Using MIS 2019

eleventh edition

David M. Kroenke | Randall J. Boyle

Using MIS

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 artificial intelligence, self-driving cars, 3D printing, social media, Big Data, virtual reality, the cloud, and cybersecurity. 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, nonroutine 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 three unique **guides** that focus on current issues in information systems. In each chapter, one of the guides focuses on an ethical issue in business, and the second focuses on security. The third 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 following table, each chapter includes various learning aids to help you succeed in this course.

Resource	Description	Benefit	Example
Guides	Each chapter includes three guides that focus on current issues in information systems. One addresses ethics, one addresses security, and the third addresses information systems careers.	Stimulate thought and discussion. Address ethics and security once per chapter. Learn about real-world IS jobs.	Chapter 5, Ethics Guide: Mining at Work Chapter 8, Security Guide: It's Not Me . . . It's You Chapter 9, Career Guide: Social Media/Online Reputation Manager
Chapter Introduction Business Example	Each chapter begins with a description of a business situation that motivates the need for the chapter's contents. We focus on two different businesses over the course of the text: eHermes, an automated mobile storefront retailer; and ARES, an augmented reality exercise startup opportunity.	Understand the relevance of the chapter's content by applying it to a business situation.	Chapter 9, opening vignette: Social Media Information Systems and ARES
Query-Based Chapter Format	Each chapter starts with a list of questions, and each major heading is a question. The Active Review contains tasks for you to perform in order to demonstrate your ability to answer the questions.	Use the questions to manage your time, guide your study, and review for exams.	Chapter 1, Q1-4: How Can You Use the Five-Component Model? Chapter 6, Q6-4: How Does the Internet Work?
So What?	Each chapter of this text includes an exercise called "So What?" This feature challenges the students to apply the knowledge they've gained from the chapter to themselves, often in a personal way. The goal is to drive home the relevancy of the chapter's contents to their future professional lives. It 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? Amazon Eats Whole Foods

Resource	Description	Benefit	Example
2029?	Each chapter concludes with a discussion of how the concepts, technology, and systems described in that chapter might change by 2029.	Learn to anticipate changes in technology and recognize how those changes may affect the future business environment.	Chapter 8, 2029? discusses the future of ERP applications
Active Review	This review provides a set of activities for you to perform in order to demonstrate your ability to answer the primary questions addressed by the chapter.	After reading the chapter, use the Active Review to check your comprehension. Use for class and exam preparation.	Chapter 9, Active Review
Using Your Knowledge	These exercises ask you to take your new knowledge one step further by applying it to a practice problem.	Test your critical-thinking skills.	Chapter 4, Using Your Knowledge
Collaboration Exercises	These exercises and cases ask you to collaborate with a group of fellow students, using collaboration tools introduced in Chapter 1.	Practice working with colleagues toward a stated goal.	Collaboration Exercise 2 discusses how to tailor a high-end resort's information system to fit its competitive strategy
Case Studies	Each chapter includes a case study at the end.	Apply newly acquired knowledge to real-world situations.	Case Study 6, Salesforce.com
Application Exercises	These exercises ask you to solve situations using spreadsheet (Excel), database (Access), or Web applications.	Develop your computer skills.	AE10-2 builds on your knowledge from Chapter 10 by asking you to score the Web sites you visit using WOT
International Dimension	This module at the end of the text discusses international aspects of MIS. It includes the importance of international IS, the localization of system components, the roles of functional and cross-functional systems, international applications, supply chain management, and challenges of international systems development.	Understand the international implications and applications of the chapters' content.	International Dimension QID-3, How Do Inter-enterprise IS Facilitate Global Supply Chain Management?

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ELEVENTH EDITION

Using MIS

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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. Self-driving vehicles made huge strides over the past year. Tesla Motors logged 1.3 billion miles on its nearly autonomous (level 3) self-driving vehicles (with a few minor traffic incidents). Waymo (Google) logged more than 5 million fully autonomous (level 5) miles, and Uber logged more than 2 million autonomous miles. 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 that self-driving vehicle services will be worth $7 trillion by 2050.[1] Consider what would happen if Amazon started using self-driving trucks. It could reduce shipping costs by 80 percent!

At the annual Consumer Electronics Show (CES), Toyota announced an autonomous concept vehicle named the e-Palette that the company believes will fulfill a role in an emerging mobility as a service (MaaS) market. Smart devices were also a hit at CES again this year. A smart treadmill allows users to participate in live exercise classes led by expert trainers streamed right to their homes. A robotic Wi-Fi-enabled smart dog can recognize individuals and interact with them and recharge itself. Businesses see the potential value in smart devices such as these. They also recognize the need to collect, store, and analyze the data these devices generate. As a result, jobs in analytics, business intelligence, and Big Data are all in high demand right now.

Digital reality (sometimes called virtual reality) has really taken off. Microsoft announced that its second-generation device would be released in 2019 after a successful launch of its first mixed-reality device. Google showed off Magic Leap and indicated that it would debut in 2019. Expectations are high for Magic Leap considering that investors have put a record-breaking $4.5 billion into this secretive startup. The reviews for these devices from early adopters are glowing. These devices will create entirely new types of companies and could change the way people live, work, shop, and entertain themselves.

In addition to changing the ways individuals 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 use of these robots to 26 warehouses around the world. These 100,000 Kiva robots have reduced operating costs by 20 percent ($22 million per warehouse); they have also reduced click-to-ship times by 75 percent.[2] 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.

Of course, not all of this year's technology news has been good. Large-scale data breaches continue to be a major problem. In fact, Yahoo! reluctantly disclosed that it experienced multiple data breaches during the previous 4 years totaling more than 3 billion lost records. Collectively, these data breaches represent the largest amount of compromised data in history, and Yahoo! chose not to notify users about these data breaches for years. Other notable data breaches this year included the loss of user accounts at DU Caller Group in China (2 billion), River City Media, LLC (1.3 billion), and FriendFinder Networks, Inc. (412 million).[3]

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 Mirai worm knocked more than 1 million German households offline, slowed large portions of the United States, and has spawned numerous variants that continue to affect IoT devices today.

This edition of the text has been updated for these developments as well as normal revisions that address emergent technologies like artificial intelligence, machine learning, cloud-based services, 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 Eleventh 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-2018) valued at $583B. That's a whopping $41B in growth per year for 14 years! MIS changes fast—very fast. We hope this new edition is the most up-to-date MIS textbook available.

The changes in this eleventh edition are listed in Table 1. The chapter on business intelligence systems was pulled forward to Chapter 3 because of the increased importance of these systems to all businesses. Every large tech company has spent considerable resources acquiring artificial intelligence (AI) companies in the past 10 years, including Google ($3.9 billion), Amazon ($871 million), Apple ($786 million), Intel ($776 million), and Microsoft ($690 million).[4] And that's not counting additional internal investments. AI and machine learning are becoming core parts of these companies' competitive advantage. Some of the highest-paying jobs are in AI, business analytics, Big Data, and data mining.

TABLE 1: CHANGES IN THE ELEVENTH EDITION

Chapter	Change
1	New eHermes introduction
	New and updated charts for CPU and data storage growth
	New job sector comparison statistics
	Discussion of the MIS skills gap
	Updated BLS job statistics for Business and MIS occupations
	New collaboration exercise (creating a collaboration system)

Chapter	Change
2	New eHermes introduction
	New So What? Guide: Amazon Eats Whole Foods
	Added discussion of first and second mover advantages
	Updated Amazon case study
3	New eHermes introduction
	New So What? Guide: Geofencing for Businesses
	New Security Guide: Equihax

Chapter	Change
	Reorganized chapter content for Q3-1 through Q3-4
	Simplified BI example in Q3-1 to find candidate 3D printing parts
	New Q3-5 discussion of why AI is important
	New Q3-6 discussion of how AI will affect organizations
	New Q3-7 discussion of the goals of AI
	New Q3-8 example of how AI works using machine learning and IBM's Watson
	New Q3-9 2029 discussion
	Updated Active Review questions
	New Using Your Knowledge questions
4	New eHermes introduction
	New So What? Guide: New from CES 2018
	New Career Guide: Senior Software Engineer
	Added discussion about cryptocurrencies, Bitcoin, blockchain, and phablets
	Updated Mac OS X to macOS
	Updated industry statistics throughout the chapter
	Updated Case Study and Ethics Guide
5	New eHermes introduction
	New Ethics Guide: Mining at Work
	New Career Guide: Director of Data Engineering
	New Q5-7 discussing databases at eHermes
	Updated images and statistics throughout the chapter
6	New eHermes introduction
	New Security Guide: IRS Systems Overtaxed
	New Ethics Guide: Reverse Engineering Privacy
	Updated industry statistics throughout the chapter
	Updated discussion about ICANN, net neutrality, and telemedicine
	Updated Q6-6 discussion of eHermes using the cloud
	New Case Study: Salesforce.com
7	New So What? Guide: Future of the Gig Economy
	New Security Guide: Security in the Sharing Economy
	New collaboration exercise
	New Case Study: Airbnb
	New Q7-9 2029 discussion about the sharing economy and the gig economy

Chapter	Change
	Updated chapter statistics and images
8	New ARES Systems introduction
	New So What? Guide: Digital Dining
	New Career Guide: Software/Platform Engineer
	Expanded discussion about major ERP vendors
9	New Security Guide: Social Engineering Bitcoin
	New Career Guide: Social Media Marketing
	New Case Study: LinkedIn
	New discussion about geofencing
	Updated collaboration exercise
	Updated industry statistics and charts throughout the chapter
	New Q7-9 2029 discussion
10	New So What? Guide: New from Black Hat 2017
	New Security Guide: Largest! Data! Breach! Ever!
	New Ethics Guide: Web Recoding Everything
	New industry statistics and charts throughout the chapter
	New discussion about legal safeguards for data
11	New So What? Guide: Poor Data Management at Facebook
	New Career Guide: Data Governance Officer
	Updated industry statistics and charts throughout the chapter
	New Q11-5 2029 discussion
12	New Security Guide: IoT and Mirai
	New Ethics Guide: Engineered Slowdown
	New charts and statistics about agile and scrum use
International Dimension	New Career Guide: Senior Learning and Development Specialist
	Updated statistics about international Internet access (fixed and mobile)
	New discussion of the General Data Protection Regulation (GDPR) law
	Updated examples of bribery and asset seizure
Appl Ex	New exercise AE3-3 Microsoft AI applications Fetch! and How-old
	New exercise AE6-4 Networking commands ping and ipconfig
	New exercise AE10-3 Recuva file recovery
	Updated data files and images

Even consumers are being affected. Consumers are interacting with AIs like Alexa, Google, and Siri in their homes on a daily basis. Machine learning is being used to make personalized recommendations for online shoppers. It's also being used to create automated Gmail replies, optimize Uber arrival times, and identify which songs you'll want to listen to.

Substantial changes were made in Chapter 3 with the addition of three new sections about artificial intelligence (AI). These sections focus on the impacts of AI on organizations and workers.

They look at why AI has become so important within the past few years and the long-term goals for this technology. We've included a simple machine learning example focused on spam filtering and a high-level look at IBM's Watson.

The chapter on collaboration information systems (now Chapter 7) was moved back to Part 3 ("MIS in Organizations") because it focuses on systems in organizations, much like Chapters 8 and 9 do. We hope this new organization of chapters will make the presentation of the chapters flow more naturally.

Chapters 1 through 6 begin with a new discussion of eHermes, a startup that provides mobile shopping experiences using self-driving vehicles. Chapters 7 through 12 continue to be introduced by the discussion of ARES Systems, a cloud-based augmented-reality exercise startup. 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 23–24), and utilitarianism is introduced in the Ethics Guide in Chapter 2 (pages 42–43).

As shown in Table 1, additional changes were made to every chapter, including seven new So What? features, four new Ethics Guides, six new Career Guides, six new Security Guides, and four new chapter cases. Additional figures, like the one showing how machine learning works in Chapter 3, 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.

Importance of MIS

As stated, we continue to believe we are teaching the single most important course in the business school. The rationale for this bold statement is presented in Chapter 1, starting on page 1. In brief, the argument relies on two observations.

First, processing power, interconnectivity of devices, storage capacity, and bandwidth are all increasing so rapidly that it's fundamentally changing how we use digital devices. Businesses are increasingly finding—and, more importantly, increasingly *required* to find—innovative applications for information systems. The incorporation of Facebook and Twitter into marketing systems is an obvious example, but this example is only the tip of the iceberg. For at least the next 10 years, every business professional will, at the minimum, need to be able to assess the efficacy of proposed IS applications. To excel, business professionals will also need to define innovative IS applications.

Further, professionals who want to emerge from the middle ranks of management will, at some point, need to demonstrate the ability to manage projects that develop these innovative information systems. Such skills will not be optional. Businesses that fail to create systems that take advantage of changes in technology will fall prey to competition that can create such systems. So, too, will business professionals.

The second premise for the singular importance of the MIS class relies on the work of Robert Reich, former Secretary of Labor for the Bill Clinton administration. In *The Work of Nations*,[5] Reich identifies four essential skills for knowledge workers in the 21st century:

- Abstract thinking
- Systems thinking
- Collaboration
- Experimentation

For reasons set out in Chapter 1, we believe the MIS course is the single best course in the business curriculum for learning these four key skills.

Today's Role for Professors

What is our role as MIS professors? Students don't need us for definitions; they have the Web for that. They don't need us for detailed notes; they have the PowerPoints. Consequently, when we attempt to give long and detailed lectures, student attendance falls. And this situation is even more dramatic for online courses.

We need to construct useful and interesting experiences for students to apply MIS knowledge to their goals and objectives. In this mode, we are more like track coaches than the chemistry professor of the past. And our classrooms are more like practice fields than lecture halls.[6]

Of course, the degree to which each of us moves to this new mode depends on our goals, our students, and our individual teaching styles. Nothing in the structure or content of this edition assumes that a particular topic will be presented in a nontraditional manner. But every chapter contains materials suitable for use with a coaching approach, if desired.

In addition to the chapter feature titled "So What?" all chapters include a collaboration exercise that students can use for team projects inside and outside of class. As with earlier editions, each chapter contains guides that describe practical implications of the chapter contents that can be used for small in-class exercises. Additionally, every chapter concludes with a case study that can be the basis for student activities. Finally, this edition contains 42 application exercises (see page 515).

eHermes and ARES Cases

Each part and each chapter opens with a scenario intended to get students involved emotionally, if possible. 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 eHermes case and continues the ARES case from the tenth edition.

eHermes

The chapters in Parts 1 and 2 are introduced with dialogue from key players at eHermes, a privately owned company that provides mobile shopping experiences using self-driving vehicles. We wanted to develop the case around an interesting business model that students would want to learn more about. Self-driving vehicles get a lot of attention in the press, but students may not know a lot about how they're used in business. Self-driving vehicles are on the road now. They should see widespread adoption in the next several years. It's likely that students will own or use a self-driving vehicle in the near future.

eHermes is considering strengthening its competitive advantage by using some type of artificial intelligence (AI) or machine learning to increase the efficiency of the fleet. However, were the company to do so, it would require a considerable capital investment. It would also need to hire a team of AI experts, develop new business processes, and modify its internal information systems. All of this is good fodder for Chapter 2 and for underlining the importance of the ways that IS needs to support evolving business strategy.

Ultimately, eHermes determines that it does not want to invest in an AI. It would be too costly, and it wants to use its capital to grow other parts of its business. The company doesn't have enough reliable data to train the AI, and it'd need to invest more in additional infrastructure. eHermes decides to focus on its core strength of selling items through its mobile storefronts.

Students may object that, in studying eHermes, 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. eHermes didn't have to hire a dozen AI experts, buy new infrastructure, and build a complex AI just to find out it would be a mistake. It could try to 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 has been 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 seventh 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.

2029?

Every chapter concludes with a question labeled "2029?" This section presents our guesses about how the subject of that chapter is likely to change between now and 2029. Clearly, if we had a crystal ball that would give good answers to that question, we wouldn't be writing textbooks.

However, we make what we believe is a reasonable stab at an answer. You will probably have different ideas, and we hope students will have different ideas as well. The goal of these sections is to prompt students to think, wonder, assess, and project about future technology. These sections usually produce some of the most lively in-class discussions.

Why Might You Want Your Students to Use SharePoint?

The difficult part of teaching collaboration is knowing how to assess it. Collaboration assessment is not simply finding out which students did the bulk of the work. It also involves assessing feedback and iteration; that is, identifying who provided feedback, who benefited from the feedback, and how well the work product evolved over time.

Microsoft SharePoint is a tool that can help assess collaboration. It automatically maintains detailed records of all changes that have been made to a SharePoint site. It tracks document versions, along with the date, time, and version author. It also maintains records of user activity—who visited the site, how often, what site features they visited, what work they did, what contributions they made, and so forth. SharePoint makes it easy to determine which students were making sincere efforts to collaborate by giving and receiving critical feedback throughout the project assignment and which students were making a single contribution 5 minutes before midnight the day before the project was due.

Additionally, SharePoint has built-in facilities for team surveys, team wikis, and member blogs as well as document and list libraries. All of this capability is backed up by a rich and flexible security system. To be clear, we do not use SharePoint to run our classes; we use either Blackboard or Canvas for that purpose. However, we do require students to use SharePoint for their collaborative projects. A side benefit is that they can claim, rightfully, experience and knowledge of using SharePoint in their job interviews.

You might also want to use Office 365 because it includes Skype, hosted Exchange, 1TB online storage, and SharePoint Online as an add-on. Microsoft offers Office 365 to academic institutions as a whole or to students directly at reduced educational rates.

Why Are the Chapters Organized by Questions?

The chapters of *Using MIS* are organized by questions. According to Marilla Svinicki,[7] a leading researcher on student learning at the University of Texas, we should not give reading assignments such as "Read pages 50 through 70." The reason is that today's students need help organizing their time. With such a reading assignment, they will fiddle with pages 50 through 70 while texting their friends, surfing the Internet, and listening to their iPods. After 30 or 45 minutes, they will conclude they have fiddled enough and will believe they have completed the assignment.

Instead, Svinicki states we should give students a list of questions and tell them their job is to answer those questions, treating pages 50 through 70 as a resource for that purpose. When students can answer the questions, they have finished the assignment.

Using that philosophy, every chapter in this text begins with a list of questions. Each major heading in the chapter is one of those questions, and the Active Review at the end of each chapter provides students a set of actions to take in order to demonstrate that they are able to answer the questions. Since learning this approach from Professor Svinicki, we have used it in our classes and have found that it works exceedingly well.

How Does This Book Differ from *Experiencing MIS* and from *Processes, Systems, and Information*?

In addition to *Using MIS*, we've written an MIS text titled *Experiencing MIS*. These two texts provide different perspectives for teaching this class. The principal difference between *Using MIS* and *Experiencing MIS* is that the latter is modular in design and has a more "in your face" attitude about MIS. Modularity definitely has a role and place, but not every class needs or appreciates the flexibility and brevity a modular text offers. A shorter, more custom version of *Experiencing MIS* is also available as *MIS Essentials*.

There is also a fourth MIS text titled *Processes, Systems, and Information: An Introduction to MIS* coauthored with Earl McKinney of Bowling Green State University. It represents a third approach to this class and is structured around business processes. It has a strong ERP emphasis and includes two chapters on SAP as well as two chapter tutorials for using the SAP Alliance Global Bikes simulation. Earl has taught SAP for many years and has extensive experience in teaching others how to use the Global Bikes simulation.

In *Using MIS*, we have endeavored to take advantage of continuity and to build the discussion and knowledge gradually through the chapter sequence, in many places taking advantage of knowledge from prior chapters.

The goal in writing these books is to offer professors a choice of approach. We are committed to each of these books and plan to revise them for some time. We sincerely hope that one of them will fit your style and objectives for teaching this increasingly important class.

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, a dedicated technical support team is ready to help with the media supplements that accompany this text. Visit *http://support.pearson.com/getsupport* for answers to frequently asked questions and toll-free user support phone numbers.

The following supplements are available with this text:

- Instructor's Resource Manual
- Image Library
- Test Bank
- TestGen® Computerized Test Bank
- PowerPoint Presentation

AACSB Learning Standards Tags

What Is the AACSB?

The Association to Advance Collegiate Schools of Business (AACSB) is a nonprofit corporation of educational institutions, corporations, and other organizations devoted to the promotion and improvement of higher education in business administration and accounting. A collegiate institution offering degrees in business administration or accounting may volunteer for AACSB accreditation review. The AACSB makes initial accreditation decisions and conducts periodic reviews to promote continuous quality improvement in management education. Pearson Education is a proud member of the AACSB and is pleased to provide advice to help you apply AACSB Learning Standards.

What Are AACSB Learning Standards?

One of the criteria for AACSB accreditation is the quality of the curricula. Although no specific courses are required, the AACSB expects a curriculum to include learning experiences in such areas as:

- Communication Abilities
- Ethical Understanding and Reasoning Abilities
- Analytic Skills
- Use of Information Technology
- Dynamics of the Global Economy
- Multicultural and Diversity Understanding
- Reflective Thinking Skills

These seven categories are AACSB Learning Standards. Questions that test skills relevant to these standards are tagged with the appropriate standard. For example, a question testing the moral questions associated with externalities would receive the Ethical Understanding tag.

How Can I Use These Tags?

Tagged questions help you measure whether students are grasping the course content that aligns with AACSB guidelines. In addition, the tagged questions may help to identify potential applications of these skills. This, in turn, may suggest enrichment activities or other educational experiences to help students achieve these goals.

Available in MyLab MIS

- MIS Video Exercises—videos illustrating MIS concepts, paired with brief quizzes
- MIS Decision Simulations—interactive exercises allowing students to play the role of a manager and make business decisions
- Auto-Graded writing exercises—taken from the end of chapter
- Assisted-Graded writing exercises—taken from the end of chapter, with a rubric provided
- Chapter Warm Ups, Chapter Quizzes—objective-based quizzing to test knowledge
- Discussion Questions—taken from the end of chapter
- Dynamic Study Modules—on the go adaptive quizzing, also available on a mobile phone
- Learning Catalytics—bring-your-own-device classroom response tools
- Enhanced eText—an accessible, mobile-friendly eText
- Excel & Access Grader Projects—live in the application auto-graded Grader projects provided inside MyLab MIS to support classes covering Office tools

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David Kroenke
Randy Boyle

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ENDNOTES

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David Kroenke has many years of teaching experience at Colorado State University, Seattle University, and the University of Washington. He has led dozens of seminars for college professors on the teaching of information systems and technology; in 1991, the International Association of Information Systems named him Computer Educator of the Year. In 2009, David was named Educator of the Year by the Association of Information Technology Professionals-Education Special Interest Group (AITP-EDSIG).

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 Corporations, 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 several textbooks, including *Experiencing MIS,* 8th ed., *Corporate Computer and Network Security,* 4th ed., *Applied Information Security*, 2nd ed., and *Applied Networking Labs*, 2nd ed.

To C.J., Carter, and Charlotte
—David Kroenke

To Courtney, Noah, Fiona, Layla, and Henry
—Randy Boyle

PART 1

Why MIS?

eHermes is a 5-year-old, privately owned company that provides mobile shopping experiences using self-driving vehicles. Essentially, it's eBay on wheels that brings a mobile storefront right to your door. eHermes acts as a local classified broker that sells both used and new items. Its mobile storefronts pick up items customers want to sell and drop off items customers want to buy. Each of eHermes' mobile storefronts, which look like futuristic transparent shipping containers, can hold hundreds of different items.

eHermes mobile storefronts allow customers to physically inspect hundreds of similar items without having to meet sellers in person. Customers love this feature, and they often end up buying several items when the storefront stops in front of their house. eHermes charges a fee to put items up for sale for a set amount of time and receives a commission on each item purchased. The company also makes a moderate amount of ad revenue from its Web site and mobile app.

eHermes' CEO and cofounder is Jessica Ramma, a former VP at a midsized venture capital (VC) firm in California. Jessica got her MBA from the University of Chicago and immediately went to work analyzing high-tech startups for the VC firm. She quickly rose within the firm and made vice president in 8 years. Along the way, she developed a large network of highly skilled engineers and angel investors.

Source: Chesky/Shutterstock

While investigating a startup, she met Victor Vazquez. At the time, Victor was managing a small artificial intelligence startup that was working on a groundbreaking vision system. Victor was charming, intelligent, and wealthy and had already run several successful startups. He had the uncanny ability to know which companies were going to be successful, and he could effectively work with the founders to grow their companies quickly.

Source: Andrey Suslov/Shutterstock

Jessica asked Victor about the practical applications of his company's vision system, and he kept coming back to its potential use in self-driving vehicles. Victor explained that self-driving vehicles can see better than human drivers and can react much more quickly if something goes wrong. The conversation then shifted to a broader discussion of the impact of self-driving vehicles. Jessica was convinced of the inevitability of widespread self-driving vehicle adoption and wondered how this might affect existing business models. In fact, a friend of hers, Kamala Patel, had developed some of the first inter-vehicle protocols used to send information between vehicles. Kamala was passionate about automation and believed self-driving vehicles would affect nearly every industry. Jessica asked Victor if he would have lunch with her and Kamala the following week. She had an idea.

At the lunch, Jessica pitched Victor and Kamala on the eHermes idea, and the company was born a few months later. Fast forward 5 years. eHermes now has several dozen mobile storefronts with revenues of about $8 million per year. As the CEO, Jessica wants to grow the company more quickly by providing mobile storefronts to traditional companies like Walmart and local grocery stores as well as e-commerce retailers like Amazon. Victor is worried that the company is not ready. It's been a bumpy ride just to get the existing mobile storefronts working correctly.

Designing, building, and testing the storefronts have been expensive and, at times, frustrating. Creating the inventory tracking system was more complicated than initially thought. The routing, coordination, and optimization of the storefronts have been a nightmare, too. Inefficient routes increase fuel consumption, which has a big impact on the company's bottom line. And then there's the hugely expensive systems development project that's currently under way to automate the collection, storage, and analysis of storefront data. Currently, everything is recorded manually by sales associates who ride inside each storefront. Any new inventory is brought back to the warehouse, where it's photographed and entered into the online system.

Victor feels like they should wait to expand the business. The company doesn't have the money or the people to start a major expansion like the one Jessica is thinking about. But customers love buying from eHermes, and sales projections look promising. The company has gotten a lot of positive press lately, and investors are more than willing to throw money into the company.

Jessica also mentioned that they should explore the possibility of using some type of artificial intelligence (AI) or machine learning to increase the efficiency of the fleet. Coordinating all of the sales stops, inventory pickups, mobile storefront stocking, travel routes, charging and fueling times, and maintenance schedules is incredibly complex. The current system is working OK, but it's not optimal. And it's hurting eHermes financially. The company needs a fully integrated solution.

CHAPTER 1

The Importance of MIS

"Fired? You're firing me?"

"Well, *fired* is a harsh word, but . . . well, eHermes has no further need of your services."

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

"Amanda, 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 costs using AI or machine learning."

"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."

MyLab MIS

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

Essay Questions 1-15, 1-16

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

"But doesn't she work down at the warehouse hub?"

"Right. She's in charge of operations . . . and it would seem to be worth talking to her."

"I'll go do that!"

"Amanda, 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."

"Amanda, you've been here almost 6 months; you have a degree in business and information systems. Several weeks ago, I asked you for your first idea for a process that would identify which AIs or machine learning processes could be used to reduce costs and increase efficiency. Do you remember what you said?"

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

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

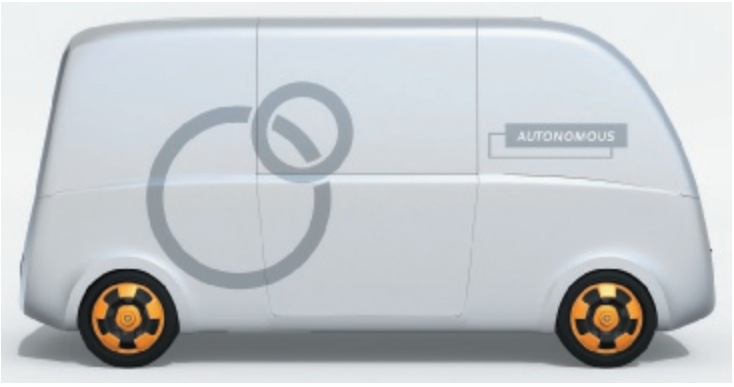
"I don't want to waste money . . . "

"No, you don't. So, when you didn't get very far with that task, I backed up and asked you to send me a list of companies that are currently using AIs and machine learning. I wanted to know what *types* of problems they're solving, the magnitude of efficiency gains they're realizing, how long it took to implement these systems, and a basic description of how they might be used in our company. Not details, just an overview."

"Yes, I sent you those lists and descriptions."

"Amanda, they made no sense. Your lists included companies that use AI vision systems and natural language processing systems; and your description of how AI could be used at eHermes was focused on robotics."

"I know they can be used for planning and optimization too, I just didn't include it in the material I sent you. But I'll try again!"



"But today, they're not enough."

Source: Haiyin Wang/Alamy Stock Photo

Study QUESTIONS

- **Q1-1** Why is Introduction to MIS the most important class in the business school?
- **Q1-2** How will MIS affect me?
- **Q1-3** What is MIS?
- **Q1-4** How can you use the five-component model?
- **Q1-5** What is information?
- **Q1-6** What are necessary data characteristics?
- **Q1-7** 2029?

"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 for a spot for you, see if we could bring you along. But we can't afford to do that now."

"What about my references?"

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

"Those are important!"

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

Chapter PREVIEW

"But today, they're not enough."

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

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

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

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

Introduction to MIS is the most important class in the business school. This wasn't always the case. A couple decades ago, majoring in "computers" was considered a nerdy thing to do. 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 $919B. The largest IPO offering in history ($25B) came from the online e-commerce giant Alibaba (Alibaba Holdings Group) in 2014.

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

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

The Digital Revolution

You've probably heard that we live in the **Information Age**, or a period in history where the production, distribution, and control of information is the primary driver of the economy. The Information Age started in the 1970s with the **Digital Revolution**, or the conversion from mechanical

and analog devices to digital devices. This shift to digital devices meant monumental changes for companies, individuals, and our society as a whole.

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

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

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

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

Evolving Capabilities

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

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

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

Moore's Law

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

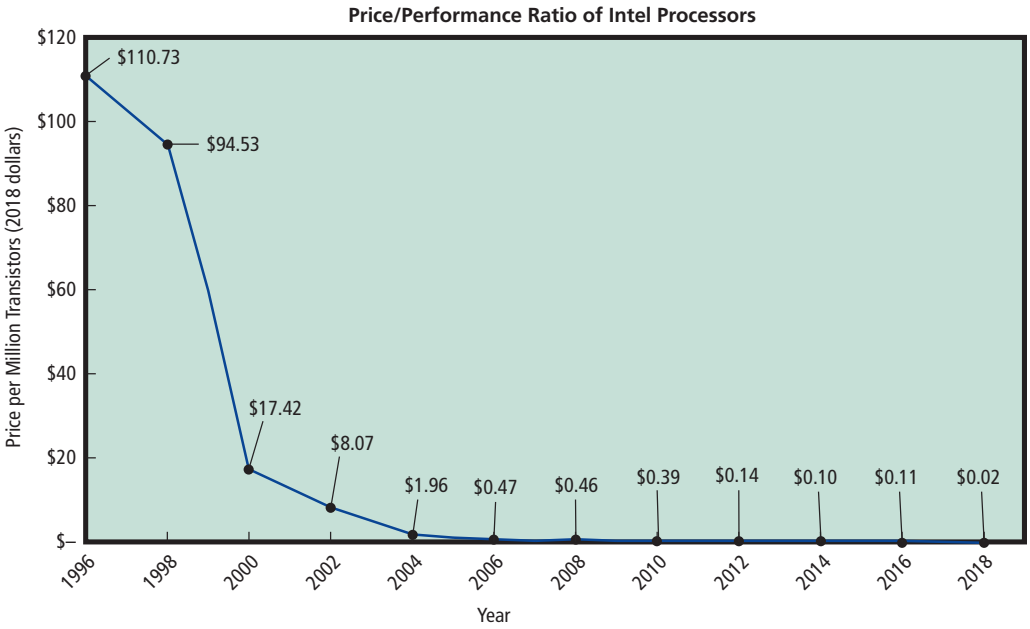


FIGURE 1-1
Computer Price/ Performance Ratio Decreases
Source: © Based on data from ark.intel.com#@Processors

Because of Moore's Law, the ratio of price to performance of computer processors has fallen dramatically. In 1996, when the Internet was really starting to take off, a standard CPU cost about $110 per million transistors. By 2018 that price had fallen to $0.02 per million transistors.[2] See Figure 1-1. Increasing processing power has had a greater impact on the global economy in the past 30 years than any other single factor. It has enabled new devices, applications, companies, and platforms. In fact, most tech companies would not exist today if processing power hadn't increased exponentially.

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

Metcalfe's Law

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

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

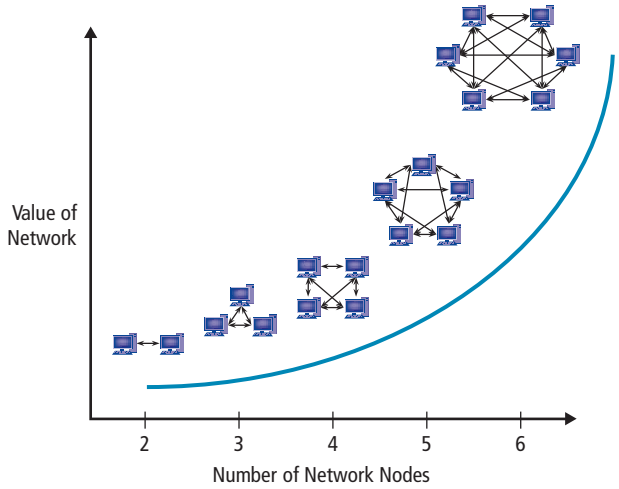


FIGURE 1-2
Increasing Value of Networks

Other Forces Pushing Digital Change

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

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

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

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

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

FIGURE 1-3
Fundamental Forces Changing Technology

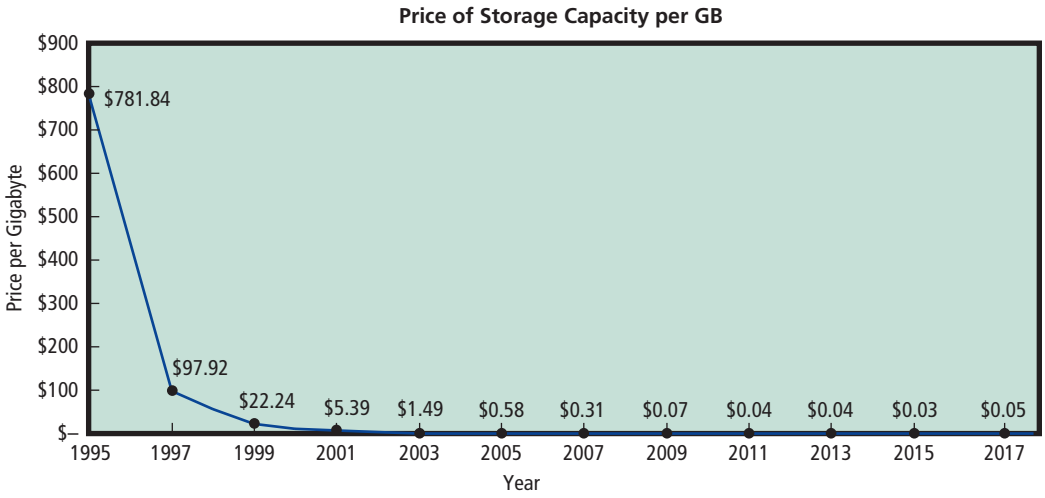


FIGURE 1-4
Price of Storage Capacity per GB

to use new technology to create a sustainable competitive advantage. This leads us to the first reason Introduction to MIS is the most important course in the business school today:

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

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

Q1-2 How Will MIS Affect Me?

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

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

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

How Can I Attain Job Security?

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

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

Numerous organizations and experts have studied the question of what skills will be marketable during your career. Consider two of them. First, the RAND Corporation, a think tank located in Santa Monica, California, has published innovative and groundbreaking ideas for more than