

GLOBAL
EDITION



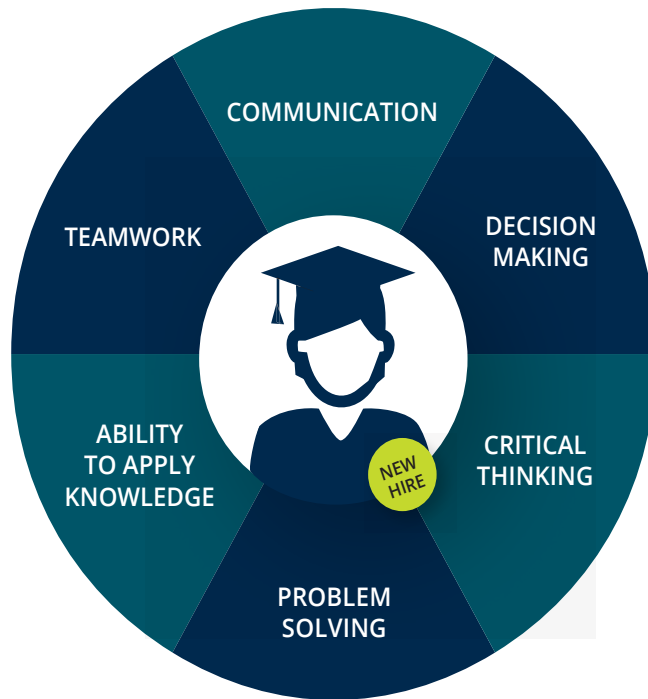
Using MIS

TENTH EDITION

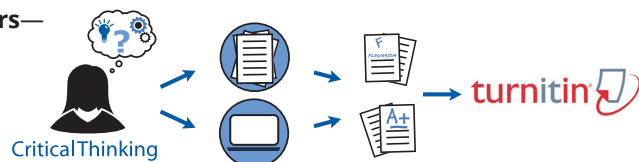
David M. Kroenke • Randall J. Boyle



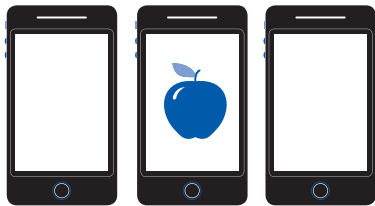
MIS: Engage, Apply, Empower



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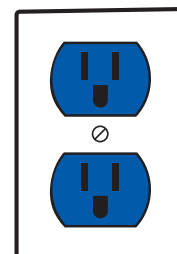
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Dear Student,

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 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.

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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: Querying Inequality? Chapter 8, Security Guide: Digital Is Forever Chapter 9, Career Guide: Manager, Data and Analytics
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: Falcon Security, a provider of aerial surveillance and inspection services; 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: Business Intelligence 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? Augmented Collaboration

Resource	Description	Benefit	Example
2027?	Each chapter concludes with a discussion of how the concepts, technology, and systems described in that chapter might change by 2027.	Learn to anticipate changes in technology and recognize how those changes may affect the future business environment.	Chapter 7, 2027? 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 2.	Practice working with colleagues toward a stated goal.	Collaboration Exercise 3 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, Cloud Solutions and Infrastructure That Safely Test for Consumer Risk and Financial Stability
Application Exercises	These exercises ask you to solve situations using spreadsheet (Excel) or database (Access) applications.	Develop your computer skills.	AE10-2 builds on your knowledge from Chapter 10 by asking you to score the websites 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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Describes how this course teaches four key skills for business professionals. Defines *MIS*, *information systems*, and *information*.

Describes characteristics, criteria for success, and the primary purposes of collaboration.

Discusses components of collaboration IS and describes collaboration for communication and content sharing. Illustrates use of Google Drive, SharePoint, and other collaboration tools.

Describes reasons why organizations create and use information systems: to gain competitive advantage, to solve problems, and to support decisions.

Describes the manager's essentials of hardware and software technology. Discusses open source, Web applications, mobile systems, and BYOD policies.

Explores database fundamentals, applications, modeling, and design. Discusses the entity-relationship model. Explains the role of Access and enterprise DBMS products. Defines *Big Data* and describes nonrelational and NoSQL databases.

Explains why organizations are moving to the cloud and how they can use the cloud effectively. Describes basic network technology that underlies the cloud and how the Internet works. Explains Web servers, SOA, and Web services standards. Discusses how organizations, including Falcon Security, can use the cloud securely.

Discusses workgroup, enterprise, and inter-enterprise IS. Describes problems of information silos and cross-organizational solutions. Presents CRM, ERP, and EAI. Discusses ERP vendors and implementation challenges.

Describes components of social media IS (SMIS) and explains how SMIS can contribute to organizational strategy. Discusses the theory of social capital and how revenue can be generated using social media. Explains the ways organizations can use ESN and manage the risks of SMIS.

Describes business intelligence and knowledge management, including reporting systems, data mining, and social media-based knowledge management systems.

Describes organizational response to information security: security threats, policy, and safeguards.

Describes the role, structure, and function of the IS department; the role of the CIO and CTO; outsourcing; and related topics.

Discusses the need for BPM and the BPM process. Introduces BPMN. Differentiates between processes and information systems. Presents SDLC stages. Describes agile technologies and scrum and discusses their advantages over the SDLC.

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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 in early 2016. 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.

Internet of Things (IoT) smart devices once again dominated the Consumer Electronics Show (CES), which is the industry's annual display of the latest innovative products. Smart refrigerators, smart beds, and smart sensors of every kind were a hit. But it isn't just consumers who are excited for IoT devices; businesses see their potential value, too. More importantly, these businesses recognize the need to collect, store, and analyze the data these devices will generate. As a result, jobs 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 13 warehouses around the world. These 30,000 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. In 6 months the nearly autonomous vehicles logged more than 100 million miles on autopilot (with a few 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. The implications for autonomous vehicles go beyond consumers, too. 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. LinkedIn (117 million), Ashley Madison (30 million), Tumblr (65 million), and MySpace (360 million) all suffered enormous data losses. 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; they also saw the proliferation of cryptographic ransomware.

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 Tenth 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 a 2-year revision cycle. 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 valued at \$341B as of mid-2016. 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 tenth edition are listed in Table 1. Substantial changes were made in Chapter 6 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 situations that students have experienced.

TABLE 1: CHANGES IN THE TENTH EDITION

Chapter	Change	Chapter	Change
1	New SoWhat? Feature: A Is for Alphabet		New SoWhat? Feature: New from CES 2016
	New and updated charts for CPU and data storage growth		New Career Guide: Technical Account Manager
	Updated BLS job statistics		Updated industry statistics throughout the chapter
	New 2027? discussion in Q1-7		Expanded augmented/mixed/virtual reality discussion
2	New Ethics Guide: Big Brother Wearables	5	New Security Guide: Big Data... Losses
	New Career Guide: Software Product Manager		New SoWhat? Guide: Slick Analytics
	Discussion of constructive criticism and groupthink		New Career Guide: Database Engineer
	New examples of providing and receiving constructive criticism		Updated images for Microsoft Office 2016 and SharePoint 2016
	Expanded discussion of real-time surveying software (Socrative)	6	Reorganized chapter content for Q6-1 through Q6-5
	Updated So What? Guide about augmented collaboration		New Q6-1 discussion about the origin of the cloud
	New 2027? discussion in Q2-9		New Q6-1 cloud adoption examples statistics
3	New SoWhat? Feature: The Autonomous Race		New discussion about scalability
	New Career Guide: Technology and Operations Executive		Expanded cloud versus in-house comparison
	New Ethics Guide: The Lure of Love Bots		New Q6-2 example using transportation as a service
	New 2027? discussion in Q3-8		New Q6-2 graphics to illustrate differences between IaaS, PaaS, and SaaS
	Updated Amazon case study		New Q6-2 example and graphics for CDNs
4	New Security Guide: Poisoned App-les		New Q6-4 example comparing the Internet and the U.S. postal system

Chapter	Change
	New Q6-4 content about DNS, TCP, IP addresses, carriers, and IXPs
	Updated Active Review questions
	Updated 2027? discussion to include AaaS and BaaS
	New SoWhat? Feature: Quantum Learning
	New Career Guide: Senior Network Manager
	Updated industry statistics throughout the chapter
7	New ARES introduction
	New Security Guide: It's Not Me, It's You
	New Career Guide: IT Technical Manager
	New Ethics Guide: Paid Deletion
	Updated Q7-7 for ARES example
8	New ARES introduction
	New SoWhat? Feature: Enhanced Golf Fan
	New Career Guide: International Content Director
	Updated industry statistics throughout the chapter
	New social media chapter examples
9	New ARES introduction
	New Career Guide: Manager, Data and Analytics
	New Ethics Guide: MIS-Diagnosis
	Updated chapter examples using ARES
	Updated Office 2016 figures
	Updated RFM scoring
	New discussion of AI and machine learning
10	New ARES introduction
	New Security Guide: Exhaustive Cheating
	New SoWhat? Feature: New from Black Hat 2015

Chapter	Change
	New Career Guide: IT Security Analyst
	New industry statistics and charts throughout the chapter
11	New ARES introduction
	New Security Guide: Watching the Watchers
	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 introduction
	New SoWhat? Feature: Banking on IoT
	New statistics about agile and scrum use
	New 2027? discussion in Q12-7
International Dimension	Updated section on localization using IBM's Watson
	New legal environment examples in QID-4
	New statistics and discussion about international Internet access (fixed and mobile)
	New Career Guide: Director of Asian Operations
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

In addition, we've introduced a new "Career Guide" in this edition that let's students read firsthand accounts from people working in information systems jobs. Each of these guides is written by an 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.² Half of the 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, 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 57–58), and utilitarianism is introduced in the Ethics Guide in Chapter 2 (pages 94–95).

As shown in Table 1, additional changes were made to every chapter, including five new Security Guides, eight new So What? features, five new Ethics Guides, 11 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.

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 Part 1, starting on page 35. 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*,³ 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.⁴

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 40 application exercises (see page 553).

Falcon Security 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 ARES case and continues the Falcon Security case from the ninth 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 the drones 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 that 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 doing so cost effective. The company would still have to buy a lot of expensive component parts to assemble an airworthy drone, something it’s not sure it 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 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.

2027?

Every chapter concludes with a question labeled “2027?” This section presents our guesses about how the subject of that chapter is likely to change between now and 2027. 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,⁵ 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.pearsonglobaleditions.com/kroenke, 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:

- 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
- 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
- Pearson eText – an accessible, mobile-friendly eText

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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.

His text *Database Processing* was first published in 1977 and is now in its 14th edition. He has authored and coauthored many other textbooks, including *Database Concepts*, 7th ed. (2015), *Experiencing MIS*, 7th ed. (2017), *SharePoint for Students* (2012), *Office 365 in Business* (2012), and *Processes, Systems, and Information: An Introduction to MIS*, 2nd ed. (2015).



Randall J. Boyle received his Ph.D. in Management Information Systems from Florida State University in 2003. He also has a master's degree in Public Administration and a B.S. in Finance. He has received university teaching awards at Longwood University, the University of Utah, and the University of Alabama in Huntsville. He has taught a wide variety of classes, including Introduction to MIS, Cyber Security, Networking & Servers, System Analysis and Design, Telecommunications, Advanced Cyber Security, Decision Support Systems, and Web Servers.

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*, 7th ed., *Corporate Computer and Network Security*, 4th ed., *Applied Information Security*, 2nd ed., and *Applied Networking Labs*, 2nd ed.

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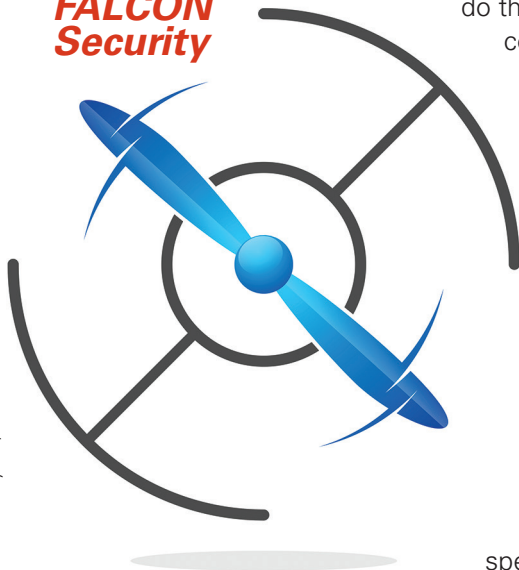
Why MIS?

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 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.

**FALCON
Security**



Source: SkyAce/Fotolia



Source: Alexander Kolomietz/Fotolia

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 \$14 million per 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 its 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 under way 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 the existing data collection and processing system? Mateo asks Joni and Cam to figure out if manufacturing drones is the right move for Falcon Security.

The Importance of MIS

“Fired?” You’re firing me?”

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

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

“Jennifer, that’s just it. You did everything *I* told you to do.”

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

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

“Right! And I did that.”

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

“How could you expect me to do that? I’ve only been here 6 months!”



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

"I didn't want to bother them."

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

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

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

"I'll go do that!"

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

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

"Has anyone seen them?"

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

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

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

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

"I know I can do this job."

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

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

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

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

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

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

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



"But today, they're not enough."

Image source: rommma/Fotolia

Study QUESTIONS

- Q1-1** Why is Introduction to MIS the most important class in the business school?
- Q1-2** How will MIS affect me?
- Q1-3** What is MIS?
- Q1-4** How can you use the five-component model?
- Q1-5** What is information?
- Q1-6** What are necessary data characteristics?
- Q1-7** 2027?

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

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

"What about my references?"

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

"Those are important!"

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

Chapter PREVIEW

"But today, they're not enough."

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

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

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

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

Introduction to MIS is the most important class in the business school. This wasn't always the case. A couple decades ago, majoring in "computers" was considered a nerdy thing 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 \$590B. The largest IPO offering in history (\$25B) came from the online e-commerce giant Alibaba (Alibaba Holdings Group) in 2014.

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

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

The Digital Revolution

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

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

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

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

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

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

Evolving Capabilities

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

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

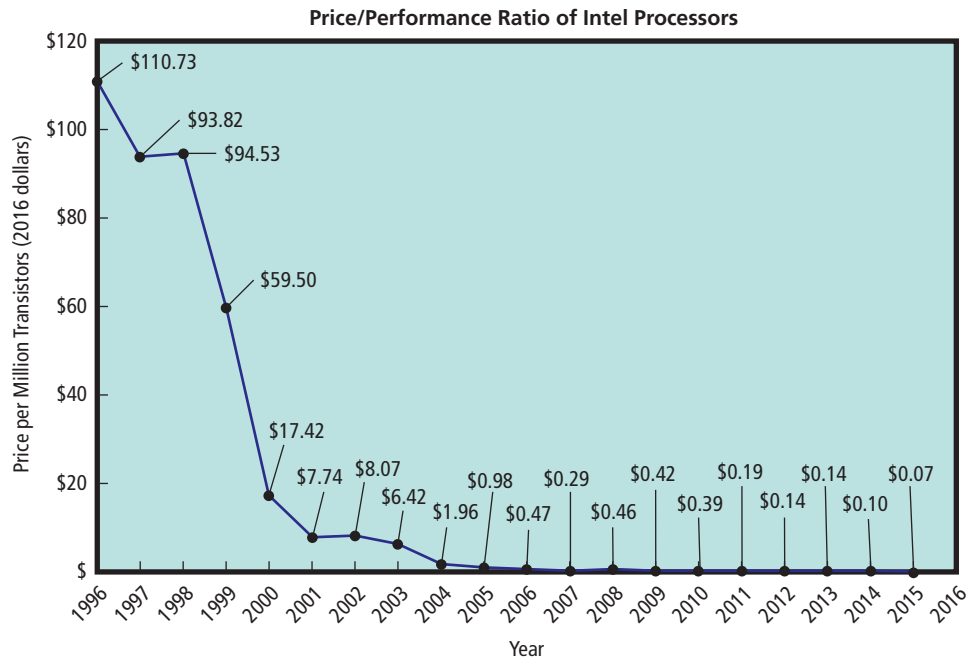
This example may seem silly at first, but it helps you understand how exponential change is affecting digital devices. Processing power, interconnectivity of devices, storage capacity, and bandwidth are all increasing extremely rapidly—so rapidly that it's changing how these devices are used. Let's explore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

Moore's Law

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

FIGURE 1-1
Computer Price/Performance
Ratio Decreases

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



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

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

Metcalfe's Law

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

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

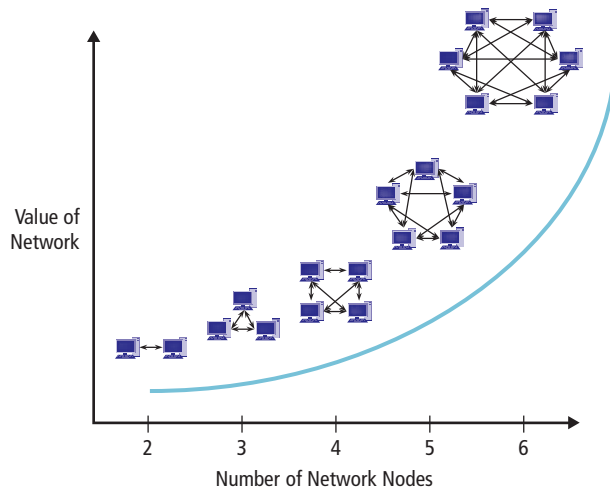


FIGURE 1-2
Increasing Value of Networks

Other Forces Pushing Digital Change

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

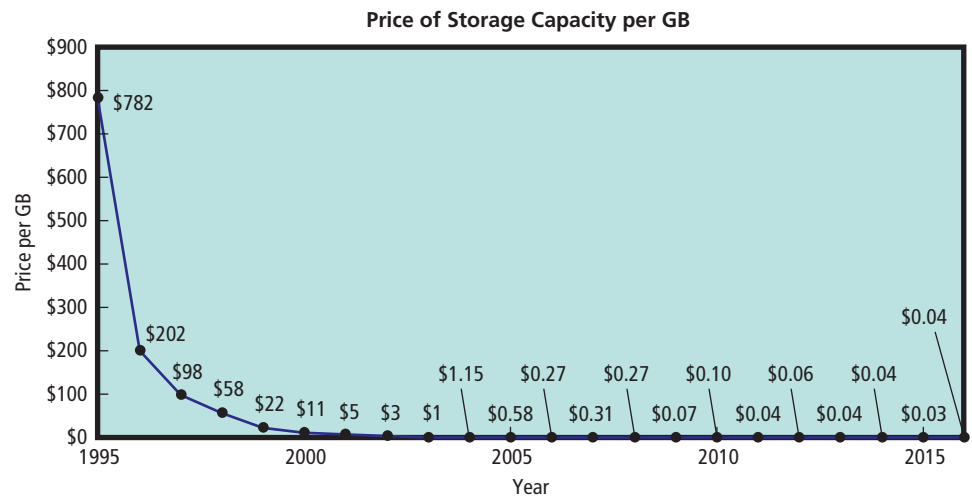
YouTube, for example, started in February 2005 when there wasn’t a lot of video shared over the Internet. But average Internet speeds were increasing to the point where a typical Internet connection could handle a stream of YouTube videos. By November 2006, the company was bought by Google for \$1.65B.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

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

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

FIGURE 1-3
Fundamental Forces Changing Technology

FIGURE 1-4
Price of Storage Capacity
per GB



This Is the Most Important Class in the School of Business

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

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

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

Q1-2 How Will MIS Affect Me?

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

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

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

How Can I Attain Job Security?

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

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

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

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

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

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

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

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

How Can Intro to MIS Help You Learn Nonroutine Skills?

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

Abstract Reasoning

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

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

FIGURE 1-5
Examples of Critical Skills
for Nonroutine Cognition

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

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

Systems Thinking

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

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

Collaboration

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

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

Ability to Experiment

"I've never done this before."

"I don't know how to do it."

"But will it work?"

"Is it too weird for the market?"

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

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

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

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

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

Jobs

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

Spence and Hlatshwayo studied employment in the United States from 1990 to 2008.⁸ They defined a *tradable job* as one that was not dependent on a particular location; this distinction is important because such jobs can be outsourced overseas. As shown in Figure 1-6, computer systems design and related services had the strongest growth of any job type in that category. The number of jobs dipped substantially after the dot-com bust in 2000; since 2003, however, job growth has not only recovered but accelerated dramatically. While this category includes technical positions such as computer programmer and database administrator, it includes nontechnical positions such as computer programmer and database administrator, it includes nontechnical

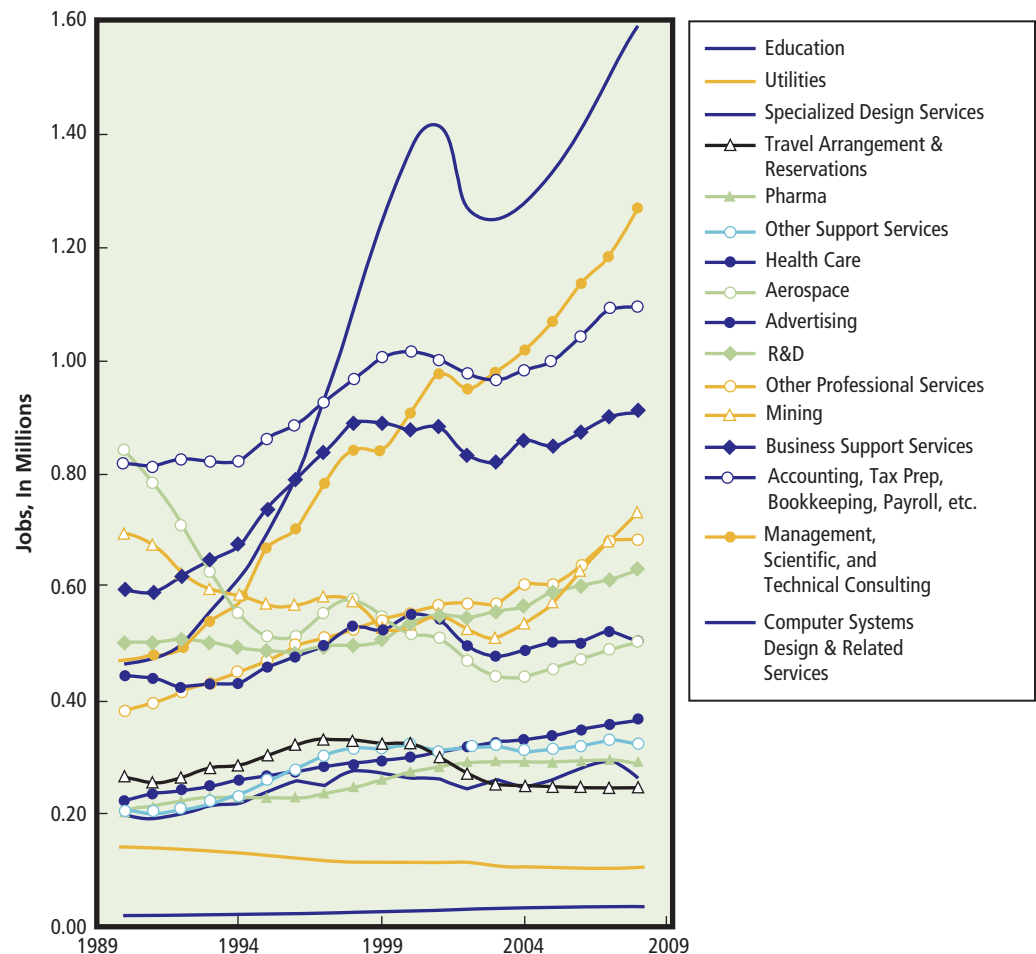


FIGURE 1-6
Growth of Jobs by Sector from 1989 to 2009

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

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

The data in Figure 1-6 stops at 2009 and, unfortunately, Spence and Hlatshwayo have not updated their study. However, Figure 1-7 shows the U.S. Bureau of Labor Statistics salary growth from 2012 to 2014 for business managers, computer and information technology, and other business occupations. It also shows job growth projections for the years 2014 to 2024.⁹ Growth rates of all information systems–related jobs are above the 7 percent average for all occupations.

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

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

FIGURE 1-7
Bureau of Labor Statistics
Occupational Outlook
2014–2024

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

What Is the Bottom Line?

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

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

Q1-3 What Is MIS?

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

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

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

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

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

Components of an Information System

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

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

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

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

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

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

Management and Use of Information Systems

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

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

FIGURE 1-8
Five Components of an
Information System



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

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 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.

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

Q1-4

How Can You Use the Five-Component Model?

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

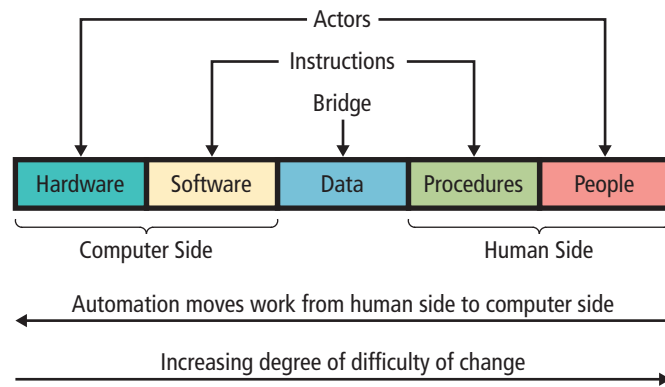


FIGURE 1-9
Characteristics of the Five Components

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

The Most Important Component—You

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

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

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

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

All Components Must Work

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

High-Tech Versus Low-Tech Information Systems

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

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 was critical because it 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?

and an email program is a very low-tech system. Only a small amount of work has been moved from the human side to the computer side. Considerable human work is required to determine when to send which emails to which customers.

In contrast, a customer support system that keeps track of the equipment that customers have and the maintenance schedules for that equipment and then automatically generates email reminders to customers is a higher-tech system. This simply means that more work has been moved from the human side to the computer side. The computer is providing more services on behalf of the humans.

Often, when considering different information systems alternatives, it will be helpful to consider the low-tech versus high-tech alternatives in light of the amount of work being moved from people to computers.

The Ethics Guide in each chapter of this book considers the ethics of information systems use. These guides challenge you to think deeply about ethical standards, and they provide for some interesting discussions with classmates. The Ethics Guide on pages 57–58 considers the ethics of presenting data that deceives the viewer.

Understanding the Scope of New Information Systems

The five-component framework can also be used when assessing the scope of new systems. When in the future some vendor pitches the need for a new technology to you, use the five components to assess how big of an investment that new technology represents. What new hardware will you need? What programs will you need to license? What databases and other data must you create? What procedures will need to be developed for both use and administration of the information system? And, finally, what will be the impact of the new technology on people? Which jobs will change? Who will need training? How will the new technology affect morale? Will you need to hire new people? Will you need to reorganize?

Components Ordered by Difficulty and Disruption

Finally, as you consider the five components, keep in mind that Figure 1-9 shows them in order of ease of change and the amount of organizational disruption. It is a simple matter to order additional hardware. Obtaining or developing new programs is more difficult. Creating new databases or changing the structure of existing databases is still more difficult. Changing procedures, requiring people to work in new ways, is even more difficult. Finally, changing personnel responsibilities and reporting relationships and hiring and terminating employees are all very difficult and very disruptive to the organization.

Q1-5 What Is Information?

Based on our earlier discussions, we can now define an information system as an assembly of hardware, software, data, procedures, and people that interact to produce information. The only term left undefined in that definition is *information*, and we turn to it next.

Definitions Vary

Information is one of those fundamental terms that we use every day but that turns out to be surprisingly difficult to define. Defining information is like defining words such as *alive* and *truth*. We know what those words mean, we use them with each other without confusion, but nonetheless, they are difficult to define.

In this text, we will avoid the technical issues of defining information and will use common, intuitive definitions instead. Probably the most common definition is that **information** is knowledge derived from data, whereas *data* is defined as recorded facts or figures. Thus, the facts that employee James Smith earns \$70.00 per hour and that Mary Jones earns \$50.00 per hour are *data*. The statement that the average hourly wage of all the graphic designers is \$60.00 per hour is *information*. Average wage is knowledge derived from the data of individual wages.

Another common definition is that *information is data presented in a meaningful context*. The fact that Jeff Parks earns \$30.00 per hour is data.¹⁵ The statement that Jeff Parks earns less than half the average hourly wage of the company's graphic designers, however, is information. It is data presented in a meaningful context.

Another definition of information that you will hear is that *information is processed data* or, sometimes, *information is data processed by summing, ordering, averaging, grouping, comparing, or other similar operations*. The fundamental idea of this definition is that we do something to data to produce information.

There is yet a fourth definition of information, which was set out by the great research psychologist Gregory Bateson. He defined information as *a difference that makes a difference*.

For the purposes of this text, any of these definitions of information will do. Choose the definition of information that makes sense to you. The important point is that you discriminate between data and information. You also may find that different definitions work better in different situations.

Where Is Information?

Suppose you create a graph of Amazon.com's stock price and net income over its history, like that shown in Figure 1-10. Does that graph contain information? Well, if it shows a difference that makes a difference or if it presents data in a meaningful context, then it fits two of the definitions of information, and it's tempting to say that the graph contains information.

However, show that graph to your family dog. Does your dog find information in that graph? Well, nothing about Amazon.com, anyway. The dog might learn what you had for lunch, but it won't obtain any information about Amazon.com's stock price over time.

Reflect on this experiment and you will realize that the graph is not, itself, information. The graph is data that you and other humans *perceive*, and from that perception you *conceive*

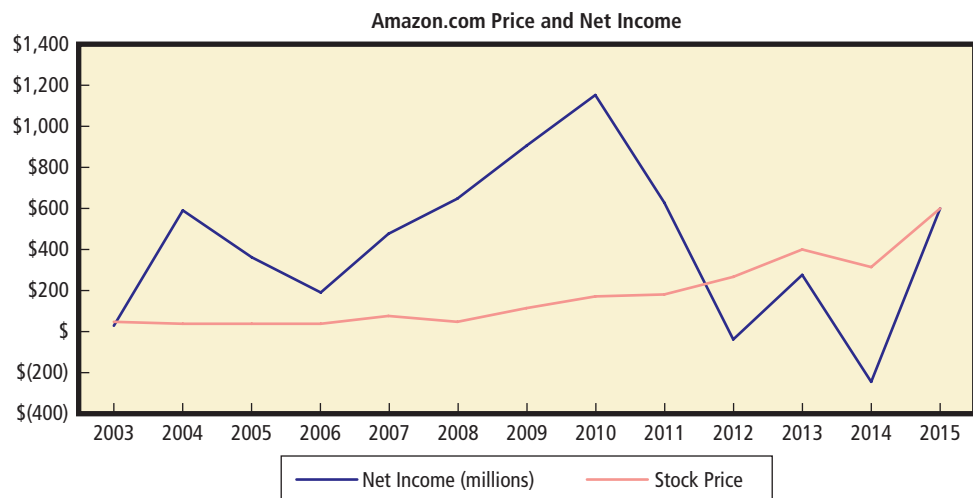


FIGURE 1-10
Amazon.com Stock Price and Net Income

Source: © Based on data from Wikinvest, [http://www.wikinvest.com/stock/Amazon.com_\(AMZN\)/Data/Net_Income/2015](http://www.wikinvest.com/stock/Amazon.com_(AMZN)/Data/Net_Income/2015)

information. In short, if it's on a piece of paper or on a digital screen, it's data. If it's in the mind of a human, it's information.

Why, you're asking yourself, do I care? Well, for one, it further explains why you, as a human, are the most important part of any information system you use. The quality of your thinking, of your ability to conceive information from data, is determined by your cognitive skills. *The data is just the data; the information you conceive from it is the value that you add to the information system.*

Furthermore, people have different perceptions and points of view. Not surprisingly, then, they will conceive different information from the same data. You cannot say to someone, "Look, it's right there in front of you, in the data" because it's not right there in the data. Rather, it's in your head and in their heads, and your job is to explain what you have conceived so that others can understand it.

Finally, once you understand this, you'll understand that all kinds of common sentences make no sense. "I sent you that information" cannot be true. "I sent you the data, from which you conceived the information" is the most we can say. During your business career, this observation will save you untold frustration if you remember to apply it.

Q1-6 What Are Necessary Data Characteristics?

You have just learned that humans conceive information from data. As stated, the quality of the information that you can create depends, in part, on your thinking skills. It also depends, however, on the quality of the data you are given. Figure 1-11 summarizes critical data characteristics.

Accurate

First, good information is conceived from accurate, correct, and complete data that has been processed correctly as expected. Accuracy is crucial; business professionals must be able to rely on the results of their information systems. The IS function can develop a bad reputation in the organization if a system is known to produce inaccurate data. In such a case, the information system becomes a waste of time and money as users develop work-arounds to avoid the inaccurate data.

A corollary to this discussion is that you, a future user of information systems, ought not to rely on data just because it appears in the context of a Web page, a well-formatted report, or a fancy query. It is sometimes hard to be skeptical of data delivered with beautiful, active graphics. Do not be misled. When you begin to use a new information system, be skeptical. Cross-check the data you are receiving. After weeks or months of using a system, you may relax. Begin, however, with skepticism. Again, you cannot conceive accurate information from inaccurate data.

Timely

Good information requires that data be timely—available in time for its intended use. A monthly report that arrives 6 weeks late is most likely useless. The data arrives long after the decisions have been made that needed your information. An information system that sends you a poor customer credit report after you have shipped the goods is unhelpful and frustrating. Notice that timeliness can be measured against a calendar (6 weeks late) or against events (before we ship).

- **Accurate**
- **Timely**
- **Relevant**
 - To context
 - To subject
- **Just sufficient**
- **Worth its cost**

FIGURE 1-11
Data Characteristics Required
for Good Information

When you participate in the development of an IS, timeliness will be part of the requirements you specify. You need to give appropriate and realistic timeliness needs. In some cases, developing systems that provide data in near real time is much more difficult and expensive than producing data a few hours later. If you can get by with data that is a few hours old, say so during the requirements specification phase.

Consider an example. Suppose you work in marketing and you need to be able to assess the effectiveness of new online ad programs. You want an information system that not only will deliver ads over the Web but that also will enable you to determine how frequently customers click on those ads. Determining click ratios in near real time will be very expensive; saving the data in a batch and processing it some hours later will be much easier and cheaper. If you can live with data that is a day or two old, the system will be easier and cheaper to implement.

Relevant

Data should be relevant both to the context and to the subject. Considering context, you, the CEO, need data that is summarized to an appropriate level for your job. A list of the hourly wage of every employee in the company is unlikely to be useful. More likely, you need average wage information by department or division. A list of all employee wages is irrelevant in your context.

Data should also be relevant to the subject at hand. If you want data about short-term interest rates for a possible line of credit, then a report that shows 15-year mortgage interest rates is irrelevant. Similarly, a report that buries the data you need in pages and pages of results is also irrelevant to your purposes.

Just Barely Sufficient

Data needs to be sufficient for the purpose for which it is generated, but just barely so. We are inundated with data; one of the critical decisions that each of us has to make each day is what data to ignore. The higher you rise into management, the more data you will be given, and because there is only so much time, the more data you will need to ignore. So, data should be sufficient, but just barely.

Worth Its Cost

Data is not free. There are costs for developing an information system, costs of operating and maintaining that system, and costs of your time and salary for reading and processing the data the system produces. For data to be worth its cost, an appropriate relationship must exist between the cost of data and its value.

Consider an example. What is the value of a daily report of the names of the occupants of a full graveyard? Zero, unless grave robbery is a problem for the cemetery. The report is not worth the time required to read it. It is easy to see the importance of economics for this silly example. It will be more difficult, however, when someone proposes new technology to you. You need to be ready to ask, “What’s the value of the information I can conceive from this data?” “What is the cost?” “Is there an appropriate relationship between value and cost?” Information systems should be subject to the same financial analyses to which other assets are subjected.

Q1-7

2027?



At the start of this chapter you read about how technology is changing exponentially. Processing power, connectivity of devices, network speed, and data storage are increasing so rapidly that they fundamentally change the way we use technology every 10 years (Bell’s Law). Businesspeople need to be able to assess, evaluate, and apply emerging technology. They need to know how these changes affect businesses.

ETHICS GUIDE

ETHICS AND PROFESSIONAL RESPONSIBILITY

Suppose you're a young marketing professional who has just taken a new promotional campaign to market. The executive committee asks you to present a summary of the sales effect of the campaign, and you produce the graph shown in Figure 1. As shown, your campaign was just in the nick of time; sales were starting to fall the moment your campaign kicked in. After that, sales boomed.

But note the vertical axis has no quantitative labels. If you add quantities, as shown in Figure 2, the performance is less impressive. It appears that the substantial growth amounts to less than 20 units. Still the curve of the graph is impressive, and if no one does the arithmetic, your campaign will appear successful.

This impressive shape is only possible, however, because Figure 2 is not drawn to scale. If you draw it to scale, as shown in Figure 3, your campaign's success is, well, problematic, at least for you.

Which of these graphs do you present to the committee? Each chapter of this text includes an Ethics Guide that explores ethical and responsible behavior in a variety of MIS-related contexts. In this chapter, we'll examine the ethics of data and information.

Centuries of philosophical thought have addressed the question "What is right behavior?" and we can't begin to discuss all of it here. You will learn much of it, however, in your business ethics class. For our purposes, we'll use two of the major pillars in the philosophy of ethics. We introduce the first one here and the second in Chapter 2.

The German philosopher Immanuel Kant defined the *categorical imperative* as the principle that *one should behave only in a way that one would want the behavior to be a universal law*. Stealing is not such behavior because if everyone steals, nothing can be owned. Stealing cannot be a universal law. Similarly, lying cannot be consistent with the categorical imperative because if everyone lies, words are useless.

When you ask whether a behavior is consistent with this principle, a good litmus test is "Are you willing to publish your behavior to the world? Are you willing to put it on your Facebook page? Are you willing to say what you've done to all the players involved?" If not, your behavior is not ethical, at least not in the sense of Kant's categorical imperative.

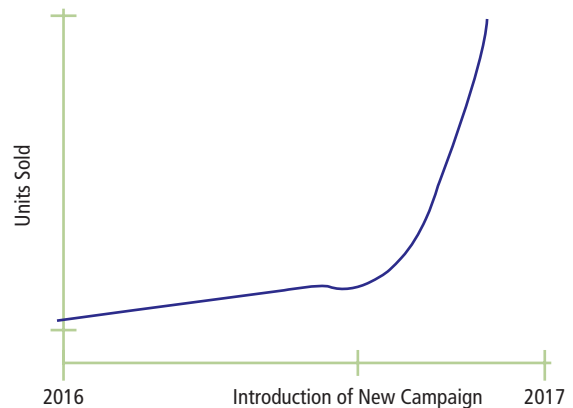


FIGURE 1

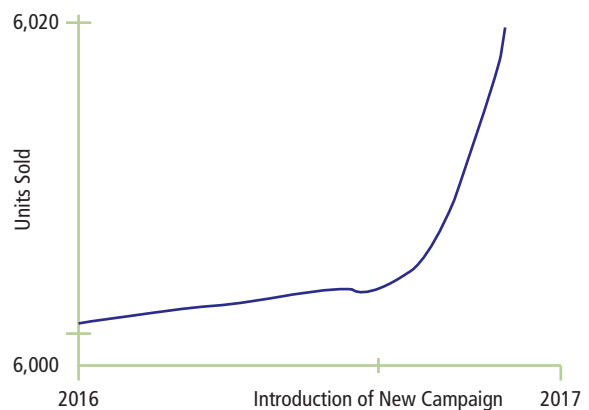


FIGURE 2

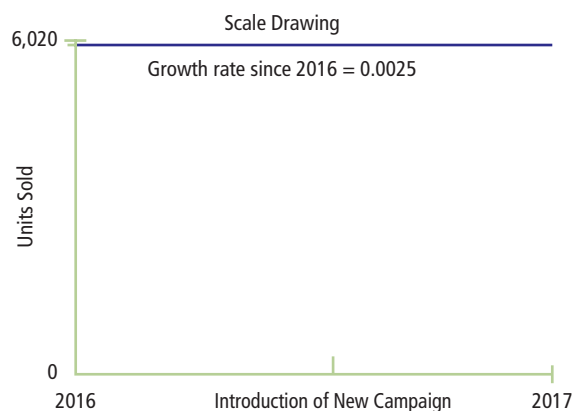


FIGURE 3

Kant defined *duty* as the necessity to act in accordance with the categorical imperative. *Perfect duty* is behavior that must always be met. Not lying is a perfect duty. *Imperfect duty* is action that is praiseworthy but not required according to the categorical imperative. Giving to charity is an example of an imperfect duty.

Kant used the example of cultivating one's own talent as an imperfect duty, and we can use that example as a way of defining professional responsibility. Business professionals have an imperfect duty to obtain the skills necessary to accomplish their jobs. We also have an imperfect duty to continue to develop our business skills and abilities throughout our careers.

We will apply these principles in the chapters that follow. For now, use them to assess your beliefs about Figures 1 through 3 by answering the following questions.



Source: Pressmaster/Fotolia



DISCUSSION QUESTIONS

1. Restate Kant's categorical imperative using your own words. Explain why cheating on exams is not consistent with the categorical imperative.
2. While there is some difference of opinion, most scholars believe that the Golden Rule ("Do unto others as you would have them do unto you.") is not equivalent to Kant's categorical imperative. Justify this belief.
3. Using the Bateson definition (discussed in Q1-5) that information is a difference that makes a difference:
 - a. Explain how the features of the graph in Figure 1 influence the viewer to create information.
 - b. Explain how the features of the graph in Figure 3 influence the viewer to create information.
 - c. Which of these graphs is consistent with Kant's categorical imperative?
4. Suppose you created Figure 1 using Microsoft Excel. To do so, you keyed the data into Excel and clicked the Make Graph button (there is one, though it's not called that). Voilà, Excel created Figure 1 without any labels and drawn out of scale as shown. Without further consideration, you put the result into your presentation.
 - a. Is your behavior consistent with Kant's categorical imperative? Why or why not?
 - b. If Excel automatically produces graphs like Figure 1, is Microsoft's behavior consistent with Kant's categorical imperative? Why or why not?
5. Change roles. Assume now you are a member of the executive committee. A junior marketing professional presents Figure 1 to the committee, and you object to the lack of labels and the scale. In response, the junior marketing professional says, "Sorry, I didn't know. I just put the data into Excel and copied the resulting graph." What conclusions do you, as an executive, make about the junior marketing professional in response to this statement?
6. Is the junior marketing person's response in question 5 a violation of a perfect duty? Of an imperfect duty? Of any duty? Explain your response.
7. If you were the junior marketing professional, which graph would you present to the committee?
8. According to Kant, lying is not consistent with the categorical imperative. Suppose you are invited to a seasonal barbeque at the department chair's house. You are served a steak that is tough, overcooked, and so barely edible that you secretly feed it to the department chair's dog (who appears to enjoy it). The chairperson asks you, "How is your steak?" and you respond, "Excellent, thank you."
 - a. Is your behavior consistent with Kant's categorical imperative?
 - b. The steak seemed to be excellent to the dog. Does that fact change your answer to part a?
 - c. What conclusions do you draw from this example?

Let's take a guess at technology in the year 2027. Of course, we won't have perfect insight, and, in fact, these guesses will probably seem ludicrous to the person who finds this book for sale for a dollar at a Goodwill store in 2027. But let's exercise our minds in that direction.

Would you use your smartphone differently if it had a gigabyte network connection, an exabyte of data storage, and a battery that lasted a month on a single charge? What if it could connect to every device in your home, car, and office—and control them remotely? With this new device you could store every book, song, and movie ever created. You could capture, store, and stream 8K of UHD video with no delay at all.

On the other hand, maybe smartphones will fade away. Large tech companies are investing tremendous resources into mixed-reality devices like HoloLens, Meta, and Magic Leap that can create virtual objects within the real world (see Chapter 4). It's possible that changes in technology will make these devices commonplace. People didn't always carry a phone around with them. But now they're in nearly every pocket.

How would these new devices change your everyday life? Well, you wouldn't have to fight over the TV remote control any more. Everyone wearing a Microsoft HoloLens could sit on the couch and watch a *different* show at the same time. In fact, you might not have a two-dimensional TV hanging on the wall at all. 3D Holographic entertainment would take place in the *center* of the room, not on the walls.¹⁶

Your mixed-reality devices would also have gesture and voice control. That means you could turn your smart lightbulbs on or off by simply pointing to them. You could even see inside your smart refrigerator without leaving the couch! Nice. Also, thanks to increases in connectivity, all of your new smart devices could talk to each other. Imagine waking up in the morning and your smart home turning the lights on automatically. Your smart home then starts reading off your daily schedule (from your Internet-based calendar), starts your coffee pot, and tells your self-driving car to check for traffic delays.

Advances in technology will undoubtedly have a profound impact on your personal life. But what about the impact of these advances on business? How will they change the way you work? What new types of jobs will be created? What new companies will form to support these advances?

In 2013, Yahoo! CEO Marissa Mayer required her employees to come to work and earned the disdain of many. She said important work gets done in informal meetings around the coffee pot. But what if you could virtually remote into work using a holographic interface and stay at home physically? You could still interact with your boss face-to-face and chat with coworkers at the coffee pot.¹⁷ But you could live anywhere, skip the commute, and work for multiple companies at the same time.

These changes may improve the way you work, but they'll also change the *type* of work you do. People with the ability to effectively experiment will be able to adapt to changes in technology required by their employer. Companies that adapt more quickly will gain a competitive advantage, at least temporarily. For example, an innovative automaker may switch from using desktop computers and traditional CAD design software to using mixed reality devices and 3D printing to shorten design time.

Systems thinking will also be important because of the need to predict changes caused by interconnected smart devices. For example, medical data (i.e., calories burned, heart rate, etc.) from your smart pacemaker and smartwatch could be integrated into other systems. It could be sent to your doctor, athletic trainer, and insurance company. Your doctor could know you're having a heart attack, call an ambulance, and forward your insurance information to the hospital before you even realize what's happening.

Advances in technology have a downside too. By 2027, privacy may be increasingly difficult to maintain. Your data will be collected by new kinds of apps, flowing through the cloud, and be packaged for sale by companies providing "free" services. Social relationships may suffer as well. We may become less connected to *people* as we become more connected to *systems*. Just look around at your family staring into their tiny phone screens at holiday parties. What will happen when they can watch a high-definition 3D holographic football game without anyone knowing?

We'll take a 2027 look at the end of each chapter. For now, just realize one certainty: Knowledge of information systems and their use in business will be more important, not less.