] See Figure 1-1. Increasing processing power has had a greater impact on the global economy in the past 30 years than any other single factor. It has enabled new devices, applications, companies, and platforms. In fact, most tech companies would not exist today if processing power hadn't increased exponentially.

As a future business professional, however, you needn't care how fast of a computer your company can buy for $1,000. That's not the point. The point is, because of Moore's Law, the cost of data processing is approaching zero. Current applications like new drug development, artificial intelligence, and molecular modeling require massive amounts of processing power. Innovations in these areas are being held back because the cost of buying sufficient processing power is so high. But the good news is that the cost of processing is dropping—rapidly.

Metcalfe's Law

Another fundamental force that is changing digital devices is Metcalfe's Law, named after Robert Metcalfe, the inventor of Ethernet. **Metcalfe's Law** states that the value of a network is equal to the square of the number of users connected to it. In other words, as more digital devices are connected together, the value of that network will increase.[3] See Figure 1-2. Metcalfe's Law can be clearly seen in the dramatic rise of the Internet in the 1990s. As more users gained access to the Internet, it became more valuable. The dot-com boom ushered in tech giants like Google, Amazon, and eBay. None of these companies would have existed without large numbers of users connected to the Internet.

Metcalfe's Law isn't lost on tech companies, either. Google's Project Loon is a major effort to bring Internet access to everyone on the planet using a network of inflated balloons floating around the world. One of the primary metrics for social media companies is the number of monthly active users (MAU) using their social network. The more people they can get in their network, the more their company will be worth. And look at the network effects of using products like Microsoft Word. Why do you pay for Microsoft Word when you could use a free word processor like LibreOffice Writer? You pay for Microsoft Word because everyone else uses it.

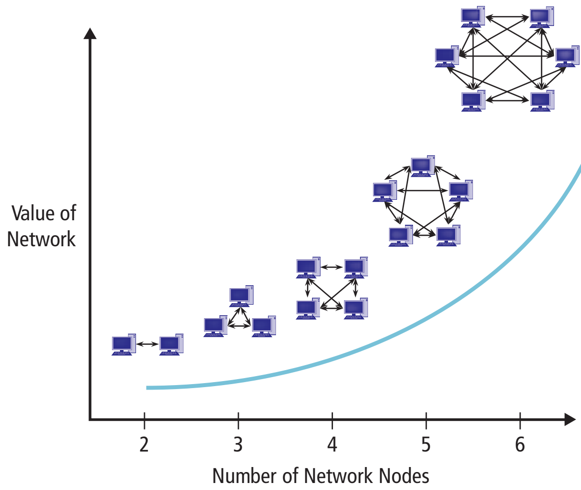

FIGURE 1-2
Increasing Value of Networks

Other Forces Pushing Digital Change

And it's not just the number of users on the network that's changing the way we use digital devices—it's the *speed* of the network. **Nielsen's Law**, named after Jakob Nielsen, says that network connection speeds for high-end users will increase by 50 percent per year. As networks become faster, new companies, new products, and new platforms will emerge.

YouTube, for example, started in February 2005 when there wasn't a lot of video shared over the Internet. But average Internet speeds were increasing to the point where a typical Internet connection could handle a stream of YouTube videos. By November 2006, the company was bought by Google for $1.65B. If you're counting, that's less than 2 years to create a billion-dollar company. Network speed matters. The question is why didn't Google, Microsoft, IBM, or Apple think of video sharing before the YouTube founders?

There are other forces changing digital devices beyond Nielsen's Law, Metcalfe's Law, and Moore's Law. See Figure 1-3. **Kryder's Law**, named after Mark Kryder, the former chief technology officer of Seagate Corp., says that the storage density on magnetic disks is increasing at an exponential rate. See Figure 1-4. Digital storage is so important that it's typically the first question you ask when you buy a new computer, smartphone, or tablet. There's also power consumption, image resolution, and interconnectivity between devices, all of which are changing, too. And this isn't a complete list.

Law	Meaning	Implications
Moore's Law	The number of transistors per square inch on an integrated chip doubles every 18 months.	Computers are getting exponentially faster. The cost of data processing is approaching zero.
Metcalfe's Law	The value of a network is equal to the square of the number of users connected to it.	More digital devices are connected together. The value of digital and social networks is increasing exponentially.
Nielsen's Law	Network connection speeds for high-end users will increase by 50 percent per year.	Network speed is increasing. Higher speeds enable new products, platforms, and companies.
Kryder's Law	The storage density on magnetic disks is increasing at an exponential rate.	Storage capacity is increasing exponentially. The cost of storing data is approaching zero.

FIGURE 1-3
Fundamental Forces Changing Technology

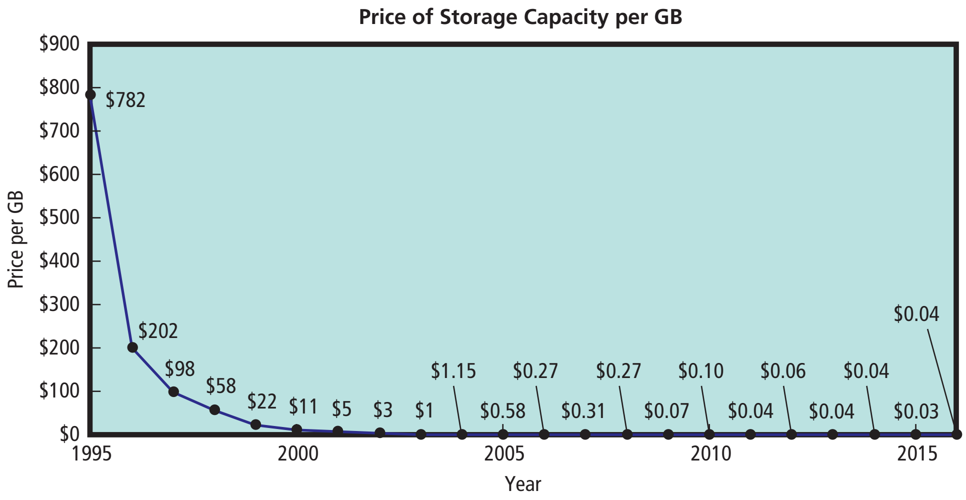

FIGURE 1-4
Price of Storage Capacity per GB

This Is the Most Important Class in the School of Business

This takes us back to our original statement that Introduction to MIS is the most important class you will take in the school of business. Why? Because this class will show you how technology is fundamentally changing businesses. You'll learn why executives are constantly trying to find ways to use new technology to create a sustainable competitive advantage. This leads us to the first reason Introduction to MIS is the most important course in the business school today:

Future business professionals need to be able to assess, evaluate, and apply emerging information technology to business.

You need the knowledge of this course to attain that skill.

Q1-2 How Will MIS Affect Me?

Technological change is accelerating. So what? How is this going to affect you? You may think that the evolution of technology is just great. You can hardly wait for the next iGadget to come out.

But pause for a second and imagine you graduated from college in 2004 and went to work for one of the largest and most successful home entertainment companies in the United States—Blockbuster LLC. In 2004, Blockbuster had 60,000 employees and 9,000-plus stores with $5.9B in annual revenues. Everything looked peachy. Fast-forward 6 years to 2010 and Blockbuster was bankrupt! Why? Because streaming a video over the Internet is easier than driving to a store. High-speed Internet connections made it all possible.

The point is that after graduation you too may choose to go to work for a large, successful, well-branded company. And 6 years down the road, it could be bankrupt because technology changed and it didn't.

How Can I Attain Job Security?

Many years ago, I had a wise and experienced mentor. One day I asked him about job security, and he told me that the only job security that exists is "a marketable skill and the courage to use it." He continued, "There is no security in our company, there is no security in any government program, there is no security in your investments, and there is no security in Social Security." Alas, how right he turned out to be.

So, what is a marketable skill? It used to be that one could name particular skills, such as computer programming, tax accounting, or marketing. But today, because of Moore's Law, Metcalfe's Law, and Kryder's Law, the cost of data processing, storage, and communications is essentially zero. Any routine skill can and will be outsourced to the lowest bidder. And if you live in the United States, Canada, Australia, Europe, or another advanced economy, the lowest bidder is unlikely to be you.

Numerous organizations and experts have studied the question of what skills will be marketable during your career. Consider two of them. First, the RAND Corporation, a think tank located in Santa Monica, California, has published innovative and groundbreaking ideas for more than 60 years, including the initial design for the Internet. In 2004, RAND published a description of the skills that workers in the 21st century will need:

> Rapid technological change and increased international competition place the spotlight on the skills and preparation of the workforce, particularly the ability to adapt to changing technology and shifting demand. Shifts in the nature of organizations … favor strong nonroutine cognitive skills.[4]

Whether you're majoring in accounting, marketing, finance, or information systems, you need to develop strong nonroutine cognitive skills.

What are such skills? Robert Reich, former Secretary of Labor, enumerates four:[5]

- Abstract reasoning
- Systems thinking
- Collaboration
- Ability to experiment

Figure 1-5 shows an example of each. Reread the Falcon Security case that started this chapter, and you'll see that Jennifer lost her job because of her inability to practice these key skills. Even though Reich's book was written in the early 1990s, the cognitive skills he mentions are still relevant today because humans, unlike technology, aren't changing that rapidly.[6]

How Can Intro to MIS Help You Learn Nonroutine Skills?

Introduction to MIS is the best course in the business school for learning Reich's four key skills because every topic requires you to apply and practice them. Here's how.

Abstract Reasoning

Abstract reasoning is the ability to make and manipulate models. You will work with one or more models in every course topic and book chapter. For example, later in this chapter you will learn about a *model* of the five components of an information system. This chapter will describe

Skill	Example	Jennifer's Problem at Falcon Security
Abstract Reasoning	Construct a model or representation.	Hesitancy and uncertainty when conceptualizing a method for identifying 3D-printable drone parts.
Systems Thinking	Model system components and show how components' inputs and outputs relate to one another.	Inability to model Falcon Security's operational needs.
Collaboration	Develop ideas and plans with others. Provide and receive critical feedback.	Unwilling to work with others on work-in-progress.
Ability to Experiment	Create and test promising new alternatives, consistent with available resources.	Fear of failure prohibited discussion of new ideas.

FIGURE 1-5
Examples of Critical Skills for Nonroutine Cognition

how to use this model to assess the scope of any new information system project; other chapters will build upon this model.

In this course, you will not just manipulate models that we have developed, you will also be asked to construct models of your own. In Chapter 5, for example, you'll learn how to create data models, and in Chapter 12 you'll learn to make process models.

Systems Thinking

Can you go to a grocery store, look at a can of green beans, and connect that can to U.S. immigration policy? Can you watch tractors dig up a forest of pulpwood trees and connect that woody trash to Moore's Law? Do you know why Cisco Systems is one of the major beneficiaries of YouTube? Answers to all of these questions require systems thinking. **Systems thinking** is the ability to model the components of the system to connect the inputs and outputs among those components into a sensible whole that reflects the structure and dynamics of the phenomenon observed.

As you are about to learn, this class is about information *systems.* We will discuss and illustrate systems; you will be asked to critique systems; you will be asked to compare alternative systems; you will be asked to apply different systems to different situations. All of those tasks will prepare you for systems thinking as a professional.

Collaboration

Collaboration is the activity of two or more people working together to achieve a common goal, result, or work product. Chapter 2 will teach you collaboration skills and illustrate several sample collaboration information systems. Every chapter of this book includes collaboration exercises that you may be assigned in class or as homework.

Here's a fact that surprises many students: Effective collaboration isn't about being nice. In fact, surveys indicate the single most important skill for effective collaboration is to give and receive critical feedback. Advance a proposal in business that challenges the cherished program of the VP of marketing, and you'll quickly learn that effective collaboration skills differ from party manners at the neighborhood barbeque. So, how do you advance your idea in the face of the VP's resistance? And without losing your job? In this course, you can learn both skills and information systems for such collaboration. Even better, you will have many opportunities to practice them.

Ability to Experiment

"I've never done this before."
"I don't know how to do it."
"But will it work?"
"Is it too weird for the market?"

Fear of failure: the fear that paralyzes so many good people and so many good ideas. In the days when business was stable, when new ideas were just different verses of the same song, professionals could allow themselves to be limited by fear of failure.

Let's look at an example of the application of social networking to the oil change business. Is there a legitimate application of social networking there? If so, has anyone ever done it? Is there anyone in the world who can tell you what to do? How to proceed? No. As Reich says, professionals in the 21st century need to be able to experiment.

Successful experimentation is not throwing buckets of money at every crazy idea that enters your head. Instead, **experimentation** is making a reasoned analysis of an opportunity, envisioning potential solutions, evaluating those possibilities, and developing the most promising ones, consistent with the resources you have.

In this course, you will be asked to use products with which you have no familiarity. Those products might be Microsoft Excel or Access, or they might be features and functions of Blackboard that you have not used. Or you may be asked to collaborate using OneDrive or SharePoint or Google

Drive. Will your instructor explain and show every feature of those products that you'll need? You should hope not. You should hope your instructor will leave it up to you to experiment, to envision new possibilities on your own, and to experiment with those possibilities, consistent with the time you have available.

Jobs

Employment is another factor that makes the Introduction to MIS course vitally important to you. Accenture, a technology consulting and outsourcing company, conducted a survey of college graduates in 2015. It found that 67 percent of students about to graduate expected to be employed full-time, but only 52 percent of the prior year's graduates actually found full-time employment. Further, 49 percent of recent graduates were working in jobs that did not require their degree or were otherwise underemployed.[7] But this is not the case in job categories related to information systems.

Spence and Hlatshwayo studied employment in the United States from 1990 to 2008.[8] They defined a *tradable job* as one that was not dependent on a particular location; this distinction is important because such jobs can be outsourced overseas. As shown in Figure 1-6, computer systems design and related services had the strongest growth of any job type in that category. The number of jobs dipped substantially after the dot-com bust in 2000; since 2003, however, job growth has not only recovered but accelerated dramatically. While this category includes technical positions such as computer programmer and database administrator, it includes nontechnical

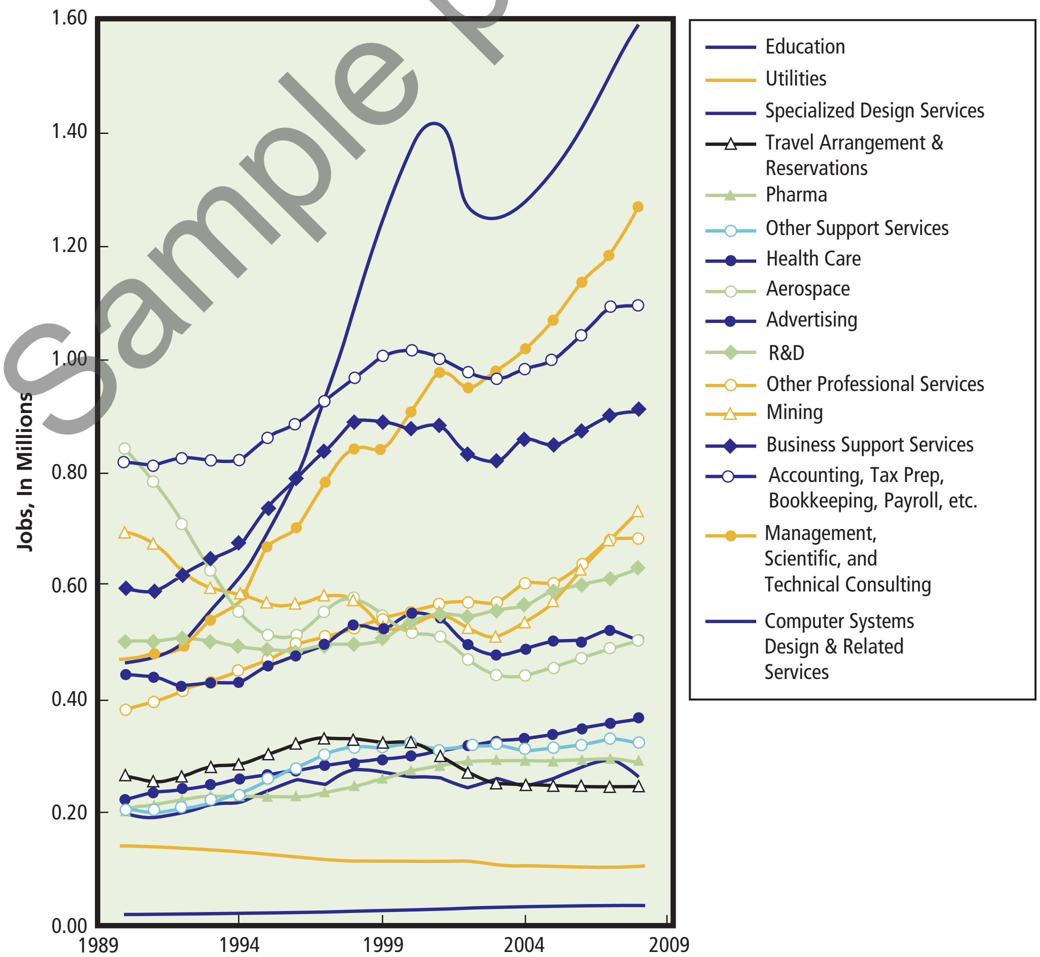

FIGURE 1-6

Growth of Jobs by Sector from 1989 to 2009

Source: From *The Evolving Structure of the American Economy* and the *Employment Challenge* by Michael Spence and Sandile Hlatshwayo. Copyright © 2011 by The Council on Foreign Relations Press. Reprinted with permission.

sales, support, and business management jobs as well. By the way, because Figure 1-6 shows tradable jobs, it puts an end to the myth that all the good computer jobs have gone overseas. According to their data analysis, sourced from the U.S. Bureau of Labor Statistics, that simply has not happened.

The data in Figure 1-6 stops at 2009 and, unfortunately, Spence and Hlatshwayo have not updated their study. However, Figure 1-7 shows the U.S. Bureau of Labor Statistics salary growth from 2012 to 2014 for business managers, computer and information technology, and other business occupations. It also shows job growth projections for the years 2014 to 2024.[9] Growth rates of all information systems–related jobs are above the 7 percent average for all occupations.

Information systems and computer technology provide job and wage benefits beyond just IS professionals. Acemoglu and Autor published an impressive empirical study of jobs and wages in the United States and parts of Europe from the 1960s to 2010. They found that early in this period, education and industry were the strongest determinants of employment and salary. However, since 1990, the most significant determinant of employment and salary is the nature of work performed. In short, as the price of computer technology plummets, the value of jobs that benefit from it increases dramatically.[10] For example, plentiful, high-paying jobs are available to business professionals who know how to use information systems to improve business process quality, or those who know how to interpret data mining results for improved marketing, or those who know how to use emerging technology like 3D printing to create new products and address new markets. See the Career Guide on pages 62–63 for more thoughts on why you might consider an IS-related job.

	2012 Median Pay	2014 Median Pay	Job Growth (%) 2014–24	Job Growth (N) 2014–24
Business Managers				
Marketing Managers	$ 115,750	$ 123,450	9%	19,700
Information Systems Managers	$ 120,950	$ 127,640	15%	53,700
Financial Managers	$ 109,740	$ 115,320	7%	37,700
Human Resources Managers	$ 99,720	$ 102,780	9%	10,800
Sales Managers	$ 105,260	$ 110,660	5%	19,000
Computer and Information Technology				
Computer Network Architects	$ 91,000	$ 98,430	9%	12,700
Computer Systems Analysts	$ 79,680	$ 82,710	21%	118,600
Database Administrators	$ 118,700	$ 80,280	11%	13,400
Information Security Analysts	$ 87,170	$ 88,890	18%	14,800
Network and Systems Admin.	$ 72,560	$ 75,790	8%	30,200
Software Developers	$ 93,350	$ 97,990	17%	186,600
Web Developers	$ 62,500	$ 63,490	27%	39,500
Business Occupations				
Accountants and Auditors	$ 63,550	$ 65,940	11%	142,400
Financial Analysts	$ 76,950	$ 78,620	12%	32,300
Management Analysts	$ 78,600	$ 80,880	14%	103,400
Market Research Analysts	$ 60,300	$ 61,290	19%	92,300
Logisticians	$ 72,780	$ 73,870	2%	2,500
Human Resources Specialists	$ 55,640	$ 57,420	5%	22,000

FIGURE 1-7

Bureau of Labor Statistics Occupational Outlook 2014–2024

Source: Based on Bureau of Labor Statistics, "Computer Systems Analysts," Occupational Outlook Handbook, accessed April 16, 2016, *www.bls.gov/ooh*.

What Is the Bottom Line?

The bottom line? This course is the most important course in the business school because:

1. **It will give you the background you need to assess, evaluate, and apply emerging information systems technology to business.**
2. **It can give you the ultimate in job security—marketable skills—by helping you learn abstraction, systems thinking, collaboration, and experimentation.**
3. **Many well-paid MIS-related jobs are in high demand.**

Q1-3 What Is MIS?

We've used the term *MIS* several times, and you may be wondering exactly what it is. **MIS** stands for **management information systems**, which we define as *the management and use of information systems that help organizations achieve their strategies*. MIS is often confused with the closely related terms *information technology* and *information systems*. An **information system (IS)** is an assembly of hardware, software, data, procedures, and people that produces information. In contrast, **information technology (IT)** refers to the products, methods, inventions, and standards used for the purpose of producing information.

How are MIS, IS, and IT different? You cannot buy an IS. But you can buy IT; you can buy or lease hardware, you can license programs and databases, and you can even obtain predesigned procedures. Ultimately, however, it is *your* people who will assemble the IT you purchase and execute those procedures to employ that new IT. Information technology drives the development of new information systems.

For any new system, you will always have training tasks (and costs), you will always have the need to overcome employees' resistance to change, and you will always need to manage the employees as they use the new system. Hence, you can buy IT, but you cannot buy IS. Once your new information system is up and running, it must be managed and used effectively in order to achieve the organization's overall strategy. This is MIS.

Consider a simple example. Suppose your organization decides to develop a Facebook page. Facebook provides the IT. It provides the hardware and programs, the database structures, and standard procedures. You, however, must create the IS. You have to provide the data to fill your portion of its database, and you must extend its standard procedures with your own procedures for keeping that data current. Those procedures need to provide, for example, a means to review your page's content regularly and a means to remove content that is judged inappropriate. Furthermore, you need to train employees on how to follow those procedures and manage those employees to ensure that they do. MIS is the management of your Facebook page to achieve your overall organization's strategy. Managing your own Facebook page is as simple an IS as exists. Larger, more comprehensive IS that involve many, even dozens, of departments and thousands of employees require considerable work.

The definition of MIS has three key elements: *management and use*, *information systems*, and *strategies*. Let's consider each, starting first with information systems and their components.

Components of an Information System

A **system** is a group of components that interact to achieve some purpose. As you might guess, an *information system (IS)* is a group of components that interacts to produce information. That sentence, although true, raises another question: What are these components that interact to produce information?

Figure 1-8 shows the **five-component framework**—a model of the components of an information system: **computer hardware**, **software**, **data**, **procedures**, and **people**. These five components are present in every information system, from the simplest to the most complex. For example, when you use a computer to write a class report, you are using hardware (the computer, storage disk, keyboard, and monitor), software (Word, WordPerfect, or some other word-processing program), data (the words, sentences, and paragraphs in your report), procedures (the methods you use to start the program, enter your report, print it, and save and back up your file), and people (you).

Consider a more complex example, say, an airline reservation system. It, too, consists of these five components, even though each one is far more complicated. The hardware consists of thousands of computers linked together by data communications hardware. Hundreds of different programs coordinate communications among the computers, and still other programs perform the reservations and related services. Additionally, the system must store millions upon millions of characters of data about flights, customers, reservations, and other facts. Hundreds of different procedures are followed by airline personnel, travel agents, and customers. Finally, the information system includes people, not only the users of the system but also those who operate and service the computers, those who maintain the data, and those who support the networks of computers.

The important point here is that the five components in Figure 1-8 are common to all information systems, from the smallest to the largest. As you think about any information system, including a new one like social networking, learn to look for these five components. Realize, too, that an information system is not just a computer and a program, but rather an assembly of computers, programs, data, procedures, and people.

As we will discuss later in this chapter, these five components also mean that many different skills are required besides those of hardware technicians or computer programmers when building or using an information system. See the Career Guide starting on page 62 for more.

Before we move forward, note that we have defined an information system to include a computer. Some people would say that such a system is a **computer-based information system**. They would note that there are information systems that do not include computers, such as a calendar hanging on the wall outside of a conference room that is used to schedule the room's use. Such systems have been used by businesses for centuries. Although this point is true, in this book we focus on computer-based information systems. To simplify and shorten the book, we will use the term *information system* as a synonym for *computer-based information system*.

Management and Use of Information Systems

The next element in our definition of MIS is the *management and use* of information systems. Here we define management to mean develop, maintain, and adapt. Information systems do not pop up like mushrooms after a hard rain; they must be developed. They must also be maintained, and, because business is dynamic, they must be adapted to new requirements.

You may be saying, "Wait a minute, I'm a finance (or accounting or management) major, not an information systems major. I don't need to know how to manage information systems." If you are saying that, you are like a lamb headed for shearing. Throughout your career, in whatever field you choose, information systems will be built for your use and sometimes under your direction. To create an information system that meets your needs, you need to take an *active role* in that system's development. Even if you are not a programmer or a database designer or some other IS professional, you must take an active role in specifying the system's requirements and in managing the system's development project. You will also have an important role in testing the new system. Without active involvement on your part, it will only be good luck that causes the new system to meet your needs.

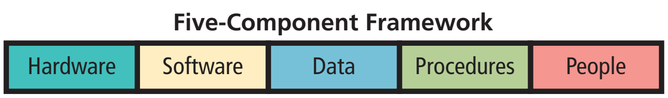

FIGURE 1-8
Five Components of an Information System

As a business professional, you are the person who understands business needs and requirements. If you want to apply social networking to your products, you are the one who knows how best to obtain customer responses. The technical people who build networks, the database designers who create the database, the IT people who configure the computers—none of these people know what is needed and whether the system you have is sufficient or whether it needs to be adapted to new requirements. You do!

Security is critically important when using information systems today. You'll learn much more about it in Chapter 10. But you need to know about strong passwords and their use now, before you get to that chapter. Read and follow the Security Guide on pages 60–61.

In addition to management tasks, you will also have important roles to play in the *use* of information systems. Of course, you will need to learn how to employ the system to accomplish your job tasks. But you will also have important ancillary functions as well. For example, when using an information system, you will have responsibilities for protecting the security of the system and its data. You may also have tasks for backing up data. When the system fails (all do, at some point), you will have tasks to perform while the system is down as well as tasks to accomplish to help recover the system correctly and quickly.

Achieving Strategies

The last part of the definition of MIS is that information systems exist to help organizations *achieve their strategies*. First, realize that this statement hides an important fact: Organizations themselves do not "do" anything. An organization is not alive, and it cannot act. It is the people within a business who sell, buy, design, produce, finance, market, account, and manage. So, information systems exist to help people who work in an organization to achieve the strategies of that business.

Information systems are not created for the sheer joy of exploring technology. They are not created so the company can be "modern" or so the company can show it has a social networking presence on the Web. They are not created because the information systems department thinks it needs to be created or because the company is "falling behind the technology curve."

This point may seem so obvious that you might wonder why we mention it. Every day, however, some business somewhere is developing an information system for the wrong reasons. Right now, somewhere in the world, a company is deciding to create a Facebook presence for the sole reason that "every other business has one." This company is not asking questions such as:

- "What is the purpose of our Facebook page?"
- "What is it going to do for us?"
- "What is our policy for employees' contributions?"
- "What should we do about critical customer reviews?"
- "Are the costs of maintaining the page sufficiently offset by the benefits?"

For more information on how an understanding of MIS can broaden your career options, see the Career Guide on pages 62–63.

But that company should ask those questions! Chapter 3 addresses the relationship between information systems and strategy in more depth. Chapter 8 addresses social media and strategy specifically.

Again, MIS is the development and use of information systems that help businesses achieve their strategies. You should already be realizing that there is much more to this class than buying a computer, working with a spreadsheet, or creating a Web page.

Q1-4 How Can You Use the Five-Component Model?

The five-component model in Figure 1-8 can help guide your learning and thinking about IS, both now and in the future. To understand this framework better, first note in Figure 1-9 that these five components are symmetric. The outermost components, hardware and people, are both actors; they can take actions. The software and procedure components are both sets of instructions: Software is instructions for hardware, and procedures are instructions for people. Finally, data is the bridge between the computer side on the left and the human side on the right.

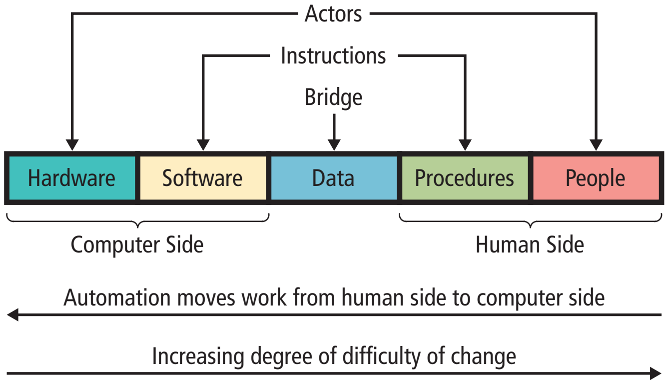

FIGURE 1-9
Characteristics of the Five Components

Now, when we automate a business task, we take work that people are doing by following procedures and move it so that computers will do that work, following instructions in software. Thus, the process of automation is a process of moving work from the right side of Figure 1-9 to the left.

The Most Important Component—You

You are part of every information system that you use. When you consider the five components of an information system, the last component, people, includes you. Your mind and your thinking are not merely a component of the information systems you use; they are the most important component.

As you will learn later in this chapter, computer hardware and programs manipulate data, but no matter how much data they manipulate, it is still just data. It is only humans that produce information. When you take a set of data, say, a list of customer responses to a marketing campaign, that list, no matter if it was produced using 10,000 servers and Hadoop (Chapter 9), is still just data. It does not become information until you or some other human take it into your mind and are informed by it.

Even if you have the largest computer farm in the world and even if you are processing that data with the most sophisticated programs, if you do not know what to do with the data those programs produce, you are wasting your time and money. The quality of your thinking is what determines the quality of the information that is produced.

Substantial cognitive research has shown that although you cannot increase your basic IQ, you can dramatically increase the quality of your thinking. That is one reason we have emphasized the need for you to use and develop your abstract reasoning. The effectiveness of an IS depends on the abstract reasoning of the people who use it.

All Components Must Work

Information systems often encounter problems—despite our best efforts, they don't work right. And in these situations, blame is frequently placed on the wrong component. You will often hear people complain that the computer doesn't work, and certainly hardware or software is sometimes at fault. But with the five-component model, you can be more specific, and you have more suspects to consider. Sometimes the data is not in the right format or, worse, is incorrect. Sometimes, the procedures are not clear and the people using the system are not properly trained. By using the five-component model, you can better locate the cause of a problem and create effective solutions.

High-Tech Versus Low-Tech Information Systems

Information systems differ in the amount of work moved from the human side (people and procedures) to the computer side (hardware and programs). For example, consider two different versions of a customer support information system: A system that consists only of a file of email addresses