INTRODUCTION TO

Information Systems

fourth edition

PATRICIA WALLACE

Introduction to Information Systems

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Introduction to Information Systems

Fourth Edition

Patricia Wallace
Johns Hopkins University

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To Julian, Callie, Eric, and Julian, and a bright future of human–centered computing.

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About the Author

Patricia Wallace's career spans the fields of information technology, business and management, and psychology, and she has held varied positions, including head of information technology, faculty member, academic administrator, and consultant. She recently retired from Johns Hopkins University, where she was Senior Director, IT and Online Programs, at the Center for Talented Youth for 14 years. Before joining Hopkins, Dr. Wallace served as Chief, Information Strategies, at the Robert H. Smith School of Business, University of Maryland, College Park. She teaches in the Graduate School of the University of Maryland University College, where she also served as the Associate Vice President and Chief Information Officer for ten years. She earned her Ph.D. in Psychology at the University of Texas at Austin and holds an M.S. in Computer Systems Management. Dr. Wallace has published 15 books, including *The Internet in the Workplace: How New Technologies Transform Work* (2004) and *The Psychology of the Internet* (2016), several educational software programs, and numerous scholarly articles.

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Preface

Content Updates and Changes for the 4th Edition

The fourth edition of Introduction to Information Systems is available in Revel!

Revel is designed to help every student come to class ready to learn. Revel is an engaging learning experience that prepares your students for class through a continuous experience—anytime, anywhere, on any device. This all-in-one solution gives students everything they need for the course— an integrated learning experience. Highlighting, note taking, and a glossary let students read and study however they like. Educators can add notes for students, too, including reminders or study tips.

Using Revel your students will be able to:

- Read conceptual content on Information Systems
- Practice the concepts through multiple interactivities to check their understanding
- Use a variety of multimedia and interactive learning tools including role-playing simulations for each chapter
- Listen to the audio through Alexa or on your own device
- Finish each chapter with a quiz

The assignability and tracking tools in Revel let you gauge your students' understanding and engagement in and out of the classroom. The detailed schedule helps students stay on task by eliminating any ambiguity as to which material they should focus on.

This edition features many new discussions and examples about emerging technologies and industry trends. Although new material has been added, the chapters have been tightened with obsolete material eliminated to ensure that the 4th edition is still concise and about the same length, but remains quite comprehensive and timely.

Major new features include the following:

- Expanded coverage of business intelligence, analytics, artificial intelligence, and robotics
- Expanded coverage of distributed databases, including blockchain
- Revised and updated Chapter 7 to emphasize the development of a digital presence, to include websites, social media, and mobile apps
- Updated Chapter 3 to introduce recent technologies, including 5G and quantum computing
- Addition of numerous interactive activities on the Revel platform to engage students
- Updated and shortened the interactive role-playing simulations to incorporate new trends
- Replaced the Chapter 3 role-playing simulation with a new one on choosing an enterprise architecture for a "glamping" resort, which features cloud computing
- Added new Excel spreadsheets that students can download to more easily complete certain Application Exercises
- Added several new case studies:
  - —Dropbox and the Personal Cloud (Chapter 3)
  - —The Race to 5G (Chapter 3)
  - —Walmart Deploys Blockchain for Food Safety (Chapter 4)
  - —Meeting Demands of Global Growth, Netflix Migrates to Integrated ERP (Chapter 5)
  - —Equifax: A Massive Data Breach at a Consumer Reporting Agency (Chapter 10)

Chapter-Specific Changes

CHAPTER 1: INFORMATION SYSTEMS AND *PEOPLE*

- New key term: **digital transformation**
- Updated tables showing social network usage
- Updated table showing important MIS research topics
- Updated examples of information systems, including social applications and recent breaches
- Added downloadable Excel file to support Application Exercise
- Updated case studies on Nasdaq and Twitter with current information and recent sources

CHAPTER 2: INFORMATION SYSTEMS AND *STRATEGY*

- Added new figure showing how the smartphone disrupted numerous products and services, inviting students to think of others
- Added new figures showing total IT spending by state, and per person spending by state to illustrate benchmarks
- Updated figure showing net profit margins of selected industries
- Added downloadable Excel file to support Application Exercise
- Updated cases on GameStop and Net Neutrality using current information and recent sources

CHAPTER 3: INFORMATION AND COMMUNICATIONS TECHNOLOGIES: *THE ENTERPRISE ARCHITECTURE*

- New key terms: **virtual personal assistant, 5G, millimeter waves**, and **quantum computing**
- Added new figure to illustrate motion capture input technology
- Updated tables and figures on storage capacities, market shares, programming languages, and 802.11 standards
- Added discussion of 5G, millimeter waves, and quantum computing
- Added new case study "Dropbox and the Personal Cloud," replacing the one on Google Glass
- Added new case study "The Race to 5G," replacing the one on Sprint.
- Added new e-project, "Analyzing Costs for Software as a Service (SAAS)," replacing the one on 4G rollouts

CHAPTER 4: DATABASES AND *DATA WAREHOUSES*

- New key terms: **distributed databases** and **blockchain**
- Reorganized chapter to include distributed databases and blockchain as a learning objective, and incorporate master data management into learning objective #6 on the challenges of information management
- New Ethical Factor feature on the challenges of coding ethnicity and race in the US Census
- Updated table on careers in database administration
- Added discussion of distributed databases and blockchain
- Moved discussion of data mining to Chapter 7 on analytics
- New case study, "Walmart Deploys Blockchain for Food Safety," replacing the one on eBay

CHAPTER 5: INFORMATION SYSTEMS FOR THE *ENTERPRISE*

- Added discussion of blockchain to supply chain management section
- New productivity tips on how credit card companies detect suspicious activity, and how the US Postal Service offers dashboards to improve visibility for customers
- New figure showing a talent development dashboard
- Expanded section on the use of robotics in supply chains
- Expanded section on the use of artificial intelligence in customer relationship management
- New "Did You Know" about artificial intelligence and consumer pricing
- Revised section on mobile CRM to include discussion of robocalls
- Added downloadable file to support Excel Application Exercise
- New Excel download that helps students solve the "bullwhip effect" problem in the role-playing simulation, "Custom Cakes"
- New case study, "Meeting Demands of Global Growth, Netflix Migrates to Integrated ERP," replacing the one on Mandarin Oriental Hotel

CHAPTER 6: DEVELOPING A DIGITAL PRESENCE: WEBSITES, SOCIAL MEDIA, AND MOBILE APPS

- Changed title to "Developing a Digital Presence: Websites, Social Media, and Mobile Apps," and revised content to match
- Updated information on ICANN
- Updated tables and charts on market shares for browsers and search engines
- New productivity tip on taking advantage of automated credit card alerts
- Expanded discussion of the value of mobility and how mobile payment systems work
- Added downloadable file to support Excel Application Exercise
- Updated case studies on mobile payments and LinkedIn with new information and recent sources

CHAPTER 7: BUSINESS INTELLIGENCE AND ANALYTICS

- New key terms: **descriptive analytics, prescriptive analytics, text analytics (or text mining), machine learning**
- Changed title to Business Intelligence and Analytics
- New Ethical Factor, "Ethics and Bias in Artificial Intelligence," which discusses how AI can generate biased recommendations in areas such as law enforcement and hiring
- Revised section on data and text mining to a broader discussion of analytics, including new table on descriptive, predictive, and prescriptive analytics
- Added new information on augmented analytics
- Added discussion of computer vision to artificial intelligence section
- Added discussion and figure on ethical guidelines for trustworthy AI
- Added downloadable file to support Excel Application Exercise
- Updated case studies on government's big data and Nielsen's social content ratings with new information and recent sources

CHAPTER 8: COLLABORATING WITH *TECHNOLOGY*

- New key term: **augmented reality**
- Updated section on email to emphasize migrations to cloud-based services

- Reorganized and updated section on IM and interoperability, including Facebook's strategies for WhatsApp and its other messaging services
- Added new productivity tip to remind students about employers' use of social media profiles to screen applicants
- Added discussion of augmented reality as a content authoring tool
- Updated case studies with recent sources

CHAPTER 9: KNOWLEDGE MANAGEMENT AND *E-LEARNING*

- New key term: **learning analytics**
- Reorganized and tightened chapter, incorporating comparison of corporate and educational e-learning with the section on approaches to e-learning and eliminating learning objective #6
- Added new productivity tip pointing students to databases that provide information about internship opportunities
- Added discussion of recent advances in content authoring tools, including augmented reality
- Added new productivity tip about free, online videos that explain Excel functions
- New section on learning analytics and their uses to improve outcomes
- Updated cases on Lynda.com and Diplopedia with new information and recent sources
- Updated e-projects to align with current websites

CHAPTER 10: ETHICS, PRIVACY, AND *SECURITY*

- New key terms: **penetration testing (pen testing), Secure Sockets Layer (SSL)**
- Updated examples of privacy breaches and information leaks
- Added new figure of phishing example
- Added discussion of penetration testing as a means to assess vulnerabilities
- Expanded section emphasizing timely software patches
- Added new case study "Equifax: A Massive Data Breach at a Consumer Reporting Agency," replacing the one on Zynga
- Updated case study on Spamhaus
- Revised E-Project 2 to align with updated Spamhaus website

CHAPTER 11: SYSTEMS DEVELOPMENT AND *PROCUREMENT*

- New key term: **robotic process automation (RPA)**
- Added new table showing software development strategies used by a government agency
- Added discussion on using agile methods in global software development
- Moved discussion of the role of senior management, and the need for oversight of cloud computing adoptions
- Added downloadable file to support Excel Application Exercise
- Updated case studies with new information and recent sources
- Expanded section on business process reengineering to emphasize robotic process automation and artificial intelligence applications

CHAPTER 12: INFORMATION SYSTEMS PROJECT MANAGEMENT AND *STRATEGIC PLANNING*

- New key term: **record retention policy**
- Emphasized the need for security policies that apply to the IT department itself, touching on logins, software patches, and other activities
- Added new section on record retention policies, particularly for electronic records such as email and texts
- Updated figure on recent technology trends to include autonomous devices, augmented analytics, blockchain, and digital ethics and privacy
- Added downloadable files to support the Excel and Access Application Exercises
- Updated case studies with new information and recent sources
- Replaced E-Project 1 with an assignment to examine an IT strategic plan

End-of-Book Comprehensive Case Studies

- Updated Facebook case study to incorporate recent events, such as efforts to combat fake accounts and hate speech
- Updated Uber case study with information about its growing services and also its major crises involving harassment and its autonomous vehicles
- Updated Apple case study with its most recent products and discussion of lawsuits from customers about manipulating battery life on older iPhone models
- Revised case study on the federal government's IT project portfolio to incorporate recent events and efforts to improve success rates and reduce costs, such as consolidation of data centers and the cloud computing initiative

To the Student

Any college student thinking about the job market can't help but notice how valuable it is to have skills related to information systems. In this course, you will learn what information systems are all about and why they are so funda-

mental to business and society. It will be an exciting journey, filled with revelations about business strategies, technology trends and innovations, and also tips that will help you work smarter as a student. Here are the main features of this text and its supplements.

Learn by Doing: Interactive Activities and the Online Role-Playing Simulations

A course on information systems should tap their power for active, experiential learning.

This title also includes a unique set of interactive role-playing simulations in which you can apply your knowledge and experience to what each chapter is about. You will enter realistic and often tense situations, interacting with the characters via a simulated smartphone or laptop, and using email, text messaging, web conferencing, video chat, voicemail, dashboards, ordering screens, and other applications. Each simulation is scored and students receive extensive feedback on the choices they make. Each one includes key terms, so you can see how they are used in context.

Some examples:

- In World of Mammals (Chapter 1), you help the harried director of a wild animal preserve interview candidates for the CIO position, after the former CIO leaves abruptly. What skills does a CIO need? What kind of experience would fit best?
- In Riverside Lodge (Chapter 3), fully revised for the 4th edition, you join a team of entrepreneurs eager to open a "glamping" resort and equip it with the information systems that will take care of operations and create competitive advantage for its adventurous guests who stay in the solar-equipped tents.
- Chocolate Lovers Unite (Chapter 7) challenges you to resolve a heated debate over which online marketing pitch works best by conducting tests and generating analytics to pursue data-driven decision making.
- Vampire Legends drops you into a fast-paced, tense situation in which the material in Chapter 10 (Ethics, Privacy, and *Security*) comes to life in an online game company that is racing to launch a sequel. When troubling things begin happening that involve the company's data center and information security, you will have difficult choices to make.
- In Green Wheeling, the simulation on software development and procurement (Chapter 11), you join a task force charged with replacing a college's obsolete fund-raising system. You and your team members weigh the pros and cons of "build" or "buy," and you will see how the outcome can change based on your decisions.

I've done research on games and simulations in education, and have led several projects to create software that draws on the compelling features of these environments for learning. While interactive applications can help students memorize terms or review the chapter contents, simulations that immerse students in a relevant and authentic case can do more. Research shows simulations create engagement, improve learning outcomes, and build critical thinking skills through active, student-centered involvement. You will find it much easier to learn and remember the material in the textbook when you can engage in simulations like this.

The Human Element in Information Systems

In addition to the simulations, this text brings a fresh perspective to the introductory course in information systems that combines comprehensive and up-to-date coverage with a stronger focus on the human element. The text covers all the major topics for the course in a rigorous way, without skimping on any of the fundamentals. But it enriches those topics with probing discussions about the roles people play in building, shaping, implementing, and sometimes obstructing information systems.

Why, for example, do some high-tech companies ban telecommuting, even though employees have well-equipped home offices? Why do organizations implement electronic surveillance? Why is human error often the problem when data breaches occur? Issues like these help illustrate why the human element is important.

Exploring Technology Battlegrounds

Grand battles over technology directions help students understand the close links between competitive business strategies and information systems. The stakes are high in debates about topics such as net neutrality, 5G rollouts, wireless spectrum auctions, cloud computing, programming languages, mobile operating systems, mobile payment systems, and social network privacy. Billions of dollars are on the line for winners and losers. Yet most people know little about these battlegrounds because the underlying technology issues are out of reach. After reading this text, students will look at online ads, privacy policies, social networks, and their own smartphones with a new appreciation for the fierce business competitions unfolding before their eyes.

Reaching a Changing Student Body

The text recognizes the growth in the number of women, minorities, international students, online students, and nontraditional students who enroll in this course, drawing on examples and settings that will resonate with them. Devon, for instance, is starting her own web design business, and students learn about relational databases by helping her build one for her small business

(Chapter 4). International student Prakash is the co-founder of *Leveling UP!*, a smartphone app that is the centerpiece for the interactive role-playing simulation on business strategy (Chapter 2). In the chapter on knowledge management and e-learning (Chapter 9), Sally takes an online course in nonprofit management as she nears retirement and helps her own company build an e-learning course for the coworkers she's leaving behind.

Balancing Coverage of Business, Government, and Nonprofits

This text broadens the coverage about information systems to include all the varied settings in which students may work. It draws on timely examples from multinational corporations, nonprofits, government agencies, midsized businesses, start-ups, charities, volunteer organizations, student clubs, and other settings. The text highlights how these different organizations launch information systems to fulfill their missions, whether that means generating profits, helping people in need, or serving citizens.

The strategies that underlie digital marketing, for instance, work as effectively for nonprofits that want to mobilize citizens as they do for businesses that tempt new customers with discount coupons. And competitive advantage is not just for business. Charities compete for volunteers and donations, and they benefit from customer relationship management systems.

Changing Student Roles

Just as students are gaining employment in a wide variety of organizations, they are taking on more varied roles within them. Though some will become information systems managers, many more will become consultants, business analysts, accountants, marketing professionals, talent development specialists, volunteers, virtual team leaders, forensic experts, legal advisors, and project managers. The text introduces emerging careers as well, such as data scientist.

Examples in the text, case studies, and simulations feature all these different roles, showing how successful information systems emerge from a broad base of stakeholders with different perspectives and specialties. Carlos, for instance, is the instructional designer on a corporate e-learning development team, adding his knowledge of usability and accessibility for people with disabilities (Chapter 9). In Chapter 11, Lily is a senior manager for an online grocery who comes up with a clever website to capture a valuable market—busy singles who forgot to buy groceries.

Emphasizing Ethics

Ethical concerns weave throughout the text, touching on human ethical dilemmas such a distributed denial of service attack in which computers of innocent bystanders who mistakenly downloaded malware are used to bring down critically important public services.

A special feature in each chapter titled "The Ethical Factor" explores timely ethical issues such as corporate responsibility in extended supply chains (Chapter 2), or the ethics of massive surveillance and collection of big data by governments and corporations (Chapter 3). In Chapter 10 on ethics, privacy, and security, students take a survey to learn more about how they judge situations that touch on information ethics, and in Revel, they can compare their decisions to those made by a sample of US adults. The online simulation for that chapter immerses students in a tense situation in which security is compromised and they face some difficult ethical dilemmas.

Here is a list of all the "Ethical Factor" boxes:

1. Ethical Issues Surrounding Information Systems, p. 21
2. Ethical Responsibility in an Extended Value Chain, p. 42
3. Ethical Implications of Big Data, p. 66
4. Ethical Issues in Database Design: The Case of Race and Ethnicity, p. 106
5. Ethics and Talent Management, p. 135
6. Website Accessibility: Why Is Progress So Slow? p. 170
7. Ethics and Bias in Artificial Intelligence, p. 199
8. Flash Mobs and Free Speech: Should Police Block Mobile Messaging Services? p. 244
9. Knowledge Sharing in Fast-Paced Industries: The Case of Formula One Racing, p. 268
10. Ethical Dilemmas in a Distributed Denial of Service Attack, p. 304
11. Developing Systems That Promote Ethical Decision Making and Social Responsibility, p. 336
12. Code of Ethics for Project Managers, p. 360

Working Smarter, Not Harder: Productivity Tips for Students

Every chapter includes several "Productivity Tips" that suggest ways students can improve their own productivity by applying what they've learned.

In Chapter 2 on information systems and strategy, for instance, a tip invites students to check out the software trial versions that came preinstalled on their computers to see how companies leverage this valuable product positioning, and then remove them to save space and improve the computer's performance. A tip in Chapter 5 advises students to alert their credit card companies before traveling abroad. If advanced financial software detects unexpected and suspicious transactions, your card might be blocked. Another tip in Chapter 3 points to solid productivity gains for people who use two monitors, which is especially helpful for students with laptops.

These tips are not only immediately useful. They help you learn chapter material by applying it so you can work smarter, not harder.

Highlighting Globalization and International Contexts

Information systems play a key role in globalization, especially through the internet and all the creative destruction it unleashed. Examples abound throughout the text, highlighting how Baidu captured the search engine market in China (Chapter 2) or how IKEA manages a global supply chain (Chapter 5). The global financial crises underscore the important work of the International Accounting Standards Board—to promote transparent and enforceable financial reporting for companies around the world using XBRL tags from the XML family of standards (Chapter 5). The international emphasis also unfolds in working relationships across national borders. For example, the chapter on collaboration (Chapter 8) discusses pitfalls of virtual multinational teams, and the section on agile software development (Chapter 11) describes how global teams can take advantage of that approach.

Inspiring Students to Pursue Promising Careers

Finally, an important goal of this text and its supplements is to convey the sheer excitement and limitless potential of this field, with an eye toward inspiring students to go further. Inside are countless examples of how savvy people leverage information systems to transform organizations of all stripes, and even build new empires.

Some of the excitement comes from groundbreaking technological advances. The disruptive innovations that topple some industries and open star-studded paths for others are also part of the excitement. GPS dealt a crushing blow to map makers, and the internet did the same to print newspapers. The ride-hailing services and their mobile apps have shaken up the transportation industry. But all these events opened up vast new territory for innovative start-ups.

To further stimulate interest, each chapter includes short "Did You Know?" snippets to highlight engaging or amusing applications of the chapter's topic. For example, the chapter on hardware, software, and networks (Chapter 3) features a coffee shop whose zany owner constantly renames the free wireless network to display different messages, such as "BuyAnotherCupYouCheapskate."

I hope you catch some of this energy and enthusiasm and decide to pursue this field. Those who do will have outstanding career prospects in the private and public sectors, and you'll never be bored.

Supplements

Image Library

This collection of the figures and tables from the text offers another aid for classroom presentations and PowerPoint slides.

TestGen

Pearson Education's test-generating software is available from www.pearsonhighered.com/irc. The software is PC/MAC-compatible and preloaded with all of the Test Item File questions. You can manually or randomly view test questions and drag-and-drop to create a test. You can add or modify test-bank questions as needed. Our TestGens are converted for use in BlackBoard, WebCT, Moodle, D2L, and Angel. These conversions can be found on the Instructor's Resource Center. The TestGen is also available in Respondus and can be found on www.respondus.com.

Alternate Electronic Versions

Pearson is proud to offer alternate versions for students seeking an electronic version of the Wallace text. VitalSource (www.vitalsource.com) provides one option, where students simply select their eText by title or author and purchase immediate access to the content for the duration of the course using a major credit card.

Acknowledgments

Many thanks go to all the reviewers who took time to comment on manuscripts, simulation storyboards, case studies, and other features of the text. Their feedback and suggestions were extremely valuable, and they help ensure the text and its ancillaries will meet the needs of faculty and students.

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And finally, thanks to Julian, Callie, Eric, and Julian, and also Keiko, Lili, and Marlene, a list that includes my very supportive human family and our four-footed companions.

Your Feedback Is Welcome

To all of you who are using this book, as professors, teaching assistants, and students, I welcome your thoughts and feedback. Please email your comments, questions, and suggestions, and I'll be eager to hear how your course goes.

Patricia Wallace, Ph.D.
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Chapter 1

Information Systems and *People*

Learning Objectives

1.1 Describe the main roles that information systems play in organizations.

1.2 Compare the terms *data*, *information*, and *knowledge*, and describe three characteristics that make information valuable.

1.3 Describe the four main components of an information system and the role that each plays.

1.4 Identify several research areas in the discipline of management information systems (MIS).

1.5 Provide examples of how business, nonprofit, and government managers, as well as information technology departments, depend on information systems knowledge.

1.6 Explain how information systems present both promises and perils, and also pose ethical questions.

Introduction

AT THE HEART OF EVERY ORGANIZATION IS ITS INFORMATION SYSTEM, and that is what this course is all about. Google, Twitter, Microsoft, and Facebook are all popular companies on the cutting edge of technology, and their innovations and competitive battles make front page news. But even organizations that don't seem very high tech—from a family-owned restaurant to a fitness gym—can hardly do without information systems or without people who know how to build and manage them.

This opening chapter highlights information systems in action, the nature of information itself, and the four main components of every information system. You will see how the information systems (IS) discipline is changing and growing and why a solid understanding of this subject will give you a critical edge, regardless of your major or career path. Finally, the chapter examines the promises and perils of information systems and the many ethical issues that arise with the phenomenal power within everyone's reach. Information is an organization's most important asset. Creating, capturing, organizing, storing, retrieving, analyzing, and acting on information are fundamental activities in every organization. The skill with which you carry out those tasks will be the deciding factor not just for your company's success but for your own as well. This book is about information and the systems that people develop and manage to perform all those tasks and more.

You will see how these systems work, why they are created, how they have become the organization's central nervous system, and why they sometimes fail. You will also learn to tap the power of information systems to help your company compete or your organization become more effective. Finally, you will become more productive yourself—working smarter, not harder—in college, in your career, at home, and throughout your life.

Like the information they manage, information systems cover a very broad scope and contribute to many different activities in an organization. What roles do they play, and how do they transform work? The next section shows the enormous variety of settings in which innovative information systems play a role, well beyond the useful search engines.

Information Systems in Action

1.1 Describe the main roles that information systems play in organizations.

- *Dancing with the Stars* became a smash reality TV hit by engaging millions of viewers in judging the contestants. Hopeful celebrity couples compete each week with a novel dance routine, and audience members cast a vote for their favorite by phoning, sending text messages, or logging into the show's website. An information system on the back end tallies the results, which count for half the couple's score. The system must be able to handle enormous incoming volume in a very short time to get accurate tallies.
- Smart doorbell company Ring launched a service called "Neighbors" in which people can share videos of anyone who comes to their front doors, sometimes catching them in the act of stealing a package or breaking in. The doorbells are motion sensitive, so they activate even if the bell isn't pressed. Working with dozens of local police departments, the creators of Neighbors highlight how social information systems like this one will help police solve crimes and make communities safer.
- Walmart, with sales that reach into the hundreds of billions, pioneered the globe's most efficient information system to track shipments as they move from supplier factories to warehouses to retail stores. Tags attached to pallets transmit information wirelessly, so Walmart execs know exactly where merchandise is in the supply chain and can spot trouble immediately.

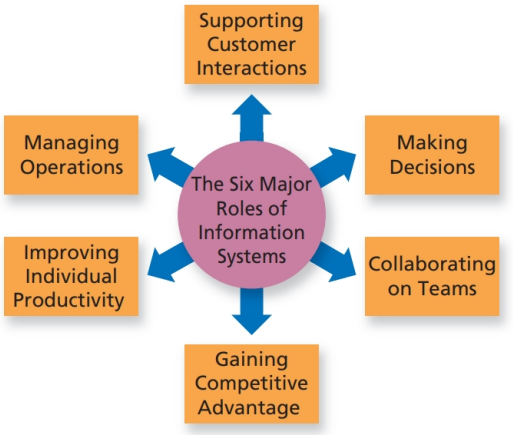
digital transformation
A term that describes how organizations develop new business models by integrating digital technologies into all aspects of the business, including relationships with customers, suppliers, and partners.

operations management
The area of management concerned with the design, operation, and improvement of the systems and processes the organization uses to deliver its goods and services.

When those bulky computers first entered company basements in the 1970s, the term *information system* brought up images of payroll programs, general ledgers, invoice tracking, and inventory management. Those back-office functions are still critically important, but today's information systems have migrated into every facet of an organization, touching employees from the mail clerk to the CEO. They also extend well beyond the company's boundaries, reaching out to customers, clients, suppliers, partners, citizens, and all kinds of stakeholders. Their hardware might be as vast as Google's data centers or far smaller than Walmart's pallet tags. And their connections could be the thick fiber-optic cables on the ocean floor or electromagnetic waves in the air around you.

The term **digital transformation** describes how organizations develop new business models by integrating digital technology into all aspects of their operations, including relationships with customers, suppliers, and partners.[1] The transformation blurs the lines between the physical and digital worlds and changes the way people interact with one another. The underlying information systems play critical roles in six major areas (Figure 1.1).

Figure 1.1 The major roles of information systems in organizations.



Managing Operations

Every successful organization must excel at **operations management**, which involves the design, operation, and improvement of the systems and processes the organization uses to deliver its goods and services. Some of these deal with several basic functions that are part of every business. Information systems are crucial for tracking employee payroll, taxes, benefits, and timesheets. Accounting information systems are essential to track accounts receivable, to process transactions, to procure goods and services, and to pay the suppliers. Organizations also must manage their assets and inventories, from the computers and the desks they sit on to the massive factories and equipment located in far corners of the globe.