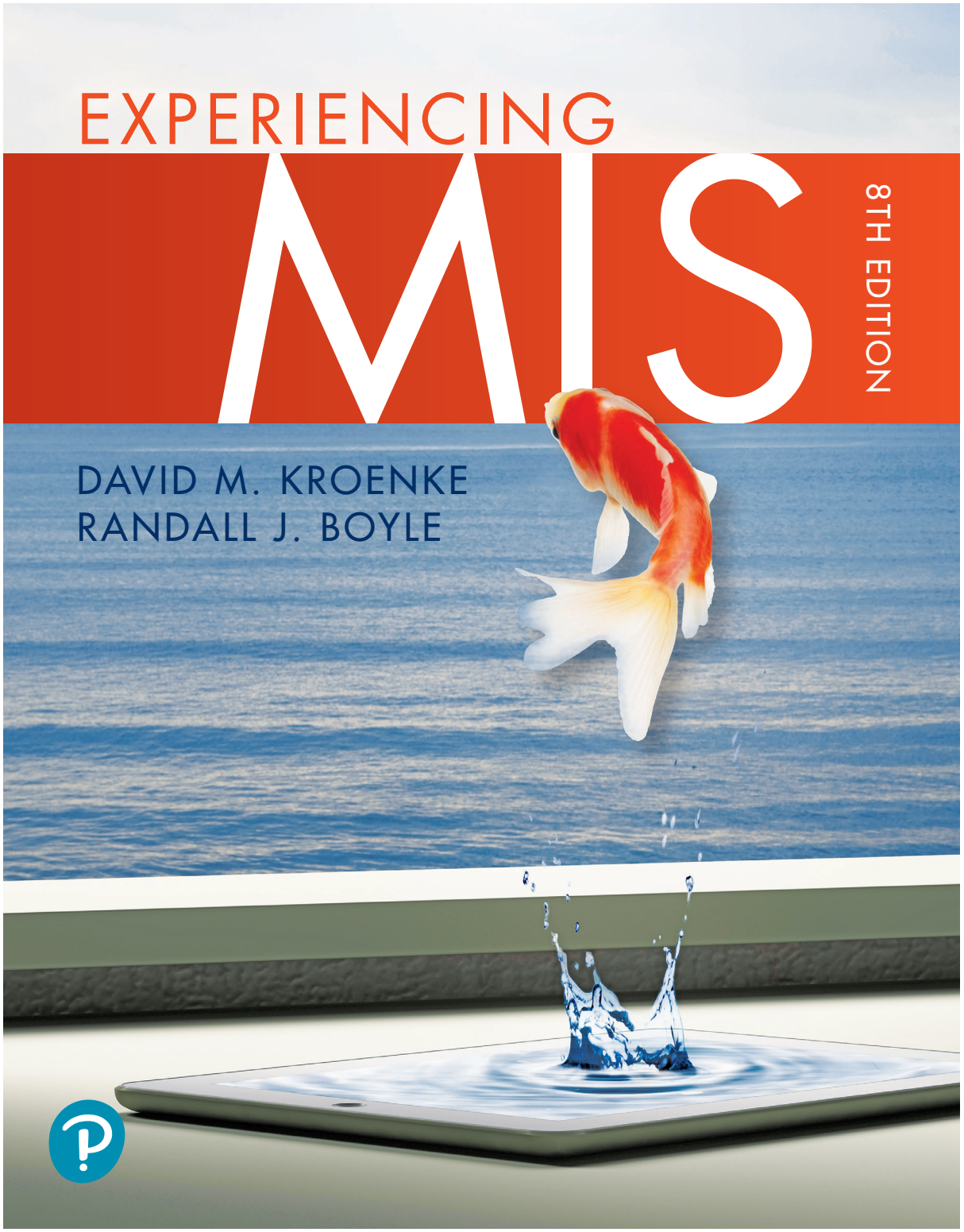

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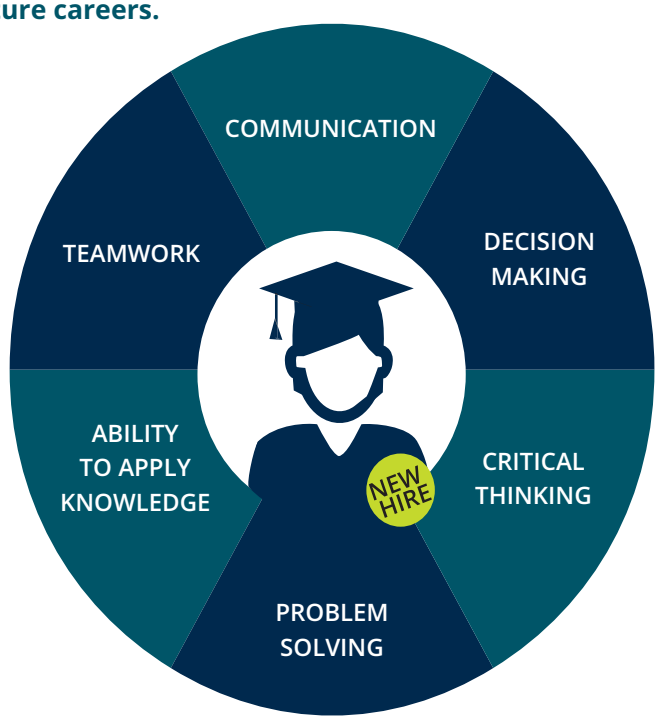

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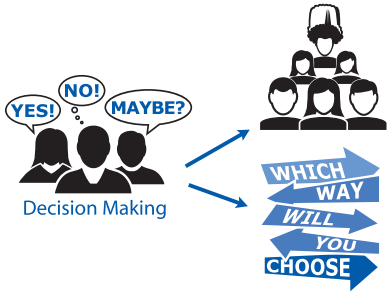

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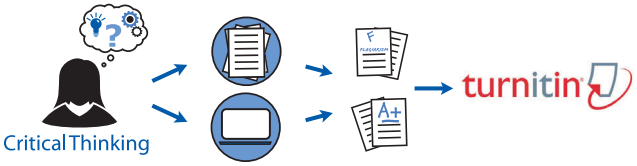

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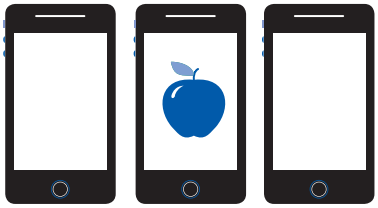

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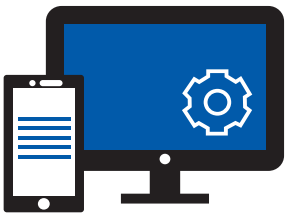

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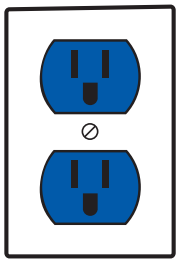

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Dear Student,

Honestly, this is a fun class. It's fun to take because you'll learn about things that dominate news headlines every day. You'll learn about things like self-driving cars, 3D printing, social media, Big Data, virtual reality, the cloud, and cyber security. No, it's not a programming class. It's not intended to be a class where you learn a bunch of boring technical terms and computer code. Not at all.

This class is about using technology to create value. For example, the smartphone sitting next to you is a piece of technology that is probably very valuable to you. It's an amazing piece of hardware that contains software, databases, and artificial intelligent agents. You use it to browse the Web, collaborate with friends, take pictures, post to social media, and make online purchases. More than 85 percent of college students have a smartphone, and 46 percent say they can't live without it. That's value, and they're willing to pay for it.

And that's what information systems are all about. Innovators like Steve Jobs, Bill Gates, Larry Ellison, Mark Zuckerberg, Larry Page, Sergey Brin, and Jeff Bezos have used technology to create value for their customers. As a result, they have made billions of dollars, revolutionized commerce, and created some of the largest companies in the world. And you can do the same thing in your personal life.

You can use technology to get a great job, increase your earning potential, and become indispensable to your future employer. You may not be a superstar entrepreneur like Steve Jobs, but you can exceed beyond your expectations by applying the knowledge you learn in this class. Companies are becoming increasingly dependent on technology. They need people who understand how to use *new* technology to solve *new* types of problems. And that's you.

Think about it. Over time, technology creates new jobs that didn't exist before. Mobile application developers, social media analysts, information security specialists, business intelligence analysts, and data architects didn't exist 20—even 10—years ago. Similarly, the best jobs 20 years from now probably don't currently exist.

The trick to turning information systems to your advantage is being able to predict technological innovations and then get ahead of them. During your career, you will find many opportunities for the innovative application of information systems in business and government—but only if you know how to look for them.

Once found, those opportunities become your opportunities when you—as a skilled, creative, non-routine problem solver—apply emerging technology to facilitate your organization's strategy. This is true whether your job is in marketing, operations, sales, accounting, finance, entrepreneurship, or another discipline.

Congratulations on deciding to study business. Use this course to help you obtain and then thrive in an interesting and rewarding career. Learn more than just the MIS terminology—understand the ways information systems are transforming business and the many, many ways you can participate in that transformation.

In this endeavor, we wish you, a future business professional, the very best success!

David Kroenke & Randy Boyle

The Guides

Each chapter includes two unique guides that focus on current issues in information systems. In each chapter, one of the guides focuses on an ethical issue in business. The other guide focuses on careers in the field of information systems. The content of each guide is designed to stimulate thought, discussion, and active participation in order to help *you* develop your problem-solving skills and become a better business professional.

LEARNING AIDS FOR STUDENTS

We have structured this book so you can maximize the benefit from the time you spend reading it. As shown in the table below, each chapter includes a series of learning aids to help you succeed in this course.

Resource	Description	Benefit	Example
Question-Driven Chapter Learning Objectives	These queries, and the subsequent chapter sections written around them, focus your attention and make your reading more efficient.	Identify the main point of the section. When you can answer each question, you've learned the main point of the section.	Chapter 6, Q6-1: Why Is the Cloud the Future for Most Organizations?
Guides	Each chapter includes two guides that focus on current issues relating to information systems. One addresses ethics, and the other addresses information systems careers.	Stimulate thought and discussion. Learn about real-world IS jobs. Help you learn to respond to ethical dilemmas in business.	Chapter 5 *Ethics Guide:* Querying Inequality? Chapter 9 *Career Guide:* Manager, Data and Analytics
So What?	Each chapter of this text includes a feature called So What? This feature presents a current issue in IS that is relevant to the chapter content and asks you to consider why that issue matters to you as a future business professional.	Understand how the material in the chapter applies to everyday situations.	Chapter 2 So What?: Augmented Collaboration
How Does the Knowledge in This Chapter Help You? (near the end of each chapter)	This section revisits the opening scenario and discusses what the chapter taught you about it.	Summarizes the "takeaway" points from the chapter as they apply to the company or person in the story and to you.	Chapter 11 How Does the Knowledge in This Chapter Help You?
Active Review	Each chapter concludes with a summary-and-review section, organized around the chapter's study questions.	Offers a review of important points in the chapter. If you can answer the questions posed, you understand the material.	Chapter 9 Active Review
Key Terms and Concepts	Highlight the major terms and concepts with their appropriate page references.	Provide a summary of key terms for review before exams.	Chapter 6 Key Terms and Concepts

Resource	Description	Benefit	Example
Using Your Knowledge	These exercises ask you to take your new knowledge one step further by applying it to a practice problem.	Tests your critical-thinking skills and keeps reminding you that you are learning material that applies to the real world.	Chapter 4 Using Your Knowledge
Collaboration Exercise	A team exercise that focuses on the chapter's topic.	Use Google Drive, Windows OneDrive, Microsoft SharePoint, or some other tool to collaborate on team answers.	Collaboration Exercise 3, which explores the use of information systems at a high-value bike rental service
Case Study	A case study closes each chapter. You will reflect on real organizations' use of the technology or systems presented in the chapter and recommend solutions to business problems.	Requires you to apply newly acquired knowledge to real situations.	Case Study 6: FinQloud Forever . . . Well, at Least for the Required Interval . . .
Application Exercises (at the end of the book)	These exercises ask you to solve business situations using spreadsheet (Excel) or database (Access) applications and other Office applications.	Help develop your computer skills.	6-2, which builds on your knowledge from Chapter 6 by asking you to import spreadsheet data into Access and produce cost reports
SharePoint Hosting	Pearson will host Microsoft SharePoint site collections for your university. Students need access to MyMISLab and a browser to participate.	Enables students to collaborate using the world's most popular collaboration software.	

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Experiencing MIS

Eighth Edition

David M. Kroenke

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To C. J., Carter, and Charlotte

—David Kroenke

To Courtney, Noah, Fiona, Layla, and Henry

—Randy Boyle

CONTENTS OVERVIEW

Experiencing MIS offers basic topic coverage of MIS in its 12 chapters and more in-depth, expanded coverage in its chapter extensions. This modular organization allows you to pick and choose among those topics. Here chapter extensions are shown below the chapters to which they are related. You will preserve continuity if you use each of the 12 chapters in sequence. In most cases, a chapter extension can be covered any time in the course after its related chapter. You need not use any of the chapter extensions if time is short.

CONTENTS

PART 3 Using IS for Competitive Advantage

CHAPTER 7: PROCESSES, ORGANIZATIONS, AND INFORMATION SYSTEMS P. 187

CHAPTER 8: SOCIAL MEDIA INFORMATION SYSTEMS P. 215

CHAPTER EXTENSIONS

CHAPTER EXTENSION 1: COLLABORATION INFORMATION SYSTEMS FOR DECISION MAKING, PROBLEM SOLVING, AND PROJECT MANAGEMENT P. 373

CHAPTER EXTENSION 2: COLLABORATIVE INFORMATION SYSTEMS FOR STUDENT PROJECTS P. 386

CHAPTER EXTENSION 3: MOBILE SYSTEMS P. 407

CHAPTER EXTENSION 4: INTRODUCTION TO MICROSOFT EXCEL 2016 P. 423

CHAPTER EXTENSION 5: DATABASE DESIGN P. 442

CHAPTER EXTENSION 6: USING MICROSOFT ACCESS 2016 P. 457

CHAPTER EXTENSION 7: USING EXCEL AND ACCESS TOGETHER P. 477

CHAPTER EXTENSION 8: NETWORK AND CLOUD TECHNOLOGY P. 505

CHAPTER EXTENSION 9: ENTERPRISE RESOURCE PLANNING (ERP) SYSTEMS P. 522

CHAPTER EXTENSION 10: SUPPLY CHAIN MANAGEMENT P. 537

CHAPTER EXTENSION 11: ENTERPRISE SOCIAL NETWORKS AND KNOWLEDGE MANAGEMENT P. 545

CHAPTER EXTENSION 12: DATABASE MARKETING P. 558

CHAPTER EXTENSION 13: REPORTING SYSTEMS AND OLAP P. 567

CHAPTER EXTENSION 14: ARTIFICIAL INTELLIGENCE AND AUTOMATION P. 578

CHAPTER EXTENSION 15: DATA BREACHES P. 593

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PREFACE

In Chapter 1, we claim that MIS is the most important class in the business curriculum. That's a bold statement, and every year we ask whether it remains true. Is there any discipline having a greater impact on contemporary business and government than IS? We continue to doubt there is. Every year brings important new technology to organizations, and many of these organizations respond by creating innovative applications that increase productivity and help them accomplish their strategies.

Over the past year, we've seen long-discussed innovations take big leaps forward. Digital reality (sometimes called virtual reality) really took off. Microsoft (HoloLens), Meta (Meta 2), and Facebook (Oculus Rift) released their digital reality devices. The reviews for these devices from early adopters were glowing. These devices will create entirely new types of companies and could change the way people live, work, shop, and entertain themselves.

Smart devices dominated the annual Consumer Electronics Show (CES) again this year. Self-balancing motorcycles, ultra-thin (2.5 mm) TVs, and Bluetooth-enabled smart cycles were a hit at the annual display of the latest innovative products. Businesses see the potential value in smart devices. They also recognize the need to collect, store, and analyze the data these devices will generate. As a result, job candidates with skills in analytics, business intelligence, and Big Data are all in high demand right now.

In addition to changing the ways we live and gather data, recent innovations are changing the way companies work, too. For example, over the past year Amazon experienced tremendous success using Kiva robots in its fulfillment centers. It expanded their use to 20 warehouses around the world. These 45,000 Kiva robots have reduced operating costs by 20 percent ($22 million per warehouse); they have also reduced click-to-ship times from 60 minutes to just 15 minutes.[1] If Amazon rolls out these robots to all of its 110 warehouses, it could save billions. Technology—in this case, an automated workforce—is fundamentally changing the way organizations operate. It's enabling them to be more productive, innovative, and adaptable.

Another technological advancement that made huge strides over the past year was self-driving cars. Tesla Motors turned a regular car into a self-driving car by simply pushing out a software update. The nearly autonomous vehicles have logged more than 1.3 billion miles on autopilot (with a few minor traffic incidents). Google, Mercedes Benz, and nearly all other automobile manufacturers are running full tilt to turn their traditional cars into fully autonomous smart cars. A recent study by Intel estimates the self-driving vehicle services to be worth $7 trillion by 2050.[2] Consider what would happen if Amazon started using self-driving trucks. It could reduce shipping costs by 80 percent!

Of course, not all of this year's technology news has been good. Large-scale data breaches continue to be a major problem. Friend Finder Networks (412 million), Dailymotion (85 million), Fling (40 million), and MySpace (164 million) all suffered enormous data losses. In fact, this year we found out about the largest data breaches ever. Yahoo! announced that it experienced data breaches in 2013 (1 billion) and again in 2014 (500 million). Unfortunately, it chose not notify users about these data breaches for years.

And these are just a fraction of the total number of organizations affected this year. Organizations saw a jump in the number of attacks from highly organized international hacking groups. The world saw the largest coordinated attack of critical systems using cryptographic ransomware ever. WannaCry malware crippled hundreds of corporate systems including but not limited to UK's National Health Service, FedEx, Nissan, Russian railway systems, Hitachi, and Renault.

This edition of the text has been updated for these developments as well as normal revisions that address emergent technologies like cloud-based services, artificial intelligence, machine learning, and so on.

All of these changes highlight the fact that more sophisticated and demanding users push organizations into a rapidly changing future—one that requires continual adjustments in business planning. In order to participate in this business environment, our graduates need to know how to apply emerging technologies to better achieve their organizations' strategies. Knowledge of MIS is critical to this endeavor. And this pace continues to remind us of Carrie Fisher's statement "The problem with instantaneous gratification is that it's just not fast enough."

WHY THIS EIGHTH EDITION?

To reiterate the preface of earlier editions, we believe it is exceedingly important to make frequent adaptations to this text because of the delays associated with long textbook revision cycles. Text materials we develop in April of one year are published in January of the next year and are first used by students in September—a minimum 17-month delay.

For some areas of study, a year and a half may not seem long because little changes in that amount of time. But in MIS, entire companies can be founded and then sold for billions of dollars in just a few years. YouTube, for example, was founded in February 2005 and then sold in November 2006 to Google for $1.65B (21 months). And that wasn't just a one-time fluke. Facebook Inc. started in 2004, led the social media revolution, and became a public company currently (as of mid-2016) valued at $341B. That's a whopping $28B in growth per year for 12 years! MIS changes fast—very fast. We hope this new edition is the most up-to-date MIS textbook available.

The changes in this eighth edition are listed in Table 1. Substantial changes were made in Chapter 6 and Chapter Extension 8 to provide some context about where the cloud came from and how it differs from previous architectures. New discussion about scalability and the advantages of cloud-based services is included as well as new graphics that more clearly differentiate between IaaS, PaaS, and SaaS. Chapter content was reorganized around an example that explains how the Internet works by comparing it to the U.S. postal system. Hopefully, this new example ties abstract and unfamiliar networking concepts to real-world experiences that students have experienced.

Table 1 Changes in the Seventh Edition

Chapter	Change
1	New So What? Feature: A Is for Alphabet New and updated charts for CPU and data storage growth Updated BLS job statistics
2	New Ethics Guide: Big Brother Wearables New Career Guide: Software Product Manager Updated So What? Feature: Augmented Collaboration
3	New So What? Feature: The Autonomous Race New Career Guide: Technology and Operations Executive New Ethics Guide: The Lure of Love Bots Updated Amazon Case Study
4	New So What? Feature: New from CES 2017 New Career Guide: Supportability Account Manager Updated industry statistics throughout the chapter Expanded augmented/mixed/virtual reality discussion New Collaboration Exercise: Microsoft HoloLens Updated Mac OS X to macOS
5	New So What? Feature: Slick Analytics New Career Guide: Senior Database Engineer Chapter content and images updated to Microsoft Access 2016, Microsoft Excel 2016, and SharePoint 2016

Chapter	Change
6	Reorganized chapter content for Q1 and Q2 New Q1 discussion about the origin of the cloud New Q1 cloud adoption examples statistics New discussion about scalability Expanded cloud versus in-house comparison New Q2 example using transportation as a service New Q2 graphics to illustrate differences between IaaS, PaaS, and SaaS New Q2 example and graphics for CDNs Updated Active Review questions Expanded Q5 discussion to include AaaS and BaaS New So What? Feature: Quantum Learning New Career Guide: Senior Network Manager Updated industry statistics throughout the chapter
7	New ARES introduction New Career Guide: IT Technical Manager New Ethics Guide: Paid Deletion Updated Q7-4 for ARES Example
8	New ARES introduction New So What? Feature: Enhanced Golf Fan New Career Guide: Freelance Marketer & Content Creator Updated industry statistics throughout the chapter New Social Media chapter examples
9	New ARES Systems introduction New Career Guide: Senior Technical Analyst New Ethics Guide: MIS-diagnosis Updated chapter examples using ARES Updated Office 2016 figures
10	New ARES Systems introduction New So What? Feature: New Black Hat 2016 New Career Guide: Security Consultant New industry statistics and charts throughout the chapter New Ethics Guide: Exhaustive Cheating Discussion of packet sniffers and global ransomware attack (WannaCry)
11	New ARES Systems introduction New Career Guide: Director of Architecture New Ethics Guide: Training Your Replacement New industry statistics and charts throughout the chapter Expanded discussion on outsourcing specialized tech skills New Automated Labor case study
12	New ARES Systems Introduction New So What? Feature: Banking on IoT New Career Guide: Developing Your Personal Brand

Chapter Extensions	Description of Change
Appl Ex	Updated data files New exercise looking up IT job salaries (O*NET and BLS) New exercise using an ad blocker (Adblock Plus) New exercise creating a mobile application (Microsoft Touch Develop) Updated Microsoft Office 2016 compliant files and chapter images
CE1	Discussion of constructive criticism and groupthink New examples of providing and receiving constructive criticism
CE2	Expanded discussion of real-time surveying software (Socrative) Updated SharePoint images
CE3	Updated mobile statistics
CE4	Chapter content and images updated to Microsoft Excel 2016
CE5	Chapter content and images updated to Microsoft Access 2016
CE6	Chapter content and images updated to Microsoft Access 2016 and Microsoft Excel 2016
CE7	Chapter content and images updated to Microsoft Access 2016 and Microsoft Excel 2016
CE8	Reorganized Chapter content for Q1-Q4 New Q4 example comparing the Internet and the U.S. postal system New Q4 content about DNS, TCP, IP addresses, Carriers, and IXPs Updated industry statistics throughout the chapter
CE9	Updated discussion about ERP leaders and market share statistics New discussion of Epicor ERP Updated discussion of the future of ERP systems
CE11	Updated chapter statistics
CE12	Updated RFM scoring
CE13	Chapter content and images updated to Microsoft Access 2016 and Microsoft Excel 2016
CE14	New chapter extension on AI and machine learning Discussion of why AI is important Discussion of how AI will affect organizations Discussion of how AI will affect you Discussion of the goals of AI Example of how AI works using machine learning and IBM's Watson
CE15	Updated chapter statistics and data breach examples
CE16	Updated section on localization using IBM Watson New examples in Q4 Legal Environment New statistics and discussion about international Internet access (fixed and mobile) New Career Guide: Director, Asian Operations
CE18	New statistics and discussion of agile methodologies and scrum use

This edition also includes a new chapter extension about artificial intelligence (AI) that focuses on the impacts of AI on organizations and workers. It looks at why AI has become so important within the last few years, and explores the long-term goals of this technology. We've included a simple machine learning example focused on spam filtering and a high-level look at IBM's Watson.

In addition, we've introduced a new "Career Guide" in this edition that lets students read firsthand accounts from people working in information systems jobs. Each of these guides is written by a MIS graduate and answers questions like "How did you get this type of job?" and "What does a typical workday look like for you?" Students taking an introductory course in MIS are often interested in majoring in MIS but aren't sure what it would be like to work in the field. These new guides answer some of the common questions students may have about working in the field.

Also, a secondary goal of these new Career Guides is to encourage female students not to be daunted by gender imbalances in a field that is 70 percent male and 30 percent female.[3] Half of the new Career Guides are written by men and the other half by women. Hopefully, hearing from successful women working in MIS jobs will inspire female students considering a career in MIS.

Chapters 7 through 12 begin with a new discussion of ARES Systems, a cloud-based augmented-reality exercise startup. Chapters 1–6 continue to be introduced by Falcon Security, a privately owned company that provides surveillance and inspection services for companies using flying drones. In addition to motivating the chapter material, both case scenarios provide numerous opportunities for students to practice one of Chapter 1's key skills: "Assess, evaluate, and apply emerging technology to business."

This edition also continues to focus on teaching ethics. Every Ethics Guide asks students to apply Immanuel Kant's categorical imperative, Bentham and Mill's utilitarianism, or both to the business situation described in the guide. We hope you find the ethical considerations rich and deep with these exercises. The categorical imperative is introduced in the Ethics Guide in Chapter 1 (pages 20–21), and utilitarianism is introduced in the Ethics Guide in Chapter 2 (pages 46–47).

As shown in Table 1, additional changes were made to every chapter, including eight new So What? features, six new Ethics Guides, eleven new Career Guides, and updated chapter cases. Additional figures, like the one showing how CDNs work in Chapter 6, were added to make the text more accessible. Numerous changes were made throughout the chapters in an attempt to keep them up-to-date. MIS moves fast, and to keep the text current, we checked every fact, data point, sentence, and industry reference for obsolescence and replaced them as necessary.

STRUCTURE, ORGANIZATION, AND APPEARANCE OF THIS TEXT

Teaching today is a very different endeavor than it was years ago. Students have many more distractions and demands on their time. They are quick to tune in and quick to tune out, so much so that someone compared their attention spans to those of Labrador Retriever puppies. We can lament that fact, but we can't change it. What we can do is to meet students where they are and creatively attempt to obtain their engagement.

We designed this text with that hope and goal in mind. Every feature of this book is designed to make it easy for students to engage with the content, not by watering it down but rather, we hope, by making it interesting and relevant to them. This text is not an encyclopedia; it attempts to teach essential topics well. It does so by providing opportunities for students to actively engage with the content, by providing features to help students better manage their study time, and with an appearance that makes it easy for students to pick up and start.

ACTIVE ENGAGEMENT

The structure of this edition of *Experiencing MIS* provides many opportunities for active engagement. Each chapter includes a So What? feature that contains exercises and questions for students to answer to demonstrate the relevancy of the chapter's material to them. Each chapter also contains an Ethics Guide that looks at the ethical implications of the chapter content. These can be used for small in-class exercises. Finally, this edition contains 41 application exercises (see page 660).

FACILITATE STUDENT STUDY

Today's students were reared in an environment of constant stimulation and channel surfing, and it seems nearly impossible for many students to focus on a single topic for more than a few minutes. Again, we can wish it otherwise, but short attention spans are students' and our reality. And recent research does seem to substantiate students' claim that, except for texting in class, students can multitask in class without problem.[5]

This text is structured to accommodate today's students' learning styles. First, to help students manage their time, it is organized around questions. Each chapter or chapter extension starts with a list of questions. Each major heading of the material is one of those questions, and the end of the chapter or extension includes an Active Review in which students are asked to demonstrate their learning of the answer to each question. Students should study until they can answer the questions; that may be 5 minutes or 5 hours, but their job is to answer those questions. This technique, from Marilla Svinicki's research, vastly helps students manage their study time.[6]

You can also use the questions to structure class sessions or at least parts of those sessions.

You can open class by asking students to "do the questions." Go around the room and call on someone to answer a question or part of one.

Second, students learn more when they are emotionally engaged in the material. The purpose of the vignettes that introduce each chapter is to raise student emotion; their purpose is to cause students to care about the chapter material.

Third, 82 percent of students in the business school prefer visual learning to auditory (voice or word) learning.[7] To make it easier for students to open this book and continue to read it, interesting and engaging art and photos have been used. *In every instance, however, we have insisted that the photo or art be related to the topic under discussion; these photos are not simply eye candy.* Pearson allows us to personally review and approve every photo and art exhibit in this text. We believe a good book does not have to appear boring, but all art must be relevant.

FEATURES FOR ENGAGING THE STUDENT

Experiencing MIS was written to make it impossible for readers of this text to miss the importance of MIS in business. The text is designed to be approachable, easy to use, sometimes humorous, with an upbeat and in-your-face attitude, but always with the goal of underlining the importance of MIS to all businesspeople in the 21st century.

An important part of making the text approachable was choosing a modular design. The text consists of 12 short chapters along with 19 supplemental discussions, called chapter extensions.

The modular nature of this text is discussed in more detail later in this preface.

EMPHASIS ON COLLABORATION

As with prior editions, this text emphasizes collaboration. It is one of Reich's key skills for the 21st-century professional, as described in Chapter 1. We believe we need not only to require our students to collaborate but also to teach them key skills for doing so. The first two chapter extensions present collaboration techniques and collaboration information systems, respectively. Each chapter also includes a collaboration exercise at the end of the chapter.

Additionally, Pearson Education is sponsoring Microsoft SharePoint for student use. At your request, Pearson will set up a SharePoint site collection that your students can use when responding to the collaboration exercises at the end of each chapter. Students need nothing more than a browser to participate. See your Pearson sales representative for more information.

OPENING SCENARIOS FOR PARTS AND CHAPTERS

Each part and each chapter opens with a scenario intended to get students involved emotionally. We want students to mentally place themselves in the situation and to realize that this situation—or something like it—could happen to them. Each scenario sets up the chapter's content and provides an obvious example of why the chapter is relevant to them. These scenarios help support the goals of student motivation and learning transfer.

Furthermore, both of these introductory cases involve the application of new technology to existing businesses. Our goal is to provide opportunities for students to see and understand how businesses are affected by new technology and how they need to adapt while, we hope, providing numerous avenues for you to explore such adaptation with your students.

In developing these scenarios, we endeavor to create business situations rich enough to realistically carry the discussions of information systems while at the same time simple enough that students with little business knowledge and even less business experience can understand. We also attempt to create scenarios that will be interesting to teach. This edition introduces the new ARES case and continues the Falcon Security case from the seventh edition.

FALCON SECURITY

The chapters in Parts 1 and 2 are introduced with dialogue from key players at Falcon Security, a privately owned company that provides surveillance and inspection services for companies using flying drones. We wanted to develop the case around an interesting business model that students would want to learn more about. Drones get a lot of attention in the press, but students may not know a lot about how they're used in business. Drones are getting cheaper and easier to fly and have a lot more functionality than they did just a few years ago. It's likely that students will see drones deployed widely during their careers.

Falcon Security is considering strengthening its competitive advantage by 3D printing its own drones. Buying fleets of drones is expensive, and they become outdated quickly. However, were the company to do so, it would be changing its fundamental business model, or at least adding to it. Making drones would require Falcon Security to hire new employees, develop new business processes, and potentially develop a new IS to support the custom-built drones. All of this is good fodder for Chapter 3 and for underlining the importance of the ways IS needs to support evolving business strategy.

Ultimately, Falcon Security determines that it does not want to become a drone manufacturer. It could print some drone parts, but not enough to make it cost effective. They'd still have to buy a lot of expensive component parts to assemble an airworthy drone, something they're not sure they can do consistently. Falcon decides to focus on its core strength of providing integrated security services.

Students may object that, in studying Falcon Security, they devoted considerable time to an -opportunity that ultimately didn't make business sense and was rejected. But this outcome is at least as informative as a successful outcome. The example uses knowledge of processes as well as application of business intelligence to avoid making a serious blunder and wasting substantial money. Falcon Security didn't have to open a factory and 3D-print a fleet of custom-built drones just to find out it would be a mistake. It could make a prototype, *analyze* the costs and benefits, and then avoid making the mistake in the first place. The very best way to solve a problem is not to have it!

ARES

The Augmented Reality Exercise System (ARES) is an embryonic entrepreneurial opportunity that uses digital reality devices (Microsoft HoloLens), data-gathering exercise equipment, and the cloud to share integrated data among users, health clubs, and employers. ARES allows users to virtually bike with friends, famous cyclists, or even "pacers" mimicking their previous performance.

ARES is based on a real-world prototype developed for the owner of a health club who wanted to connect the workout data of his club members to their workout data at home and to their employers, insurance companies, and healthcare professionals. The prototype was written in C#, and the code runs against an Azure database in the cloud. It used the Windows Phone emulator that is part of Visual Studio.

As reflected in the ARES case, the developers realized it was unlikely to succeed because Dr. Flores was too busy as a cardiac surgeon to make his startup a success. Therefore, he sold it to a successful businessman who changed the staff and the strategy and repurposed the software to take advantage of new digital reality hardware. All of this is described at the start of Chapter 7.

USE OF THE CATEGORICAL IMPERATIVE AND UTILITARIANISM IN ETHICS GUIDES

Since the introduction of the Ethics Guides into the first edition of this text, we believe there was a shift in students' attitudes about ethics. Students seem, at least many of them, to be more cynical and callous about ethical issues.

As a result, in the fifth edition, we began to use Kant's categorical imperative and Bentham and Mill's utilitarianism to ask students, whose ethical standards are often immature, to adopt the categorical imperative and utilitarian perspectives rather than their own perspectives and, in some cases, in addition to their own perspectives. By doing so, the students are asked to "try on" those criteria, and we hope in the process they think more deeply about ethical principles than they do when we allow them simply to apply their personal biases.

The Ethics Guide in Chapter 1 introduces the categorical imperative, and the guide in Chapter 2 introduces utilitarianism. If you choose to use these perspectives, you will need to assign both of those guides.

MODULAR DESIGN

Not every MIS class is the same, and even though most MIS professors would agree on the basic content of this class, each professor has his or her own interests, expertise, and emphasis. Further, courses differ not only because of student and professor interests, but also because of the local employment environment, the grade level at which the class is taught, the background and educational maturity of students, and so on.

To support such specialization, the text is organized into short chapters and optional chapter extensions. Each of the 12 short chapters describes the minimum essentials of a topic. Additional material is then presented in 18 optional chapter extensions. Thus, for example, Chapter 9 -addresses the basic ideas and purpose of business intelligence. That chapter is then supported by two chapter extensions: one on data mining and one on reporting and OLAP.

You can pick the extensions that relate to your class's interests and needs, or you can use just the chapter itself and skip the extensions without loss of continuity. For a more specific description of how the book is organized, see the section titled "How Is the Content Organized?"

GUIDES

This book contains boxed essays called "guides" that amplify each chapter's core material. These features have two purposes. First, the Career Guides are intended to give students a glimpse at real-world information systems jobs. Each career guide focuses on the relevant chapter material

and was written by an MIS graduate that works in that field. These guides help students think about the relevance of the chapter material to their future careers as businesspeople and, possibly, to encourage them to consider a career in MIS.

The second purpose of these guides is to encourage students to address the unique ethical issues that arise from using information systems. Use of the Ethics Guides will expose students to some of the fundamental principles relating to the combination of ethics, information systems, and business in general. All of the guides encourage students to grapple with some idea and its application to them either now or as future business professionals. Working with the guides should help students transfer knowledge from their MIS class to other classes and eventually to their business careers.

INTEGRATION OF EXCEL AND ACCESS

Most MIS courses today include some use of Microsoft Office. Usually, professors adopt a main MIS book and then select another book for Office instruction. The result is an expensive package for the student to buy and a schizophrenic break between the "principles" text and the "applications" text.

To eliminate these problems, this text includes four chapter extensions on Microsoft Excel and Access 2016. Chapter Extension 4 teaches the fundamentals of Excel. Chapter Extension 5 teaches database design, and Chapter Extension 6 shows how to apply the principles of database design using Microsoft Access. Finally, Chapter Extension 7 discusses the use of Excel and Access together. Data are passed back and forth between those products so that students can compare and contrast Excel and Access features and strengths. Also, students learn practical skills for managing real data.

Most students should be able to learn (or review) fundamental Excel and Access skills with no supplemental text. Students who need extra instruction can, of course, find it in one of the many excellent tutorials. But having that material in this text means that most students need not buy another book. Those exercises are consolidated into one list, starting on page 662.

HOW IS THE CONTENT ORGANIZED?

The text is organized into four parts. See the graphic outline on pages x-xi of the front matter for a visual presentation of the parts and chapters and of the relationship of the chapter extensions to the parts and chapters.

Part 1, "Why MIS?," introduces MIS and explains why and how it is important for business students. The three chapters in Part 1 address basic MIS definitions and the five-component framework, show how information and information systems relate to business processes, and explain the role of IS in support of organizational strategy and competitive advantage. Chapter extensions for Part 1 concern collaboration techniques and collaboration IS.

Part 2, "Information Technology," addresses fundamental IT concepts. The three chapters in Part 2 discuss hardware and software, database processing, and data communication. Chapter Extension 3 describes the development of Web and native mobile applications and describes an array of bring your own device (BYOD) policies. The next four chapter extensions teach the basics of Excel and Access, describe database design techniques, and show how to use Excel and Access together. Finally, Chapter Extension 8 discusses data communication technology that supports the cloud with particular focus on SOA and Web service standards.

Part 3 is titled "Using IS for Competitive Advantage." The three chapters in this part consider organization and systems, social media, and business intelligence systems. Part 3 chapter extensions present information on systems for ERP and supply chain management. Chapter Extensions 12 through 14 discuss database marketing, reporting systems and OLAP, and artificial intelligence.

Part 4, "Information Systems Management," concludes the text with three chapters that address information systems security, IS management including outsourcing, and systems

development. Note that due to the increased importance of security, that chapter is the first chapter in this part. Part 4 chapter extensions include a detailed description of data breaches, discussions of international MIS, systems development project management, agile systems development with scrum, and business process management.

Again, the goal of the modular organization of this text is to allow you to pick and choose among those topics that best fit your needs. You will preserve continuity if you use each of the 12 chapters in sequence, but you need not use any of the chapter extensions if time is short.

INSTRUCTOR RESOURCES

At the Instructor Resource Center, www.pearsonhighered.com/irc, instructors can easily register to gain access to a variety of instructor resources available with this text in downloadable format. If assistance is needed, our dedicated technical support team is ready to help with the media supplements that accompany this text. Visit http://247.pearsoned.com for answers to frequently asked questions and toll-free user support phone numbers.
The following supplements are available with this text:

- Test Bank
- TestGen® Computerized Test Bank
- PowerPoint Presentation

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David Kroenke
Randy Boyle

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ENDNOTES

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David worked for the U.S. Air Force and Boeing Computer Services. He was a principal in the startup of three companies, serving as the vice president of product marketing and development for the Microrim Corporation and as chief of database technologies for Wall Data, Inc. He is the father of the semantic object data model. David's consulting clients have included IBM, Microsoft, and Computer Sciences Corporation, as well as numerous smaller companies. Recently, David has focused on using information systems for teaching collaboration and teamwork.

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His research areas include deception detection in computer-mediated environments, secure information systems, the effects of IT on cognitive biases, the effects of IT on knowledge workers, and e-commerce. He has published in several academic journals and has authored additional textbooks, including *Using MIS*, 10th ed., *Corporate Computer and Network Security*, 4th ed., *Applied Information Security*, 2nd ed., and *Applied Networking Labs*, 2nd ed.

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PART 1

Why MIS?

Falcon Security is a 5-year-old, privately owned company that uses aerial drones to provide surveillance and inspection services for customers. Its customers are large industrial companies that want to reduce their physical security labor costs or need periodic inspection services for industrial sites. Falcon has contracts with several large oil refineries in Texas to provide real-time video surveillance of their sizable industrial facilities. It also does occasional safety inspections on critical infrastructure components (e.g., flare stacks), which would be difficult and dangerous to do in person.

Falcon Security's CEO and cofounder is Mateo Thomas. In the early part of his career, Mateo was a major in the United States Army in charge of physical security at a large military base in the Middle East. After retiring from the Army, Mateo went to work as the director of security at a large Texas-based industrial manufacturer. While serving on a security policy steering committee with business unit managers, he met the young and ambitious Joni Campbell. He told Joni that the company was paying way too much for physical security. He thought the company could buy a few drones to do the work of several physical security guards at a fraction of the cost. From his time in the military, he'd seen how drones could be used successfully to improve security with much less time and effort. The problem was that he didn't know much about actually operating the drones. Neither did Joni.

A week later, Joni was at a friend's wedding and saw a wedding video that included amazing aerial shots of the bride and groom on the beach, driving, and walking in the park. Curious, she approached the photographer, Camillia (Cam) Forset, and asked her how she produced those stunning videos. Turns out that Cam did weddings part-time during the summer months. Her day job, which she didn't especially like, was as a regional sales representative for a drone manufacturer. She experimented with drones at a few photo shoots and the results were spectacular. Everyone who saw the aerial

footage wanted it. She was the only photographer in the metro area who could produce aerial video, and her business thrived. But weddings were mostly seasonal, and she still needed her day job to pay the bills. Joni knew she'd found the drone expert she needed and asked Cam if she'd like to have lunch with her and Mateo the following Saturday.

After hearing Cam talk about everything commercial drones could do, Mateo and Joni realized that using drones for corporate security was a much bigger opportunity than they had thought. Mateo and Joni founded Falcon Security and hired Cam. Five years later, Falcon Security has 15 large industrial clients that pay for daily security surveillance and dozens of industrial clients that contract for aerial safety inspections. It has also recently contracted with a few clients asking for one-time aerial land survey, videography (commercials, real estate, etc.), and agricultural monitoring.

Falcon Security has revenues of about $14M a year, most of which comes from providing physical security to its large industrial clients. Mateo wants to grow Falcon Security nationally. He knows there are plenty of industrial clients outside of Texas that would pay for Falcon's services, possibly even a lucrative contract with the federal government. Joni is worried that Falcon is not ready. It's been a bumpy ride. Buying fleets of drones (planes and helicopters) has been expensive and, at times, frustrating. People have to be trained to operate the drones, the drones seem to break frequently, and newer models are always coming out. Then there's the hugely expensive systems development project that's currently underway to automate the collection, storage, and analysis of the data from the drones.

Mateo has also been exploring 3D printing as a way to reduce the costs of the drones. Cam's team was able to rapidly create an innovative prototype of a new passive recharging platform using a 3D printer. Now Falcon's drones can land, charge, and take off again without any human intervention. This has saved countless hours managing the drones and has increased the overall effective range of the drones. Fleets of autonomous drones can now be deployed across long distances by stopping every 10 to 15 miles at a recharging station.

Mateo hopes the company can have the same success in making its own drones. But he's not sure he wants to manufacture drones. How many new employees will he need to hire and train? How much will it cost to buy additional equipment and information systems to support the manufacturing process? Will these new drones be compatible with their existing data collection and processing system? Mateo asks Joni and Cam to figure out if manufacturing drones is the right move for Falcon Security.

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?"

MyLab MIS

Using Your Knowledge Questions 1-1, 1-2, 1-3

Essay Questions 1-15, 1-16

Excel and Access Application Questions 1-1 to 1-2

"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."

"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."

Source: cheskyvv/123RF

"But today, they're not enough."

"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."

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 WHY ARE MIS-RELATED JOBS IN HIGH DEMAND?

Q1-4 WHAT IS MIS?

Q1-5 WHAT IS YOUR ROLE IN IS SECURITY?

How does the knowledge in this chapter help you?

CE

Optional Extension for this chapter is • CE1: Collaboration Information Systems for Decision Making, Problem Solving, and Project Management 373

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 $735B. The largest IPO offering in history ($25B) came from the online ecommerce 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 ground breaking. 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.

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 stardard CPU cost about $110 per million transistors. By 2017, 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

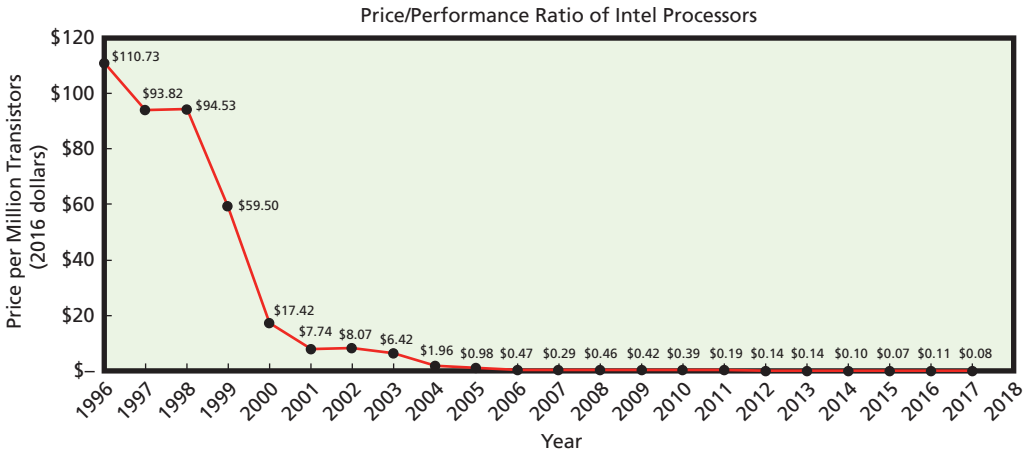


Figure 1-1
Computer Price/Performance Ratio Decreases

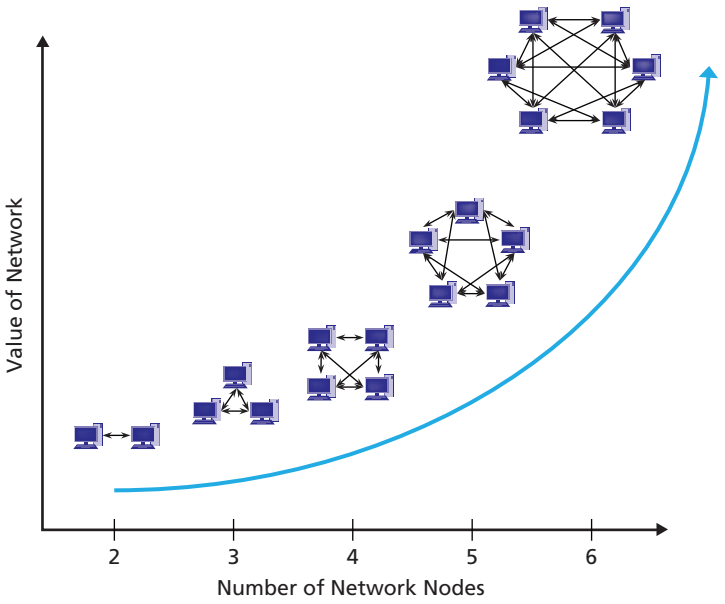


Figure 1-2
Increasing Value of Networks

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.

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

Figure 1-3
Fundamental Forces Changing Technology

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.

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.

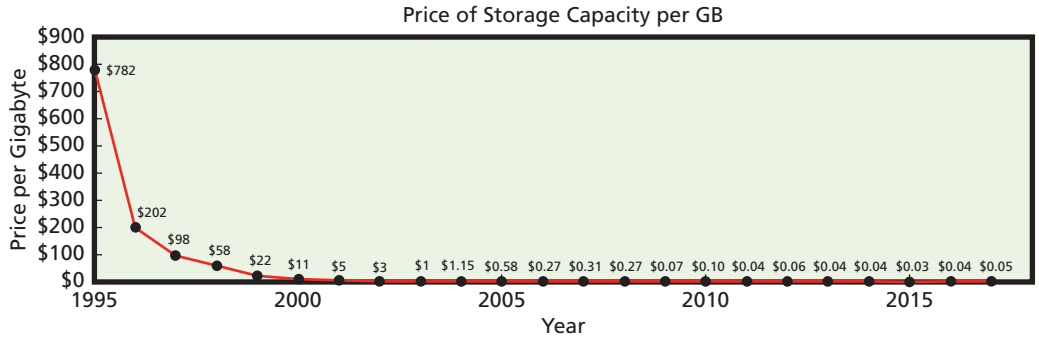
THIS IS THE MOST IMPORTANT CLASS IN THE SCHOOL OF BUSINESS

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.

Figure 1-4
Price of Storage Capacity per GB



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 i-Gadget 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]

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 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 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

The first two chapter extensions on pages 373–406 discuss collaboration in detail and guide you in how to collaborate with your peers.

Collaboration is the activity of two or more people working together to achieve a common goal, result, or work product. Chapter Extensions 1 and 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.

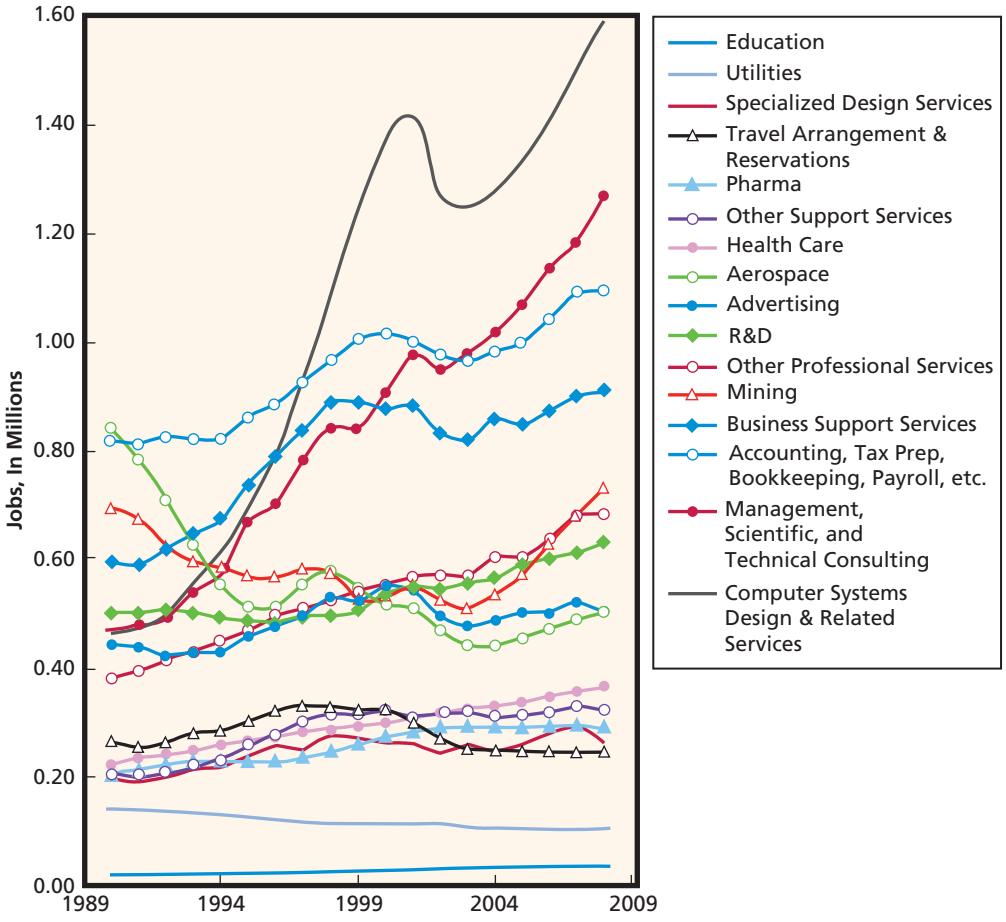
Q1-3 WHY ARE MIS-RELATED JOBS IN HIGH DEMAND?

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 2014. It found that 68 percent of 2016 college graduates say they will need additional on-the-job training, and 37 percent indicated that they will require an advanced degree to further their career. Further, 51 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 non-technical sales, support, and business management jobs as well. By the way, because Figure 1-6

Figure 1-6
Growth of Jobs by Sector

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.



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 Guide on pages 22–23 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

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.**

The Ethics Guide in each chapter of this book considers the ethics of information system use. The guides challenge you to think deeply about how to apply ethical standards to unfamiliar situations. The Ethics Guide on pages 20–21 considers the ethics of using information that deceives the viewer.

So What? | A Is for Alphabet

We are living in an era referred to as the Information Age, a period in human history characterized by the shift from an economy based on industrial production to one based on information and computerization.[11] This shift has changed virtually every aspect of our lives, from the way we communicate with friends, coworkers, and loved ones to the way we purchase goods and carry out various financial transactions. What advancement made this shift possible? You guessed it—the Internet!

As with most technological innovations, the Internet started out as a project sponsored by both research and governmental entities. It took several decades to lay the groundwork for the Internet as we know it today, and the tipping point for widespread Internet use was the introduction of Netscape Navigator, the Web browser of choice in the mid-1990s. The adoption and use of Netscape were critical because they allowed fledgling Internet users to access information posted by other users around the world. At that time, the content available on the Internet was minimal, and only tech-savvy users could create and manage content. Over time, the amount of information available became so great that new tools were needed to search the Internet. Enter Google.

Google Searches for a Better Future in Alphabet

Today, Google is the dominant Internet search engine and is one of the largest publicly traded companies in the world. What you may not realize is that Google's core search engine service (Google Search) is only one of many successful products in a larger portfolio. Google has turned Google Maps, YouTube, Chrome, and Android into successful standalone offerings. The success and diversity of Google's many projects led the company to announce that, as of August 10, 2015, it was a subsidiary of an overarching company named Alphabet Inc.[12]

Google founders Larry Page and Sergey Brin decided that it was time to reduce their involvement in the daily management of Google projects. To facilitate this change, each project was transitioned into a standalone company with its own CEO, and each standalone company is a subsidiary of Alphabet Inc. In this way, Page and Brin can manage the overall strategic objectives of the subsidiaries without having to immerse themselves in the daily operations of each company.

Why did they choose the name Alphabet? In a blog post about the new direction of the company, Page revealed that there are a number of meanings associated with this new name. First, an alphabet represents the collection of letters used to define a language, which Page classifies as one of humanity's most profound creations. Second, alphabets serve as the basis for Google searches around the world. Finally, in the world of finance, alpha represents an investment return above the benchmark, which, according to Page, is something the company is continuously striving to achieve.[13]

While Page's rationale about the restructuring makes sense, outsiders have identified this strategy as a direct response to Google's struggles to retain top talent in a highly competitive industry. Before restructuring, Google housed a wide variety of projects and research initiatives under one roof; this led to an increasingly bureaucratic climate and inherent limitations on the career trajectories of industry superstars.[14] Alphabet was born to create a new corporate environment in which top talent can thrive. In the Alphabet hierarchy, individual companies are much more nimble and better able to provide the autonomy and efficiency that smaller companies offer.

When future generations look back at the Information Age, it is likely Alphabet will be seen as playing a prominent role. With all of the projects the company is pursuing—everything from drones and robots to medical research and artificial intelligence—it is intriguing to think about the role Alphabet will play in shaping the next era of humanity.

QUESTIONS

1. The feature identifies the Internet as a catalyst for the Information Age. What other innovations have contributed to this era of unprecedented access to information via computers?
2. Think about your daily use of phones, tablets, and traditional desktop/laptop computers. How many searches do you perform each day? What types of things do you search for on the Internet? Do you use Google for these searches? If not, what search engine do you use? Why do you use that search engine?
3. Conduct an Internet search to find a project or product offered by Alphabet that you had not heard about before reading this feature. Are you surprised at the diversity of the company and its projects and research initiatives?
4. What technological innovation do you think will drive the next great era in humanity? What do you think the defining elements of that era will be?

Q1-4 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

These five components also mean that building information systems requires many different skills besides those of hardware technicians or computer programmers. See the Guide on pages 22–23 for more.

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.

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.

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!

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

Figure 1-8
Five Components of an Information System

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?"

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.

Q1-5 WHAT IS YOUR ROLE IN IS SECURITY?

As you have learned, information systems create value. However, they also create risk. For example, Amazon.com maintains credit card data on millions of customers and has the responsibility to protect that data. If Amazon.com's security system was breached and that credit card data stolen, Amazon.com would incur serious losses—not only lost business, but also potentially staggering liability losses. Because of the importance of information security, we will consider it throughout this textbook. Additionally, Chapter 10 is devoted to security.

However, you have a role in security that is too important for us to wait until you read that chapter. Like all information systems, security systems have the five components, including people. Thus, every security system ultimately depends on the behavior of its users. If the users do not take security seriously, if they do not follow security procedures, then the hardware, software, and data components of the security system are wasted expenses. So, before we proceed further, we will address how you should create and use a strong password, which is an essential component of computer security.

Almost all security systems use usernames and passwords. As a user of information systems in a business organization, you will be instructed to create a strong password and to protect it. *It is vitally important for you to do so*. You should already be using such passwords at your university.