

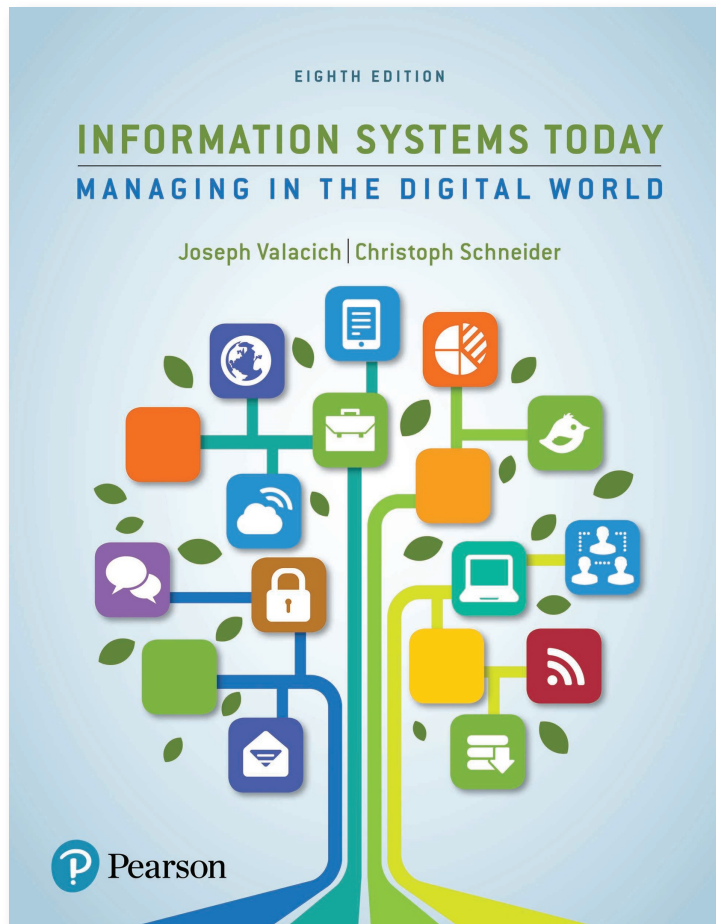
EIGHTH EDITION

INFORMATION SYSTEMS TODAY

MANAGING IN THE DIGITAL WORLD

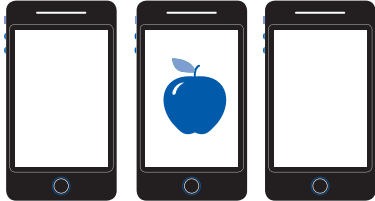
Joseph Valacich | Christoph Schneider





Information systems have become *pervasive*. *Mobile devices*, *social media*, and *cloud computing* have transformed organizations and society. The *Internet of Things* can generate a wealth of potentially useful *Big Data*. The rapid development of transportation and telecommunication technologies, national and global infrastructures, and information systems as well as a host of other factors has created a number of pressing societal issues that tremendously influence the world we live in. These issues include *demographic changes*, *urbanization*, *shifts in economic power*, *resource scarcity*, and *climate change*. As a consequence, *sustainable development* will become an ever increasingly important aspect for organizations. Throughout this revision, we discuss how organizations can harness radical innovations and other technological developments, as well as the role of information systems in influencing and addressing pressing societal issues; further, we added a new chapter element about the role of *Green IT*. We designed the book's cover to emphasize how IT resides within and influences various societal issues.

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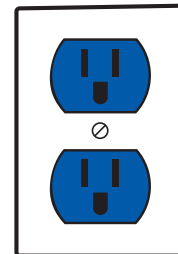
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Dedication

To my mother Mary, you are the best.
—**Joe**

To Birgit for your love and support.
—**Christoph**

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About the Authors

Joseph (Joe) Valacich is an *Eller Professor of MIS* within the Eller College of Management at the University of Arizona, a Fellow of the Association for Information Systems (2009), and the Chief Science Officer (CSO) of Neuro-ID, Inc. He was previously on the faculty at Indiana University, Bloomington, and Washington State University, Pullman. He has had visiting faculty appointments at City University of Hong Kong, Buskerud College (Norway), the Helsinki School of Economics and Business, the Norwegian University of Life Sciences, and Riga Technical University (Latvia). He received a PhD degree from the University of Arizona (MIS) and MBA and BS (Computer Science) degrees from the University of Montana. Prior to his academic career, Dr. Valacich worked in the software industry in Seattle in both large and startup organizations.

Dr. Valacich has served on various national task forces designing model curricula for the information systems discipline, including *IS '97*, *IS 2002*, and *IS 2010: The Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems*, where he was co-chairperson. He also served on the task force that designed *MSIS 2000* and *2006: The Master of Science in Information Systems Model Curriculum*. He served on the executive committee, funded by the National Science Foundation, to define the *IS Program Accreditation Standards* and served on the board of directors for CSAB (formally the Computing Sciences Accreditation Board) representing the Association for Information Systems (AIS). He was the general conference co-chair for the 2003 International Conference on Information Systems (ICIS) and the 2012 Americas Conference on Information Systems (AMCIS); both were held in Seattle.

Dr. Valacich has conducted numerous corporate training and executive development programs for organizations, including AT&T, Boeing, Dow Chemical, EDS, Exxon, FedEx, General Motors, Microsoft, and Xerox. He has served in a variety of editorial roles within various academic journals and conferences. His primary research interests include human-computer interaction, deception detection, technology-mediated collaboration, mobile and emerging technologies, and e-business. He is a prolific scholar, having published more than 200 scholarly articles in numerous prestigious journals and conferences, including: *MIS Quarterly*, *Information Systems Research*, *Management Science*, *Academy of Management Journal*, *Journal of MIS*, *Decision Sciences*, *Journal of the AIS*, *Communications of the ACM*, *Organizational Behavior and Human Decision Processes*, and *Journal of Applied Psychology*. He is a coauthor of the leading textbooks *Modern Systems Analysis and Design* (8th ed.) and *Essentials of Systems Analysis and Design* (6th ed.), both published by Pearson.

In 2016, Dr. Valacich was awarded the University of Arizona, Tech Launch Arizona, “Innovation & Impact Award” for Information Technology. He was awarded the “Distinguished Alumnus Award” from the University of Montana Alumni Association in 2012 and the “Outstanding Alumnus Award” from the University of Montana’s School of Business Administration in 2009. Dr. Valacich is also ranked as one of the most prolific authors in the history of *MIS Quarterly*—his discipline’s top journal—over the life of the journal (1977–2016) (see misq.org). Throughout his career, he has also won numerous teaching, service, and research awards.

Christoph Schneider is an assistant professor in the Department of Information Systems at City University of Hong Kong and previously held a visiting faculty appointment at Boise State University. He earned a Swiss Higher Diploma in Hotel Management at the University Centre César Ritz in Brig, Switzerland, a BA in Hotel and Restaurant Administration at Washington State University, and a PhD in Business Administration (Management Information Systems) at Washington State University. His teaching interests include the management of information systems and web design.



Dr. Schneider is an active researcher. His primary research interests include human–computer interaction, electronic commerce, and computer-mediated collaboration. His research has appeared in peer-reviewed journals, such as *Information Systems Research*, *Management Information Systems Quarterly*, *Management Science*, and *IEEE Transactions on Professional Communication*; further, he has presented his research at various international conferences, such as the International Conference on Information Systems, the European Conference on Information Systems, and the Hawaii International Conference on System Sciences. He serves as a member of the International Steering Committee of the International Conference on Information Systems Development (ISD) and as senior editor at *Information Systems Journal*.

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Approach

Information systems have become *pervasive*. *Mobile devices, social media, and cloud computing* have transformed organizations and society. Organizations see the possibilities of the *Internet of Things*, in that not only computers but various sensors, motors, actuators, or even cameras can generate a wealth of potentially useful data. Businesses face unprecedented opportunities, but also challenges, through the ability to utilize *Big Data*. What does all this mean? What are the catalysts of these concepts and of all this change? More important, how can organizations thrive in this dynamic and highly competitive marketplace? The answer to these and many similar questions is that information systems and related information technologies are driving innovation, new business models, and hypercompetition. It is little wonder that teaching an introductory course on information systems has never been more crucial—or more challenging.

One of the greatest challenges that we face in teaching information systems courses is how to keep pace in the classroom with what is happening out in the real world. Being relevant to students while at the same time providing the necessary foundation for understanding the breadth, depth, and complexity of information systems has never been more difficult. We wrote *Information Systems Today*, Eighth Edition, with this overarching goal in mind, to be both rigorous *and* relevant. To accomplish this, we want students not only to learn about information systems but also to clearly understand the importance of information systems for individuals, organizations, and society. Additionally, we do not want to simply spoon-feed students with technical terms and the history of information systems. Instead, students must understand exactly what innovative organizations are doing with contemporary information systems and, more important, where things are heading. Finally, we want to empower students with the essential knowledge needed to be successful in the use and understanding of information systems in their careers.

To this end, we wrote *Information Systems Today*, Eighth Edition, so that it is contemporary, fun to read, and useful, focusing on what business students need to know about information systems to survive and thrive in the digital world.

Audience

Information Systems Today, Eighth Edition, is primarily for the undergraduate introductory information systems course required of all business students. The introductory information systems course typically has a diverse audience of students majoring in many different areas, such as accounting, economics, finance, marketing, general management, human resource management, production and operations, international business, entrepreneurship, and information systems. This book was also written for students studying topics outside of business, especially in the growing and broad area of information sciences. Given the range of students taking this type of course, we have written this book so that it is a valuable guide to all students, providing them with the essential information they need to know. Therefore, this book has been written to appeal to a diverse audience.

Information Systems Today, Eighth Edition, can also be used for the introductory course offered at the graduate level—for example, in the first year of an MBA program. Such usage would be especially appropriate if the course heavily focused on the diverse set of cases provided in each chapter.

What's New to the Eighth Edition

Our primary goal for *Information Systems Today*, Eighth Edition, was to emphasize the importance of information systems to all business students as the role of information technology and systems continues to expand within organizations and society. Most notably, we extensively

examine how five big megatrends—mobile, social media, the Internet of Things, cloud computing, and Big Data—are transforming individuals, organizations, and society. Given this clear focus, we are better able to identify those topics most critical to students and future business professionals. Consequently, we have made substantial revisions to the basic content of the chapters and pedagogical elements as well as introduced several new elements that we believe help achieve this goal. New or expanded chapter topics include the following:

- An extensively revised chapter—Chapter 1, “Managing in the Digital World”—focuses not only on defining what an information system consists of but also provides new content on globalization and societal issues in the digital world as well as the role of five IT megatrends in fueling and addressing these issues.
- An extensively revised chapter—Chapter 2, “Gaining Competitive Advantage Through Information Systems”—provides new content describing how information systems play a key part in enabling different types of innovation and innovative business models.
- A revised chapter—Chapter 3, “Managing the Information Systems Infrastructure and Services”—provides updated content on the need for a reliable, adaptable, and scalable infrastructure to support the needs of today’s organizations as well as on essential infrastructure concepts related to hardware, software, storage, networking and the Internet, data centers, and cloud computing.
- A revised chapter—Chapter 4, “Enabling Business-to-Consumer Electronic Commerce”—provides updated content related to e-commerce involving the end consumer as well as new and expanded coverage of e-finance, fintech, and related issues.
- A revised chapter—Chapter 5, “Enhancing Organizational Communication and Collaboration Using Social Media”—centers around various topics related to the need for organizational communication and provides updated content on how individuals and organizations use both traditional communication and collaboration tools and social media for communication, collaboration, cooperation, and connection.
- An extensively revised chapter—Chapter 6, “Enhancing Business Intelligence Using Big Data and Analytics”—provides extended coverage on business intelligence and advanced analytics and greatly expanded content on machine learning, predictive modeling, artificial intelligence, unstructured data analytics, and spatial decision support.
- A revised chapter—Chapter 8, “Strengthening Business-to-Business Relationships via Supply Chain and Customer Relationship Management”—provides updated content on business-to-business electronic commerce and supply chain management as well as customer relationship management (CRM).
- A revised chapter—Chapter 9, “Developing and Acquiring Information Systems”—provides updates to various topics and extended content on alternative system development methodologies.
- A revised chapter—Chapter 10, “Securing Information Systems”—provides an update to all topics and deeper coverage on industrial espionage and cyberterrorism.
- A revised Technology Briefing covers foundational concepts related to various information technologies. The Technology Briefing provides the foundations for a deeper understanding of the topics introduced in Chapter 3 and is intended for use in more technically oriented courses. Each section of this briefing was designed to stand alone—it can be read with or without the other sections.

In addition to the changes within the main chapter content, we have also added two new features to each chapter—Green IT and Security Matters. Green IT presents environmental issues arising from the use of information systems. For example, in Chapter 4, we discuss the environmental impacts of online shopping. Security Matters presents some current issues and threats arising from the ubiquitous use of information systems. For example, in Chapter 5, we discuss how hacktivists challenged the extramarital dating website Ashley Madison.

Beyond the chapter content and features, we have also made substantial changes and refinements to the end of each chapter. In particular, we carefully revised many of the end-of-chapter problems and exercises to reflect content changes and new material. Further, we have carefully updated the end-of-chapter cases about contemporary organizations and issues to illustrate the complexities of the digital world. Each case mirrors the primary content of its chapter to better emphasize its relevancy within the context of a real organization. All these elements are discussed more thoroughly next.

Our goal has always been to provide only the information that is relevant to all business students, nothing more and nothing less. We believe that we have again achieved this goal with *Information Systems Today*, Eighth Edition. We hope you agree.

Key Features

As authors, teachers, developers, and managers of information systems, we understand that in order for students to best learn about information systems with this book, they must be motivated to learn. To this end, we have included a number of unique features to help students quickly and easily assess the true value of information systems and their impact on everyday life. We show how today's professionals are using information systems to help modern organizations become more efficient and competitive. Our focus is on the application of technology to real-world, contemporary situations. Next, we describe each of the features that contribute to that focus.

Pedagogy—A Multitiered Approach

Each chapter provides a list of learning objectives to lay the foundation for the chapter content, followed by an opening case to highlight how contemporary organizations are utilizing information systems to gain competitive advantage, streamline organizational processes, or improve customer relationships or how information systems fuel societal change. In addition, throughout each chapter, various short pedagogical elements are presented to highlight key information systems issues and concepts in a variety of contexts. These elements help to show students the broader organizational and societal implications of various topics. At the end of each chapter, the Key Points Review repeats the learning objectives and describes how each objective was achieved; a variety of questions and exercises helps students assess their understanding of the chapter material and encourages them to synthesize and apply the concepts learned. A list of references appears at the end of each chapter.

OPENING CASE—MANAGING IN THE DIGITAL WORLD. Each chapter begins with an opening case describing a real-world company, technology, and/or issue to spark students' interest in the chapter topic. We have chosen engaging cases that relate to students' interests and concerns by highlighting why information systems have become central for managing in the digital world. Each opening case includes a series of associated questions the students will be able to answer after reading the chapter contents. The organizations, technologies, or issues highlighted in these cases are as follows:

- The rise of open innovation
- How information systems fuel startups and new business models
- Google's meteoric rise and its transition to Alphabet
- How Chinese e-commerce company Taobao became a leader in the world of e-commerce
- How Facebook has emerged as one of the most successful and powerful social media sites
- Intelligence through drones
- Amazon.com's use of its sophisticated infrastructure to automate the supply chain for both large and small customers
- How Walmart became a leader in managing its global supply chains
- The rise of the maker movement
- How the hacking group "Anonymous" uses various tactics to further its ideological goals

Green IT Case

Climate change and resource scarcity are among the most pressing issues societies face. To highlight the role of information systems in this context, each chapter includes a Green IT case. This new feature discusses important issues related to the environmental impacts of information systems as well as how information systems can be used to reduce negative environmental impacts. The Green IT cases are embedded in the text of the chapter and highlight concepts from the surrounding chapter material. The issues and organizations highlighted in these cases are as follows:

- Green IT and the Internet of Things
- How the U.S. Navy is using alternative energy sources to address power consumption of its fleets

- How Alphabet uses renewable energy to power its data centers
- The environmental impacts of online shopping
- How green IT is fueling the use of renewable energy
- How the Internet of Things, Big Data, and analytics fuel greener facilities
- Why your ERP system should be in the cloud
- How Nike builds a greener supply chain
- How companies are trying to reduce the carbon footprint of modern data centers
- How Anonymous protests the killing of dolphins and whales in Japan

Security Matters

With information systems becoming ever more ubiquitous, security is of growing concern, not only for organizations but also for individuals. While we dedicate an entire chapter to issues surrounding securing information systems, this new feature presents some current issues and threats. The topics discussed in this element are as follows:

- How computer criminals use ransomware to extort money from organizations and everyday people
- How attackers use the SWIFT system to conduct virtual bank robberies
- How attackers can remotely hack into a car's onboard systems
- How even small companies are not immune from being targeted
- How terrorism is winning the social media battle
- How hacktivists challenged the extramarital dating website Ashley Madison
- How companies have to weigh the benefits and dangers of not updating ERP systems
- How VTech's attackers disclosed the customer data of the most vulnerable
- How attackers use mobile malware to steal online banking users' login credentials
- How analog may be the future of securing critical infrastructure

Coming Attractions

We worked to ensure that this book is contemporary. We cover literally hundreds of different current and emerging technologies throughout the book. This feature, however, focuses on innovations that are likely to soon have an impact on organizations or society. The topics discussed are as follows:

- Storing the history of humankind in memory crystals
- CITE—a city-sized test lab for innovations
- Extending the human lifetime indefinitely
- Using artificial intelligence to manage hedge funds
- Dissolvable electronics to fight bacteria
- Emotion aware gaming
- Transforming ERP and organizations using the Internet of Things
- Reducing supply chain problems using augmented reality
- Harvesting human energy
- Using brainwaves to verify people's identities

When Things Go Wrong

Textbooks don't usually describe what not to do, but this can be very helpful to students. This feature enables students to learn about a real-world situation in which information systems did not work or were not built or used well. The topics and issues discussed are as follows:

- The negative effects of technology addiction
- The pains of Uber in China
- Dirty data centers and the environmental impact of cloud computing
- How companies are trying to rig "likes" to gain reputation on social networking sites
- Crowdfunding failures
- How Twitter can quickly disseminate *misinformation*, with unforeseen consequences

- How a software error freed prisoners early
- How a supply chain failure caused SpaceX rocket failure
- Top security threats
- How the “heartbleed” bug almost killed the Internet

Who’s Going Mobile

Mobile technologies have become pervasive throughout society. New opportunities and issues have emerged with the growing importance of mobile devices, such as smartphones and tablets, which are in people’s immediate reach 24/7. Related to each chapter’s content, this feature examines topics related to the growth in mobile device usage throughout the world. The topics discussed are as follows:

- The rise of wearable technologies
- How information systems support the lifestyle of the digital nomads
- How mobile payment systems have transformed developing countries
- The rise of mobile payments
- Going SoLoMo: Yelp
- Identifying malaria hotspots using mobile phone data
- Managing businesses on the road using mobile ERP
- Developing mobile CRM apps for customers
- How to succeed in mobile app development
- Backdoors in mobile phones

Ethical Dilemma

Ethical business practices are now a predominant part of contemporary management education and practice. This feature examines contemporary dilemmas related to the chapter content and highlights the implications of these dilemmas for managers, organizations, and society. Discussion questions are provided to seed critical thinking assignments or class discussions. The topics discussed are as follows:

- The social and environmental costs of the newest gadgets
- The ethics of the sharing economy
- The ethics of publishing street photography on the web
- The ethics of reputation management
- Anonymity, trolling, and cyberharassment
- The Orwellian Internet of Things
- Privacy issues of radio frequency identification
- Using CRM systems to target or exploit consumers
- Ethical app development
- The ethics of cyberwar

Industry Analysis

Every industry is being transformed by the Internet and the increasing use of information systems by individuals and organizations. To give students a feel for just how pervasive and profound these changes are, each chapter presents an analysis of a specific industry to highlight the new rules for operating in the digital world. Given that no industry or profession is immune from these changes, each Industry Analysis highlights the importance of understanding information systems for *every* business student, not only for information systems majors. Discussion questions help students better understand the rapidly changing opportunities and risks of operating in the digital world. Chapter 1 examines how the digital world is transforming the opportunities for virtually all business professions. Subsequent chapters examine how globalization and the digital world have forever transformed various industries, including education, entertainment, retail, travel, health care, automobile, manufacturing, broadcasting, and law enforcement. Clearly, we are in a time of tremendous change, and understanding this evolution will better equip students to not only survive but also thrive in the digital world.

End-of-Chapter Material

Our end-of-chapter material is designed to accommodate various teaching and learning styles. It promotes learning beyond the book and the classroom. Elements include the following:

- **Key Terms**—Highlight key concepts within the chapter.
- **Review Questions**—Test students’ understanding of basic content.
- **Self-Study Questions**—Enable students to assess whether they are ready for a test.
- **Problems and Exercises**—Push students deeper into the material and encourage them to synthesize and apply it.
- **Application Exercises**—Challenge students to solve two real-world management problems using spreadsheet and database applications from a running case centered on a university travel agency. Student data files referenced within the exercises are available on the book’s website: www.pearsonhighered.com/valacich.
- **Team Work Exercise**—Encourage students to keep up with, discuss, visualize, and present interesting, important trends and forecasts related to Internet usage within a variety of contexts.

We have extensively updated these elements to reflect new chapter content and the natural evolution of the material.

End-of-Chapter Cases

To test and reinforce chapter content, we present two current real-world cases at the end of each chapter. Like the Opening Cases of each chapter, these cases are taken from the news and are contemporary. However, these are longer and more substantive than the Opening Cases. Sources for these cases include *BusinessWeek*, *CIO* magazine, *InformationWeek*, *Wired*, and various websites. They too are followed by discussion questions that help the student apply and master the chapter content. The organizations, products, and issues highlighted in these cases are as follows:

- Apple’s rise, fall, and reemergence as a global technology giant
- How electronic health records are transforming healthcare
- How Groupon achieved a first-mover advantage by reinventing the business model of group buying
- How streaming video is disrupting the movie rental and TV broadcasting industries
- How Amazon Web Services are a catalyst for innovation
- How the dark web fuels illegal activities
- How web analytics are providing unprecedented insights into online consumer behavior
- How Rocket Internet aims to become a European Internet giant by cloning business models
- How algorithms determine news feeds
- How scammers use like farming and clickbait to game Facebook’s newsfeed algorithms
- How the National Security Agency, or NSA, is being viewed as the National *Surveillance* Agency
- How companies gather social intelligence through social media
- How software as a service has enabled small and medium-sized organizations to utilize enterprise resource planning (ERP) systems
- How Amazon’s order fulfillment fuels technological unemployment
- How natural disasters disrupt global supply chains
- How companies attempt to use information systems to efficiently deliver products to the “last mile”
- How the Federal Bureau of Investigation and Department of Homeland Security joined forces in developing a comprehensive database of biometric information to better track and apprehend criminals
- How Hadoop and MapReduce fuel the use and analysis of Big Data
- How the National Security Agency is attempting to stop insider leaks
- How China limits information exchange within its society through its “great firewall”

Organization

The content and organization of this book are based on our own teaching as well as on feedback from reviewers and colleagues throughout the field. Each chapter builds on the others to reinforce key concepts and allow for a seamless learning experience. Essentially, the book has been structured to answer three fundamental questions:

1. What are contemporary information systems, and how are they being used in innovative ways?
2. Why are information systems so important and interesting?
3. How best can we build, acquire, manage, and safeguard information systems?

The ordering and content of our chapters were also significantly influenced by the “IS 2010 Curriculum Guidelines for Undergraduate Degree Programs in Information Systems”¹; these guidelines, written by prominent information systems scholars, define the information systems core body of knowledge for all business students. By design, the content of *Information Systems Today*, Eighth Edition, carefully follows these guidelines, and we are, therefore, very confident that our book provides a solid and widely agreed-on foundation for any introductory information systems course.

The chapters are organized as follows:

- **Chapter 1: Managing in the Digital World**—Information systems are fueling change in the digital world. Here, we help students understand what information systems are, the pressing issues societies in the digital world are facing, how five IT megatrends—mobile, social media, the Internet of Things, cloud computing, and Big Data—influence organizations and society, and how information systems have become a vital part of modern organizations. We walk the student through the technology, people, and organizational components of an information system, and lay out types of jobs and career opportunities in information systems and in related fields. We also focus on how technology is creating countless ethical concerns.
- **Chapter 2: Gaining Competitive Advantage Through Information Systems**—Given the rapid advancement of new technologies, we explain why and how companies are continually looking for innovative ways to use information systems for competitive advantage, and how information systems support organizations’ business strategies. Here, we discuss how companies from GE to Uber can use information systems for automation, organizational learning, and strategic advantage by creating new and innovative business models.
- **Chapter 3: Managing the Information Systems Infrastructure and Services**—With the ever-increasing complexity of maintaining a solid information systems infrastructure, it becomes increasingly important for organizations such as Google to design a reliable, robust, and secure infrastructure. Here, we provide an overview of the essential information systems infrastructure components and describe why they are necessary for satisfying an organization’s informational needs. We also examine the rapid evolution toward the delivery of infrastructure capabilities through a variety of cloud-based services.
- **Chapter 4: Enabling Business-to-Consumer Electronic Commerce**—Perhaps nothing has changed the landscape of business more than the use of the Internet for electronic commerce. Here, we describe how firms such as Amazon.com, Dell, or Taobao; governments; financial services providers; and e-finance startups use the Internet to conduct commerce in cyberspace. Further, we describe the requirements for successful e-commerce websites and discuss Internet marketing and mobile commerce as well as consumer-to-consumer and consumer-to-business e-commerce. Finally, we discuss payment and legal issues in e-commerce.
- **Chapter 5: Enhancing Organizational Communication and Collaboration Using Social Media**—Social media have forever changed how people interact. In addition to enabling various business opportunities, social media have also enabled companies to better harness the power and creativity of their workforce. Here, we provide an overview of traditional communication and collaboration tools and examine how different social media can

¹Topi, H., Valacich, J., Wright, R. T., Kaiser, K., Nunamaker Jr., J. F., Sipior, J. C., & de Vreede, G. J. (2010). IS 2010: Curriculum guidelines for undergraduate degree programs in information systems. *Communications of the Association for Information Systems*, 26(18).

enhance communication, collaboration, cooperation, and connection within organizations but also between organizations and their customers. Further, we discuss the importance of carefully managing the use of social media within organizations. Finally, using examples such as Twitter and Facebook, we describe how companies can deal with potential pitfalls associated with social media.

- **Chapter 6: Enhancing Business Intelligence Using Big Data and Analytics**—A key to effective management in a global, highly competitive, and rapidly changing environment is high-quality and timely information to support decision making in order to realize the strategic goals of the organization. Here, we first describe the need for enhanced decision making and explain how databases serve as a foundation for gaining business intelligence. We then discuss concepts related to business intelligence and advanced analytics, including data mining, machine learning, and predictive modeling. Finally, we discuss how knowledge management and geographic information systems help organizations make better business decisions.
- **Chapter 7: Enhancing Business Processes Using Enterprise Information Systems**—Enterprise systems have become a critical technology in a broad range of organizations, both large and small, to integrate information and span organizations' boundaries to better connect a firm with customers, suppliers, and other partners. Here, we focus on foundational concepts related to enterprise systems, walking students through various core business processes, and then examine how enterprise resource planning systems can be applied to improve these processes and organizational performance.
- **Chapter 8: Strengthening Business-to-Business Relationships via Supply Chain and Customer Relationship Management**—Two additional types of enterprise systems, supply chain management systems and customer relationship management systems, are being used to facilitate various business processes between suppliers and customers. Here, we begin by introducing business-to-business electronic commerce. Next, we examine how supply chain management systems can support the effective management of supply networks. Finally, we examine customer relationship management systems and their role in attracting and retaining customers and, using examples from companies such as Dell, discuss how organizations can integrate social media in their CRM efforts.
- **Chapter 9: Developing and Acquiring Information Systems**—Nearly every organization needs to develop or acquire information systems. Here, we begin by describing how to formulate and present the business case to build or acquire a new information system. We then walk the student through the traditional systems development approach and explain how numerous other approaches, such as agile development, can be utilized depending on the situation. Finally, we examine the steps followed when acquiring an information system from an outside vendor.
- **Chapter 10: Securing Information Systems**—With the pervasive use of information systems, new dangers have arisen for organizations, and the interplay between threats, vulnerabilities, and potential impacts has become a paramount issue within the context of global information management. Here, we contrast several types of computer crime and discuss the growing significance of cyberwar and cyberterrorism. We then highlight the primary threats to information systems security and explain how systems can be compromised and safeguarded. We conclude this chapter with a discussion of the role of auditing, information systems controls, and the Sarbanes–Oxley Act. Note that some instructors may choose to introduce this chapter prior to the discussion of the information systems infrastructure in Chapter 3.
- **Technology Briefing**—In addition to these 10 chapters, we include a Technology Briefing that focuses on foundational concepts regarding hardware, software, networking and the Internet, and databases. While Chapter 3, “Managing the Information Systems Infrastructure and Services,” provides a more managerial focus to these enabling technologies, this foundational material provides a more in-depth examination of these topics. By delivering this material as a Technology Briefing, we provide instructors the greatest flexibility in how and when they can apply it.

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Instructor Resources

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

The following supplements are available with this text:

- Instructor's Resource Manual
- Test Bank
- TestGen[®] Computerized Test Bank
- PowerPoint Presentation
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Reviewers

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1

Managing in the Digital World

Preview

Today, organizations from Apple to Zappos use information systems to better manage their organizations in the digital world. These organizations use information systems to provide high-quality goods and services as well as to gain or sustain competitive advantage over rivals. In addition to helping organizations to be competitive, information systems have contributed to tremendous societal changes. Our objective for this chapter is to help you understand the role of information systems as we continue to move further into the digital world, the role of information systems in current issues faced by societies in the digital world, and the role of information technology (IT) megatrends in influencing the digital future. We then highlight what information systems are, how they have evolved to become a vital part of modern organizations, and why this understanding is necessary for you to become an effective manager in the digital world. We conclude by discussing ethical issues associated with the use of information systems.

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MANAGING IN THE DIGITAL WORLD:

Open Innovation

Where do good ideas come from? An eccentric inventor toiling alone? A secretive lab filled with researchers in white coats? Views of innovation are shifting away from these traditional stereotypes. For decades, corporations funded internal research and development units and tightly controlled both the inputs and outputs of these operations. Opportunities to interact with customers were limited, and the possibility of spending months or years and millions of dollars developing products that no one wanted was a real threat. New technologies are enabling a shift in the way innovation occurs.

Traditionally, universities would conduct basic and applied research, but the results of this research only sometimes would make their way to the private sector. Corporations would fund their own research and development operations, often at great expense. Such operations took years to set up and were often highly constrained in the types of research they could carry out. Programs of research were evaluated against business plans that had been studied, reviewed, and approved by multiple layers of management. The time and complexity involved in these bureaucratic processes often left the actual research out of date and out of touch with the realities of the marketplace and actual customer wants and needs. The resulting products

After reading this chapter, you will be able to do the following:

1. Describe the characteristics of the digital world, contemporary societal issues of the digital world, and IT megatrends shaping the digital future.
2. Explain what an information system is, contrasting its data, technology, people, and organizational components.
3. Describe the dual nature of information systems in the success and failure of modern organizations.
4. Describe how computer ethics affect the use of information systems and discuss the ethical concerns associated with information privacy and intellectual property.

would often fail in the market due to being years late or no longer being relevant.

Open innovation is a new approach. Instead of relying on tightly controlled internal research projects, companies are opening up their research and development efforts to a broad audience (Figure 1.1). Customers, suppliers, and other companies are invited to participate more directly in different phases of the innovation process, and companies are working more collaboratively with universities.

Many companies take these ideas even further and open up the research and development efforts to anyone who wishes to participate online or in person. For example, Starbucks introduced “My Starbucks Idea,” where customers can post ideas and suggestions as well as vote on or discuss others’ ideas. Hundreds of customer-generated ideas have been launched over the years. Likewise, more than 37,000 ideas have been submitted to Dell’s “IdeaStorm” website, with more than 550 ideas implemented, and Heineken’s “Innovators Brewhouse” uses open innovation to generate ideas related to topics ranging from methods for counterfeit detection to brewing closer to the consumer or new, more convenient packaging. Further, new tools like interactive 3D visualization and rapid prototyping technologies like 3D printing allow for tremendously lowered barriers to entry to innovation. Many companies and institutions have set up collaborative spaces to share resources and encourage the fusion of ideas and skills that can lead to exciting breakthroughs. As with many innovations themselves, this innovative way of innovating would not be possible without information systems.

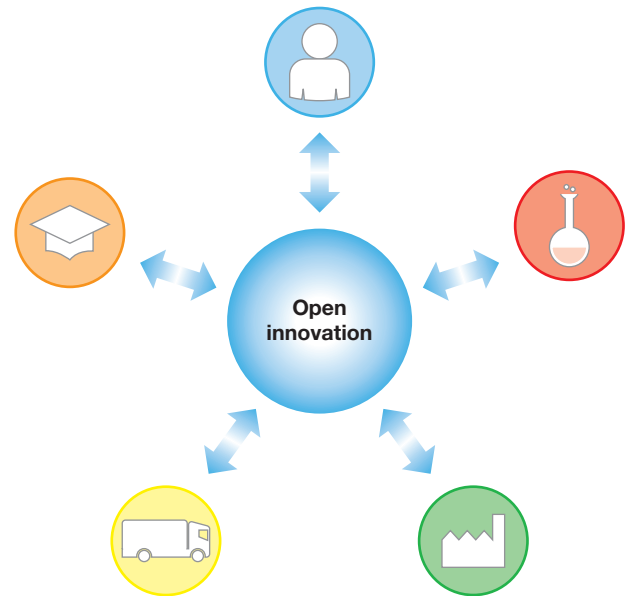


FIGURE 1.1

Open innovation entails opening up the innovation process to outside entities, including academia, individual innovators, research labs, other companies, or suppliers.

After reading this chapter, you will be able to answer the following:

1. How do the five IT megatrends fuel open innovation?
2. What are the primary information systems components that enable open innovation?
3. What intellectual property issues arise from engaging in open innovation?

Based on:

Board of Innovation. (n.d.). List of open innovation and crowdsourcing examples. Retrieved June 20, 2016, from <http://www.boardofinnovation.com/list-open-innovation-crowdsourcing-examples>

GE. (2016). GE open innovation. *GE.com*. Retrieved April 24, 2016, from <http://www.ge.com/about-us/openinnovation>

Open Innovation Community. (2016). Open innovation. Retrieved April 24, 2016, from <http://openinnovation.net/about-2/open-innovation-definition>

Information Systems Today

Today, information systems (IS) are ubiquitous: Be it traditional desktop computers, laptop computers, smartphones, tablets, you name it; information systems are all around us, whether you see them or not. Companies such as FedEx and UPS use information systems to route trucks and track packages. Retailers such as Walgreens and Walmart use information systems for everything from optimizing supply chains to recording purchases and analyzing customer tastes and preferences. Cities use information systems for adaptive traffic control systems or variable speed limits. Cars use information systems for everything from ignition control to airbags to distance control and park assist systems. Many innovative business models, ranging from Airbnb to Uber, are built on or around information systems. Alternatively, just look around your school or place of work. At your school, you register for classes online; use e-mail, Twitter, or Facebook to communicate with fellow students and your instructors; access e-books from your library; and complete or submit assignments on online learning platforms such as Blackboard, Moodle, Canvas, or Sakai. At work, you may use a PC for e-mail and many other tasks. Your paychecks are probably generated by computer and automatically deposited into your bank account via high-speed networks. Even in your spare time, information systems are ubiquitous: You use social networking sites like Facebook to stay connected with your friends and family, you watch videos on YouTube, you upload pictures taken with your smartphone to picture-sharing sites like Instagram, you listen to music on Pandora or Spotify, and you use your smartphone for playing games, sending e-mails, or reading books. Chances are that each year you see more information systems than you did the year before, and these systems are a more fundamental and important part of your social, academic, and work life than ever before.

The Emergence of the Digital World

Over the past decades, the advent of powerful, relatively inexpensive, easy-to-use computers has had a major impact on business and society. When you stop and think about it, it is easy to see why information systems are important. Increasing global competitiveness has forced companies to find ways to be better and to do things less expensively. The answer for many firms continues to be to use information systems to do things better, faster, and cheaper. Many organizations use information systems to support innovative business models, or build their entire business models around technological innovations. Likewise, using global telecommunications networks, companies can more easily integrate their operations to access new markets for their products and services as well as access a large pool of talented labor in countries with lower wages.

Clearly, we are living in a digital world. Given the proliferation of mobile devices such as tablets or smartphones, some have even argued that we are living in the post-PC era, where wireless, mobile devices will replace traditional desktop and laptop computers. In fact, already in the last quarter of 2011, Apple sold more iPads than HP (traditionally one of the world's leading PC makers) sold PCs, and in the United States, smartphone penetration has reached 82 percent (Nielsen, 2016). Initially created as consumer devices, tablets have become commonplace in various professional settings, including warehouses, showrooms, airplane cockpits, and hospitals (Figure 1.2).

Yet desktop PCs and laptops are unlikely to go away. Rather, devices with newer form factors will work in tandem with older form factors to provide truly ubiquitous experiences; mobile devices complement traditional computers, providing different devices for different users and different tasks, where not the device but the services and data provided are of primary importance. Further, the changes we've seen so far have given rise to developments such as wearable computers, augmented reality devices, or surface computers.

Changes in technology have enabled new ways of working and socializing; whereas traditionally, people were bound to a stationary PC to do essential tasks, they can now perform such tasks from almost anywhere they have a cell phone signal. Likewise, workdays traditionally had a clear beginning and a clear end—from when you powered your computer on to when you turned it off at night. Today, many tasks (especially more casual tasks such as reading or sending e-mails) can be done at any time, often in small chunks in between other tasks, such as when waiting in line at the supermarket cashier.

Computing has changed from an activity primarily focused on automating work to encompass various social and casual activities. Devices such as smartphones or tablets, paired with mobile broadband networks, allow for instant-on computing experiences, whenever and

**FIGURE 1.2**

Mobile devices are increasingly being used in various professional settings.

Source: William Perugini/Shutterstock.

wherever; advances in *cloud computing* (think Gmail, Office Online, or Dropbox) allow for accessing e-mails, files, notes, and the like, from different devices, further enhancing portability and mobility.

In effect, we are in a virtuous cycle (or in a vicious cycle, considering the creep of work life into people's leisure time and the increasing fixation on being permanently "on call"), where changes in technology lead to social changes and social changes shape technological changes. For example, communication, social networking, and online investing almost necessitate mobility and connectivity, as people have grown accustomed to checking e-mails, posting status updates, or checking on real-time stock quotes while on the go. In addition, the boundaries between work and leisure time are blurring, so that employees increasingly demand devices that can support both and often bring their own devices into the workplace.

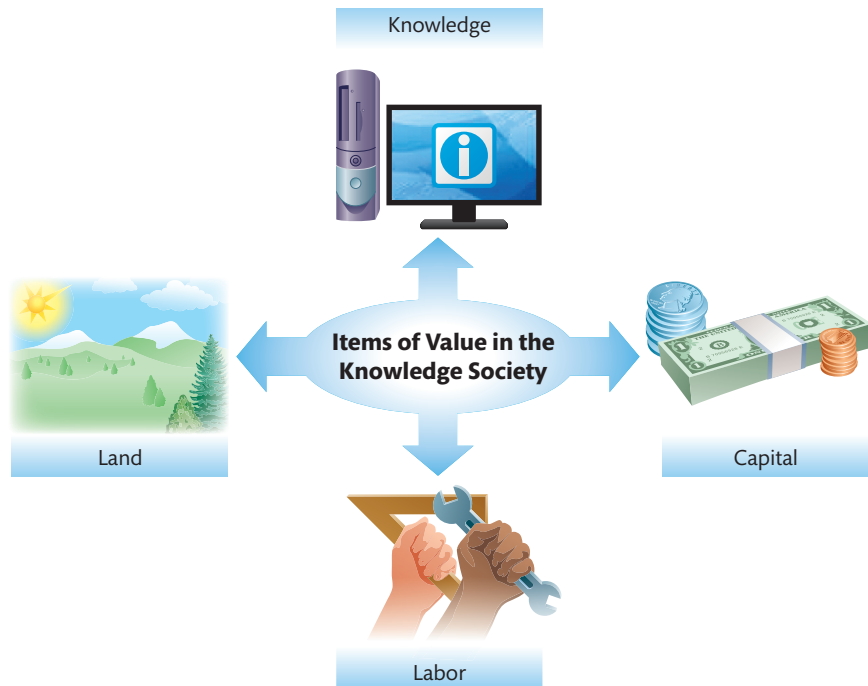
KNOWLEDGE WORKERS AND THE KNOWLEDGE SOCIETY. In 1959, Peter Drucker predicted that information and information systems would become increasingly important, and at that point, more than half a century ago, he coined the term **knowledge worker**. Knowledge workers are typically professionals who are relatively well educated and who create, modify, and/or synthesize knowledge as a fundamental part of their jobs.

Drucker's predictions about knowledge workers were accurate. As he predicted, they are generally paid better than their prior agricultural and industrial counterparts; they rely on and are empowered by formal education, yet they often also possess valuable real-world skills; they are continually learning how to do their jobs better; they have much better career opportunities and far more bargaining power than workers ever had before. Knowledge workers make up about a quarter of the workforce in the United States and in other developed nations, and their numbers are rising quickly.

Drucker also predicted that, with the growth in the number of knowledge workers and with their rise in importance and leadership, a **knowledge society** would emerge. He reasoned that, given the importance of education and learning to knowledge workers and the firms that need them, education would become the cornerstone of the knowledge society. Possessing knowledge, he argued, would be as important as possessing land, labor, or capital (if not more so) (Figure 1.3). Indeed, research shows that people equipped to prosper in the knowledge society, such as those with a college education, earn far more on average than people without a college education, and that gap is increasing. In fact, the most recent data from the U.S. Census Bureau's American Community Survey (2014 data) reinforce the value of a college education: Median earnings for workers 25 and over with a bachelor's degree were US\$50,450 a year, while those for workers with a high school diploma were US\$27,809. Median earnings for workers with a graduate or professional degree were US\$66,175, and for those without a high school diploma US\$20,542. These data suggest that a bachelor's degree is worth about US\$1 million in additional lifetime earnings compared to a worker with only a high school diploma.

FIGURE 1.3

Knowledge has become as important as—and many feel more important than—land, labor, and capital resources.



Additionally, getting a college degree will qualify you for many jobs that would not be available to you otherwise and will distinguish you from other job candidates. Finally, a college degree is often a requirement to qualify for career advancement and promotion opportunities once you do get that job.

People generally agree that Drucker was accurate about knowledge workers and the evolution of society. While people have settled on Drucker's term *knowledge worker*, there are many alternatives to the term *knowledge society*. Others have referred to this phenomenon as the *knowledge economy*, the *new economy*, the *digital society*, the *network era*, the *Internet era*, and other names. We simply refer to this as the *digital world*. All these ideas have in common the premise that information and related technologies and systems have become indispensable and that knowledge workers are vital.

Today, not only knowledge workers use information systems as integral parts of their work lives; many "traditional" occupations now increasingly use information systems—from the UPS package delivery person using global positioning system (GPS) technology to take the best route to deliver parcels to the farmer in Iowa who uses precision agriculture to plan the use of fertilizers to increase crop yield. In essence, (almost) every organization can now be considered an e-business. An **e-business** is an organization that uses information technologies or systems to support nearly every part of its business. Thus, the lines between "knowledge workers" and "manual workers" are blurring, to the point that some argue that "every worker is a knowledge worker" (Rosen, 2011).

THE DIGITAL DIVIDE. Some have argued, however, that there is a downside to being a knowledge worker and to living in the digital world. For example, some have argued that knowledge workers will be the first to be replaced by automation with information systems. Others have argued that in the new economy there is a **digital divide**, where those with access to information systems have great advantages over those without access to information systems. The digital divide is one of the major ethical challenges facing society today when you consider the strong linkage between computer literacy and a person's ability to compete in the digital world. For example, access to raw materials and money fueled the Industrial Revolution, "but in the informational society, the fuel, the power, is knowledge," emphasized John Kenneth Galbraith, an American economist who specialized in emerging trends in the U.S. economy. "One has now come to see a new class structure divided by those who have information and those who must function out of ignorance. This new class has its power not from money, not from land, but from knowledge" (Galbraith, 1987).

The good news is that the digital divide in America is rapidly shrinking, but there are still major challenges to overcome. In particular, people in rural communities, the elderly, people with disabilities, and minorities lag behind national averages for Internet access and computer literacy. Outside the United States and other developed countries, the gap gets even wider and the obstacles get much more difficult to overcome, particularly in the developing countries where infrastructure and financial resources are lacking. For example, most developing countries are lacking modern informational resources such as affordable Internet access or efficient electronic payment methods.

To be sure, there is a downside to overreliance on information systems, but one thing is for certain: Knowledge workers and information systems are now critical to the success of modern organizations, economies, and societies. At the same time, information systems play a crucial role in various major issues societies face. These issues are examined next.

Globalization and Societal Issues in the Digital World

The past decades have brought about a number of dramatic global changes, many of which will continue to influence individuals, businesses, economies, and societies well into the future. Many of such interrelated societal “megatrends,” discussed by consulting firms such as PricewaterhouseCoopers (PwC) or Ernst & Young (EY), local and national governments, or global political and business leaders at the World Economic Forum, are related to ever-increasing **globalization**—the integration of economies throughout the world, enabled by innovation and technological progress (International Monetary Fund, 2002). You can see the effects of globalization in many ways, such as the greater international movement of commodities, money, information, and labor as well as the development of technologies, standards, and processes to facilitate this movement.



COMING ATTRACTIONS

Memory Crystals

In the *Superman* films and many other sci-fi movies and books, characters make use of data storage devices that resemble large crystals. In the stories, these crystals often store incredibly large amounts of data and last for extraordinary lengths of time. Now scientists have taken a step toward making such technology a reality. Researchers at the University of Southampton (UK) have created a nanostructured glass storage device that resembles the fictional technologies. The technique uses self-assembling nanostructures written into fused quartz using tiny femtosecond (one-quadrillionth, or one-millionth of one-billionth, of a second) laser light pulses. The data are encoded in five dimensions (5D): height, length, width, position, and orientation. Using these multiple dimensions along with the nanoscale laser writing allows a small glass disc, about the size of a large coin, to store 360 terabytes (TB) of data. As a terabyte is equal to 1,024 gigabytes (GB), the amount of data stored on each tiny disk is several hundred times the amount of data stored on a standard desktop computer (1–4 TB) and several thousand times the data storage capacity of most smartphones (16–128 GB). The quartz material is highly stable (up to 13.8 billion years at 190 degrees Celsius), so data can be archived essentially forever.

To demonstrate the technology, the scientists recorded several major documents from human history on the disks,

including the Universal Declaration of Human Rights, Newton’s *Opticks*, the Magna Carta, and the King James Bible. The technology could be used by any organization or business seeking to store large volumes of data for long periods of time. Museums, libraries, national archives, and others could preserve their information and records for nearly unlimited time. Data stored using the technique could well outlast any other aspects of not just our technology but our civilization. Professor Peter Kazansky from the university’s research team says: “It is thrilling to think that we have created the technology to preserve documents and information and store it in space for future generations. This technology can secure the last evidence of our civilization: all we’ve learnt will not be forgotten.” The scientists are looking for industry partners to further develop and commercialize the technology.

Based on:

Mullen, M. (2016, February 17). New “Superman” crystals can store data for billions of years. *CNN Money*. Retrieved April 14, 2016, from <http://money.cnn.com/2016/02/17/technology/5d-data-storage-memory-crystals/index.html>

Phys.org. (2016, February 15). Eternal 5D data storage could record the history of humankind. Retrieved April 14, 2016, from <http://phys.org/news/2016-02-eternal-5d-storage-history-humankind.html>

GLOBALIZATION: OPPORTUNITIES AND CHALLENGES. For organizations, globalization has opened up many opportunities, brought about by falling transportation and telecommunication costs. Today, shipping a bottle of wine from Australia to Europe costs merely a few cents, and people can make voice or video calls around the globe for free using services such as Skype, Google Hangouts, or WhatsApp. To a large extent fueled by movies, television, and other forms of media, the increasing globalization has moved cultures closer together. The streaming movie provider Netflix is available in almost every country of the world, people in all corners of the world can receive television programming from other countries, and major movies are increasingly international. Developments such as these help create a shared understanding about norms of behavior or interaction, desirable goods or services, or even forms of government (though such shared understanding is still often lacking, and many of these developments have not yet happened). The rapid rise of a new middle class in many developing countries has enabled established companies to reach new markets, enabling them to sell their products to literally millions of new customers. At the same time, with the decrease in communication costs, companies can now draw on a large pool of skilled professionals from all over the globe. Countries such as Russia, China, and India offer high-quality education, leading to an ample supply of well-trained people at low cost. Some countries have even built entire industries around certain competencies, such as software development or tax preparation in India and call centers in Ireland.

The tremendous decrease in communication costs has increased the use of **outsourcing**—the moving of business processes or tasks (such as accounting, manufacturing, or security) to another company or another country—as now companies can outsource business processes on a global scale (Figure 1.4). Companies are choosing to outsource business activities for a variety of reasons; the most important reasons include the following (King, 2003):

- To reduce or control costs
- To free up internal resources
- To gain access to world-class capabilities
- To increase the revenue potential of the organization
- To reduce time to market
- To increase process efficiencies
- To be able to focus on core activities
- To compensate for a lack of specific capabilities or skills

Often, companies located in countries such as India can provide certain services much cheaper because of lower labor costs, or companies perform certain functions in a different country to reduce costs or harness skilled labor. For example, in India, two companies—Wipro and Infosys—have emerged as the leaders in providing IT services that range from business consulting to systems development. In addition, a wide variety of other services—ranging from telephone support to tax returns—are candidates for outsourcing to different countries, be it Ireland, China, or India. Even highly specialized services, such as reading of X-rays by skilled

FIGURE 1.4

Companies are outsourcing production to overseas countries (such as China) to utilize talented workers or reduce costs.

Source: Lianxun Zhang/Fotolia.



radiologists, are outsourced by U.S. hospitals to doctors around the globe, often while doctors in the United States are sleeping.

Yet globalization has also brought about a number of operational challenges for organizations. Organizations face governmental challenges related to differences in political systems, regulatory environments, laws, standards, or individual freedoms. Likewise, geoeconomic challenges include differences in infrastructure, demographics, welfare, or workers' expertise. Lastly, organizations face cultural challenges, such as dealing with differences in languages, beliefs, attitudes, religions, or life focus but also different viewpoints regarding intellectual property. As a result, companies intending to outsource services or production have to carefully choose outsourcing locations, considering numerous different factors, such as English proficiency, salaries, or geopolitical risk. While countries such as India remain popular, other formerly popular countries (such as Singapore, Canada, or Ireland) are declining because of rising salaries. With these shifts, outsourcers are constantly looking at nascent and emerging countries such as Bulgaria, Egypt, Ghana, Bangladesh, or Vietnam.

Obviously, organizations have to weigh the potential benefits (e.g., cost savings) and drawbacks (e.g., higher geopolitical risk or less experienced workers) of outsourcing to a particular country, and often, cost savings prove to be negligible due to added overhead, such as customs, shipping, or training as well as quality problems. In fact, *InformationWeek*, a leading publication targeting business IT users, found that 20 percent of the 500 most innovative companies in terms of using IT took back projects previously outsourced to another country. Nevertheless, IT outsourcing is big business: Research firm IDC forecasted the market for IT outsourcing to be \$103 billion in 2019 (Tapper, 2015).

SOCIETAL ISSUES IN THE DIGITAL WORLD. The rapid development of transportation and telecommunication technologies, national and global infrastructures, and information systems as well as a host of other factors has created a number of pressing societal issues that will tremendously influence the world we live in (PWC, 2016; Schreiber, 2016). In this section, we will highlight a few of these issues (Figure 1.5). One such issue is **demographic changes**—changes in the structure of populations such as related to age, birth rates, and migration. While many countries in the developed world see rapidly aging populations, developing regions such as Africa are expected to rapidly rise in population, fueling a massive global population growth. These differences in demographic changes will also shift the balance of demand and supply of labor; further, differences in welfare are likely to further increase, and many countries are already experiencing both positive and negative effects of mass migrations. In addition, many regions of the world are seeing rapid **urbanization**—the movement of rural populations to urban areas, to a point where 50 percent of the world's population is now living in cities (PWC, 2016); sustaining this growth while providing livable environments for the inhabitants will pose major challenges. Another major trend is the global **shifts in economic power**—changes in countries' purchasing power and control over natural resources—where established economies are losing



FIGURE 1.5

Societal issues in the digital world.

Source: Pichaitun/Fotolia.