Cover Design: Wiley
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ISBN 978-1-119-70290-0
90000
9 781119 702900

TURBAN
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INFORMATION TECHNOLOGY FOR MANAGEMENT

TWELFTH EDITION

WILEY

EFRAIM TURBAN | CAROL POLLARD | GREGORY WOOD

INFORMATION TECHNOLOGY FOR MANAGEMENT

DRIVING DIGITAL TRANSFORMATION TO INCREASE LOCAL AND GLOBAL PERFORMANCE, GROWTH AND SUSTAINABILITY

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Information Technology for Management

Driving Digital Transformation to Increase Local and Global Performance, Growth and Sustainability

Twelfth Edition

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Driving Digital Transformation to Increase Local and Global Performance, Growth and Sustainability

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VP AND EDITORIAL DIRECTOR — Mike McDonald
PUBLISHER — Lise Johnson
EDITOR — Jennifer Manias
EDITORIAL ASSISTANT — Kali Ridley
SENIOR MANAGING EDITOR — Judy Howarth
PRODUCTION EDITOR — Umamaheswari Gnanamani
COVER PHOTO CREDIT — © Yuichiro Chino/Getty Images

This book was set in 9.5/12.5 pt Source Sans Pro by SPi Global.

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ISBN: 978-1-119-70290-0 (PBK)
ISBN: 978-1-119-71379-1 (EVALC)

Library of Congress Cataloging in Publication Data

Names: Turban, Efraim, author. | Pollard, Carol (Carol E.), author. | Wood, Gregory R., author.
Title: Information technology for management : on-demand strategies for performance, growth and sustainability / Efraim Turban, Carol Pollard, Appalachian State University, Gregory Wood, Canisius College.
Description: Twelfth edition. | Hoboken : Wiley, 2021. | Includes indexes.
Identifiers: LCCN 2020025488 (print) | LCCN 2020025489 (ebook) | ISBN 9781119713807 (cloth) | ISBN 9781119702900 (pbk) | ISBN 9781119713791 (evalc) | ISBN 9781119713784 (adobe pdf) | ISBN 9781119702917 (epub)
Subjects: LCSH: Management information systems.
Classification: LCC T58.6 .T765 2021 (print) | LCC T58.6 (ebook) | DDC 658.4/038011—dc23
LC record available at https://lccn.loc.gov/2020025488
LC ebook record available at https://lccn.loc.gov/2020025489

The inside back cover will contain printing identification and country of origin if omitted from this page. In addition, if the ISBN on the back cover differs from the ISBN on this page, the one on the back cover is correct.

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Preface

Information Technology for Management discusses the importance of aligning business-IT strategies and explains how companies rely on data, digital technology, and mobile devices to support them in the on-demand and sharing economies and help them address the challenges of the COVID-19 pandemic. Our goal is to provide students from any business discipline with a strong foundation for understanding digital technology concepts and terminology and the critical role that it plays in facilitating business sustainability, profitability, and growth locally and globally. The text also seeks to equip students with the information they need to become "informed users of IT." Enabling technologies and related concepts, discussed in this text include the following:

- **Sustainability.** Cloud services, artificial intelligence, blockchain technologies, edge computing, and other disruptive technologies are fundamental to sustaining business profitability and growth in today's on-demand and sharing economies. These technologies play a critical role in developing and managing projects and sourcing agreements, addressing personal privacy, encouraging social responsibility and attracting, connecting with and engaging employees, customers, and partners across omnichannel technologies to promote sustainable business performance and growth.
- **Performance and Profitability.** Combining the latest capabilities in descriptive, predictive, and prescriptive data analytics, reporting, collaboration, search, and digital communication helps enterprises be more agile and cuts costs to optimize business performance and profitability.
- **Growth.** Strategic technologies enable business to create new core competencies, expand their markets, and move into new markets to experience exponential growth in the on-demand and sharing economies locally and globally.

In this twelfth edition, students learn, explore, and understand technology concepts and terminology and the importance of IT's role in supporting the three essential components of business performance improvement: *technology, business processes,* and *people*. This edition has a greater focus on the global impacts of IT and includes discussions of the impact of the COVID-19 pandemic on the ways technology is enabling organizations to connect with employees, customers, and partners and to use disruptive technologies in new and innovative ways to get the job done!

What's New in the Twelfth Edition?

In the twelfth edition of *Information Technology for Management*, we present and discuss concepts in a comprehensive, yet easy-to-understand format by actively engaging students through a wider selection of case studies, interactive figures, chapter summaries, 34 whiteboard animations, tech notes, self-check quizzes, online and interactive exercises, critical thinking questions, and crossword puzzles. We have enhanced the twelfth edition in the following ways:

Diverse Audience. *Information Technology for Management* is directed toward undergraduate, introductory MBA courses, and Executive Education courses in Management Information Systems and General Business programs. Concepts are explained in a straightforward way, and interactive elements, tools, and techniques provide tangible resources that appeal to all levels of students.

Strong Pedagogical Approach. To encourage improved learning outcomes, we continue to employ a blended learning approach, in which different types of delivery and learning methods, enabled and supported by technology, are blended with traditional learning methods. For example, case study and theoretical content are presented visually, textually, and/or interactively to enable different groups of students to use different learning strategies in different combinations to fit their individual learning style and enhance their learning. Throughout the book, general content has been reorganized and updated to reflect the current state of new and previously included topics and 100 new informative static or interactive figures and 29 new tables have been added to effectively visually demonstrate new and expanded concepts. In addition, all cases and IT at Work vignettes have been updated or replaced, and learning objectives have been updated to be more succinct and consistent with new content. Finally, a chapter summary linked directly to each learning objective has been added at the end of each chapter.

Leading-Edge Content. Prior to and during the writing process, we consulted with a number of vendors, IT professionals, and managers who are hands-on users of leading technologies, to learn about their IT/business successes, challenges, experiences, and recommendations. To integrate the feedback of these business and IT professionals, new or updated chapter opening and closing cases have been added to many of the chapters along with the addition of relevant, leading-edge content in the body of the chapters.

New Technologies and Expanded Topics. New to this edition are the topics of artificial intelligence, quantum computing, edge computing, cognitive knowledge management and blockchain technology. Also included are updates to the IT framework, expanded coverage of data science and advanced data analytics and the tools and techniques that support them, the newest systems developments methodologies, and expanded

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coverage of the Project, Program, and Portfolio Management framework. Table P-1 provides a detailed list of new and expanded topics.

Useful Tools and Techniques. The "IT Toolbox" feature provides a skills-based takeaway tool or technique that the students can use in future courses and their upcoming career. In the twelfth edition, it has been revised and/or updated to reflect new content in the text. New to this edition is a feature we call "Did You Know?" This feature appears at the beginning of the main text of each chapter and delivers some interesting and often "fun" facts related to the technologies discussed within the chapter content and is designed to more effectively capture the students' interest at the beginning of each chapter.

Engaging Students to Assure Learning

The twelfth edition of *Information Technology for Management* engages students with up-to-date coverage of the most important IT trends today. Over the years, this IT textbook has distinguished itself with an emphasis on illustrating the use of cutting-edge business technologies for supporting and achieving managerial goals and objectives. The twelfth edition continues this tradition with more interactive activities and analyses.

Real-World Case Studies. Each chapter contains numerous real-world examples illustrating how businesses use IT to increase productivity, improve efficiency, enhance communication and collaboration, and gain a competitive edge. Faculty will appreciate a variety of options for reinforcing student learning, that include three different types of **Case Studies** (opening case, business case, and video case), along with IT at Work vignette.

Interactive Figures. The unique presentation of interactive figures enhances the students' comprehension of concepts by actively engaging the students in their own learning to effectively reinforce concepts and learning objectives.

Whiteboard Animations. These features tied to chapter learning objectives reinforce understanding of the textual content of the book and provide a clearer path to understanding key concepts through a multimedia overview of each learning objective. The 34 whiteboard animations fit particularly well with the "flipping the classroom" model that has become increasingly important during the COVID-19 pandemic and complement additional functionality and assets offered throughout the twelfth edition.

Learning Aids. Each chapter contains various learning aids, which include the following:

- **Learning Objectives** are listed at the beginning of each chapter and repeated at the beginning of each relevant section to help students focus their efforts and alert them to the important concepts that will be discussed.
- **IT at Work** boxes spotlight real-world cases and innovative uses of IT.
- **Tech Note** boxes explore topics such as "Key Performance Indicators" and "Six Basic Systems Development Guidelines."
- **Career Insight** boxes highlight different jobs in the IT for management field.
- **Chapter Summary** directly tied to learning objectives is included to close out each chapter.
- **Key Terms** definitions appear in the margins throughout the book and listed at the end of each chapter.

End of Chapter Activities. At the end of each chapter, features designed to assure student learning include the following:

- **Critical Thinking Questions** are designed to facilitate student discussion.
- **Online and Interactive Exercises** encourage students to explore additional topics.
- **Analyze and Decide** questions help students apply IT concepts to business decisions.
- **Reinforce Your Learning** A crossword puzzle is available for each chapter in the online resources to reinforce and test the students' understanding of key terms.
- **Concept Check Questions** in the enhanced e-book test student comprehension of each learning objective within a chapter. To ensure that the students are "clear on the concepts" and provide immediate feedback on their performance.

Details of New and Enhanced Features of the Twelfth Edition

The textbook consists of 14 chapters organized into 4 modules. All chapters have new or updated cases and content, as shown in Table P-1.

TABLE P-1 Summary of New and Expanded IT Topics, Cases, and IT at Work Vignettes

Chapter	New and Expanded IT and Business Topics	New and Updated Cases and IT at Work
1. Digital Transformation Disrupts Companies, Competition, and Careers Locally and Globally	• IT's role in the sharing economy • IT impact on global economy • Technology mega trends	• Uber • Airbnb • Coca-Cola • Costa Coffee • Creating a Digital Vision • IoT • Kroger • Netflix
2. Information Systems, IT Infrastructure, and the Cloud	• IS concepts and framework • Information, information, knowledge, wisdom model • Software-defined data center	• Tommy Flowers, Father of Computing • Lufthansa Technik • Grupo AGORA
3. Data Management, Data Warehouses, and Data Governance	• Data lifecycle • Genomics and big data • Blockchain technology • Cognitive knowledge management	• ThyssenKrupp Elevator • PwC and Energy Sector • Master Data in Healthcare • Predictive Policing Systems • ERMS in Action • University of Washington
4. Networks, the Internet of Things (IoT), and Edge Computing	• Net neutrality status • Mobile networks and near-field communication • Internet of things • Edge computing	• Cedar Park Smart Water • Minnesota Twins Audio Network • Ericsson in Africa • Salvation Army • States Take on Net Neutrality • Carnival Cruise Lines
5. Data Privacy and Cyber Security	• Data breaches • Major sources of cyberthreats • Cryptojacking • Man-in-the middle attacks • SQL injection • Data privacy	• Yahoo • Google • Oregon DHS • Bayer • Kenya protects citizen data • Marriott
6. Business Intelligence, Data Science, and Advanced Data Analytics	• Social search technologies • Descriptive data analytics • Predictive data analytics • Prescriptive data analytics • Tools and techniques to support all levels of data analytics	• NASCAR
7. Social Media and Semantic Web Technology	• Social bookmarking • Social customer service moves from optional to essential • Role of APIs in development of new Web applications and functionality • The dominance of Facebook and the demise of Google+ • Semantic Web and semantic search technologies • Social commerce, video conferencing, and remote work during COVID-19	• Digital Campaigns • Google • Amazon Neptune • Best Buy • Facebook • Power Searching with Google

(*Continued*)

TABLE P-1 Summary of New and Expanded IT Topics, Cases, and IT at Work Vignettes *(Continued)*

Chapter	New and Expanded IT and Business Topics	New and Updated Cases and IT at Work
8. Omnichannel Retailing, E-Commerce, and Mobile Commerce Technology	• Role of convenience in shaping retail markets • Direct and marketplace B2B ecommerce • Grab and go retailing • Subscription-based retailing • In-store retail technology • Omnichannel retailing • Growth of mobile commerce • Fulfillment as a service (FaaS) • Mobile payment methods • Impact of 5G networks on retailing • Expanded use of digital voice assistants (DVAs) for retail search, research, and ordering	• Amazon • Kroger • Macy's • Personalizing E-commerce • Dunkin Donuts • Bay Area Relief • eBay • MVS
9. Functional Business Systems	• Cross-functional coordination and integration of systems	• Equifax • MAHLE and SAP • Chatbot Marketing • THULE • SaaS and Global HR • MAHLE • FUZE
10. Enterprise Systems	• Always-on supply chain • Enterprise social platforms	• Walmart • FUZE • UPS • 1-800-Flowers.com • CISCO • Lowes
11. Artificial Intelligence, Robotics, and Quantum Computing Technology	• Artificial intelligence (AI) • Ethical issues associated with AI • Robotics • Work automation • AI-powered sentiment analysis, predictive analytics and content management systems • Quantum computing	• HSBC • Facebook • HUBSPOT • Facial Recognition • Hanson Robotics • Recommendation Systems
12. IT Strategy, Sourcing, and Strategic Technology Trends	• IT sourcing strategies • Strategic technology trends	• San Diego County • Nations and Comparative Advantage • Balanced Scorecard • ESSA Academy • DOD and CBRN Technology
13. Systems Development, IT Service Management and Project, Program and Portfolio Management	• New systems development methodologies • DevOps • IT service management • Project, program, and portfolio management Framework	• VELCO • Oakley • Target • Steve Jobs • BER • Denver International Airport

TABLE P-1 Summary of New and Expanded IT Topics, Cases, and IT at Work Vignettes *(Continued)*

Chapter	New and Expanded IT and Business Topics	New and Updated Cases and IT at Work
14. IT Ethics and Local and Global Sustainability	• Sustainability in developing countries • Climate change update • Access to clean water • Food security • Impact of technology on various aspects of quality of life before, during, and after the COVID-19 pandemic • Tech-Clash and an increased need for a 'People First' approach to technology amid the COVID-19 pandemic • Disruptive Technologies to address the challenges of the COVID-19 pandemic	• Royal Bank of Scotland • Facebook • Users Leaving Social Media • Blockchain and Sustainability • La Liga

Supplemental Materials

An extensive package of instructional materials is available to support this twelfth edition. These materials are accessible from the book companion website at *www.wiley.com/go/turban/infotechformgmt12E*

- **Instructor's Manual.** The Instructor's Manual presents objectives from the text with additional information to make them more appropriate and useful for the instructor. The manual also includes practical applications of concepts, case study elaboration, answers to end-of-chapter questions, questions for review, questions for discussion, and Internet exercises.
- **Test Bank.** The test bank contains over 1,000 questions and problems (about 75 per chapter) consisting of multiple-choice, short answer, fill-ins, and critical thinking/essay questions.
- **Respondus Test Bank.** This electronic test bank is a powerful tool for creating and managing exams that can be printed on paper or published directly to Blackboard, ANGEL, Desire2Learn, Moodle, and other learning systems. Exams can be created offline using a familiar Windows environment, or moved from one LMS to another.
- **PowerPoint Presentations.** A series of slides designed around the content of the text incorporates key points from the text and illustrations where appropriate.
- **Chapter Summary Whiteboard Animations.** A library of 34 video animations—"chunked" by learning objectives in each chapter—summarizes the content of each chapter in an entertaining visual way to engage the students in grasping the subject matter and providing an easily accessible audio track for those who are visually impaired.
- **Crossword Puzzles.** A set of online crossword puzzles that test and reinforce student understanding of key terms in a fun and interactive way.

Acknowledgments

No book is produced through the sole efforts of its authors, and this book is no exception. Many people contributed to its creation, both directly and indirectly, and we wish to acknowledge their contributions.

First, a special thank you goes to the team at John Wiley, including Lise Johnson, Business Publisher and Jennifer Manias, Editor, who shared their expert and encouraging editorial insights, Judy Howarth, Sr. Managing Editor, who provided much appreciated project management leadership, Padmapriya Soundarajan, Senior Production Editor, who offered valuable guidance throughout the production process, and Aarthi Ramachandran, Permissions Specialist, whose extensive and expert research into the images used in the text greatly enhanced the overall "look" of this edition.

Many thanks also to our talented graphic designer and Appalachian State University alumni, Nathan Sherrill, who created the innovative Whiteboard Animations for Chapters 7, 8, and 11.

Their combined skill, patience, humor, and support during the development and production of this most recent version of the text made the process much easier.

Our sincere thanks go to the following reviewers of the twelfth edition whose valuable feedback, insights, and suggestions were invaluable in ensuring the accuracy and readability of the book:

Joni Adkins, Northwest Missouri State University

Ahmad Al-Omari, Dakota State University

Rigoberto Chinchilla, Eastern Illinois University

Michael Donahue, Towson University

Samuel Elko, Seton Hill University

Robert Goble, Dallas Baptist University

Eileen Griffin, Canisius College

Binshan Lin, Louisiana State University in Shreveport

Thomas MacMullen, Eastern Illinois University

James Moore, Canisius College

Beverly S. Motich, Messiah College

Barin Nag, Towson University

Luis A. Otero, Inter-American University of Puerto Rico, Metropolitan Campus

John Pearson, Southern Illinois University

Daniel Riding, Florida Institute of Technology

Josie Schneider, Columbia Southern University

Derek Sedlack, South University

Eric Weinstein, The University of La Verne

Patricia White, Columbia Southern University

Gene A. Wright, University of Wisconsin–Milwaukee

Last, but by no means least, we extend our very special thanks to our families, friends, and colleagues who provided enormous encouragement, support, and understanding as we dedicated the necessary time and effort to create this new edition amid the turmoil of the COVID-19 pandemic. Their unfailing support and the power of information and communications technology enabled us to bring the twelfth edition in on time and on budget!

CAROL POLLARD
GREGORY WOOD

CHAPTER 1

Digital Transformation Disrupts Companies, Competition, and Careers Locally and Globally

CHAPTER OUTLINE	LEARNING OBJECTIVES
Case 1.1 Opening Case: Uber and Airbnb Innovative Digital Business Models Facilitate Global Expansion and Operational Resilience During the COVID-19 Pandemic	
1.1 Doing Business in the On-Demand and Sharing Economies	**1.1 Define** the differences between the on-demand and sharing economies and the six business objectives IT should focus on to enhance organizational performance, growth, and sustainability.
1.2 Business Process Improvement and Competition	**1.2 Explain** the role of IT in improving business processes. Understand the concepts of business process reengineering and competitive advantage.
1.3 IT Innovation and Disruption	**1.3 Describe** how IT is disrupting the way that companies operate, the IT megatrends that are driving organizational performance, growth, and sustainability and how COVID-19 is accelerating digital transformation.
1.4 IT and You	**1.4 Discuss** what it means to be an "informed user" of IT and the ways in which IT can add value to your career path and job performance.
Case 1.2 Business Case: The IoT Comes to Sports	
Case 1.3 Video Case: Creating a Digital Vision to Transform a Company and Improve the Customer Experience	

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Case 1.1 Opening Case

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Uber and Airbnb Innovative Digital Business Models Facilitate Global Expansion and Operational Resilience During the COVID-19 Pandemic

Almost every new startup wants to disrupt some traditional industry with a digital solution. Two of the most ingenious and most-valuable startups to achieve this goal are Uber and Airbnb. For example, most consumers who tap an Uber app to get a ride would never consider dialing an 800 number for a taxi. With all transactions performed by apps and automated processes, the entire process from hailing to paying for a ride is slick, quick, and easy and eliminates the use of cash or credit cards at the time of service. Similarly, Airbnb provides an easy-to-use digital platform to offer accommodations, dining, and leisure activities to guests worldwide with the click of a couple of buttons.

New Economies and COVID-19 Require New Digital Business Models

Uber and Airbnb are popular examples of companies that developed new digital business models to transform slow-to-innovative industries. A simple definition of a business model is the way a company generates revenue and makes a profit. On-demand and sharing (access-over-ownership) business models provide real-time fulfillment of goods and services, which have attracted millions of users worldwide. These models fit best when speed and/or convenience matter the most. The ground transportation, grocery, and restaurant industries are examples of hyper-growth categories in the on-demand world. The home-based accommodation and bicycle/scooter rental industries are good examples of high-growth categories in the sharing economy. Currently, forward-thinking companies that have reaped the benefits of rethinking their business models by applying digital solutions to reshape their industries are now adapting their business models by utilizing technology in even more new and creative ways to meet the demands and uncertainties of the COVID-19 pandemic. The sharing economy has been severely impacted by COVID-19 causing companies like Uber and Airbnb to make creative adjustments and develop new strategies to ensure their customers feel safe and how they will need to operate in the 'new normal.'

Uber On-Demand Business Model

Uber disrupted the taxi industry with a workforce that is essentially any person with a smartphone and a car. Location-aware smartphone apps bring drivers and passengers together, while in-app accounts make the cashless payment process effortless. By simply opening the Uber app and pressing the middle button for several seconds (a long press), customers can order a ride to their current location, selecting the kind of car they want. Payment is automatically charged to the credit card on file with receipts via e-mail.

The Uber concept developed in response to scarcity of taxies. It started on a snowy Paris night in 2008 when the two founders could not get a cab. They wanted a simple app that could get them a car with a tap. On June 1, 2015, the entrepreneurs celebrated Uber's fifth anniversary and announced that the company had grown into a transportation network covering 311 cities in 58 countries in North and South Americas, Europe, Africa, Asia Pacific, and the Middle East. By mid-2018, their global presence had grown tremendously over the past few years, and to achieve this phenomenal growth Uber has invested in new and developing technologies and partnerships. For example, the company partnered with Carnegie Mellon University to build robotic cars and purchased deCarta, a 40-person mapping start-up to reduce its dependence on Google Maps.

Airbnb Access-over-Ownership Business Model

Another disruption to a traditional industry occurred when Airbnb blindsided the hotel industry. Airbnb—probably the most global of the new startups—allows anyone with a spare apartment or room to run their own bed and breakfast by giving them a technology platform to market themselves to a global market. Just click a few buttons on Airbnb's website and type up a brief description of your property and its amenities, and your spare room can become a new source of income! By 2016, Airbnb hosts had accommodated 40 million guests in its 1.5 million listings in 34,000 cities in 190 countries. In mid-2018, Airbnb had accommodated over a whopping 150 million guests in 4 million listings—including 1,400 castles—in 65,000 cities and 191 countries around the globe. In comparison, Hilton, InterContinental, and Marriott, the largest hotel chains in the world, have less than one million rooms each.

Business Success of Uber and Airbnb in terms of Company Valuation, Growth, and Globalization

The ride-hailing app Uber and the housing rental app Airbnb are two of the most valuable start-ups, as displayed in **Figure 1.1.** Valuation of a company at its early stages is based heavily on its growth potential and future value. In contrast, the valuation of an established company is based on its present value, which is calculated using traditional financial ratios and techniques related to revenues or other assets.

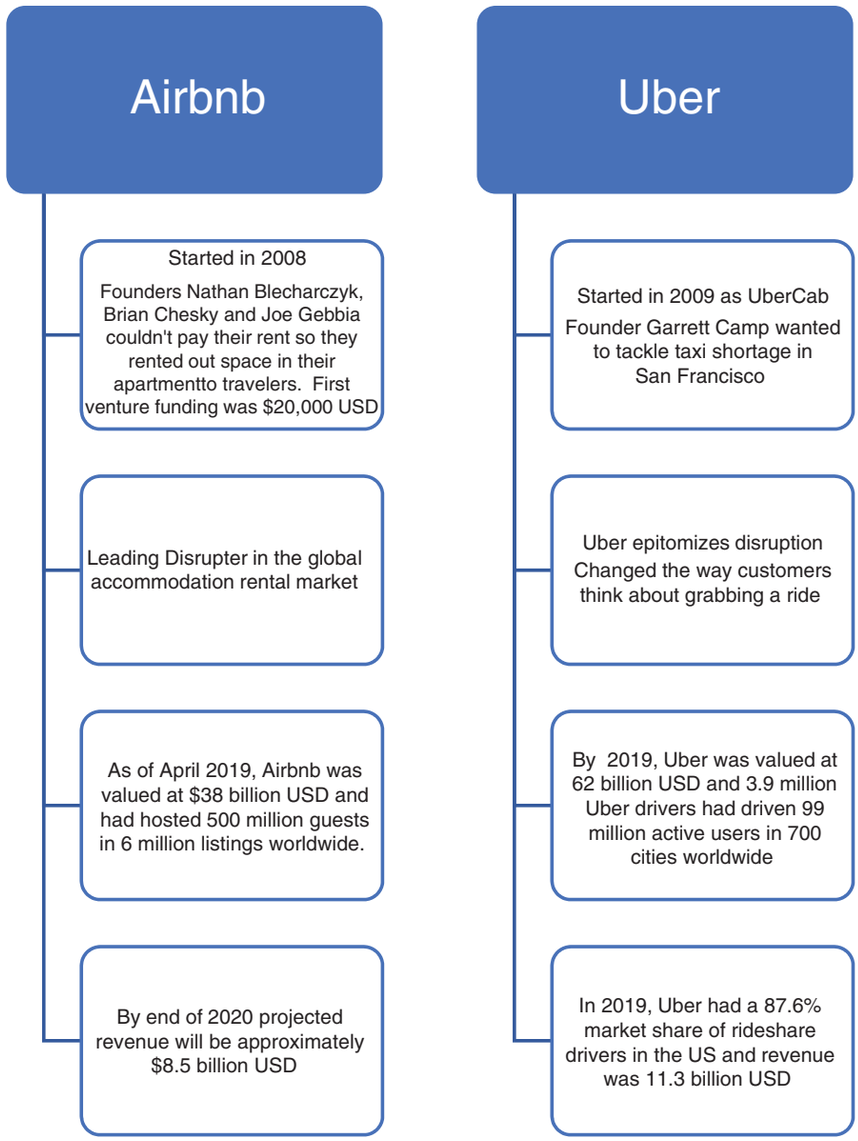

FIGURE 1.1 Innovative business models of Airbnb and Uber have been extremely successful.

Uber's massive market value—estimated at $60 billion—is greater than 80% of all Standard & Poor (S&P) 500 companies, many of which have been around for 25, 50, or 100 years. Currently, investors value Airbnb at $31 billion—rivaling that of hotel giant Marriott International.

To achieve their phenomenal local and global growth, both Uber and Airbnb have used some interesting technology-enabled strategies. For example, Uber has been aggressive in going global. It uses "Ambassadors" who are paid to recruit new drivers from its competitor Lyft using an automated hiring, recruitment, and onboarding system that is far more efficient than the process used by traditional taxi companies. Ambassadors also offer free rides to new customers to advertise Uber by word of mouth in new cities, and drones are used to recruit new drivers and customers around the globe! Once a customer base has been established, Uber founder, Travis Kalanick, then actively lobbies governors worldwide to write new laws that favor Uber's business model.

However, globalization hasn't all been plain sailing for Uber. Since 2011, when Uber first expanded its services outside of the United States, Uber has encountered resistance in several countries such as China, Russia, and Southeast Asia. Despite setbacks, it has been able to salvage market share in these countries by retaining a substantial share in joint ventures with local rivals such as Yandex.Taxi (https://taxi.yandex.ru) and Grab (https://www.grab.com/sg). More recently, Uber has shifted its focus to countries where it is convinced it can win, including India, Middle East, and North Africa, and has a particular interest in Saudi Arabia where Uber is focusing on recruiting female drivers who have only recently been allowed to drive there. Despite its optimism that its business model will be successful in these parts of the world, local competitors there also present undisputed barriers to Uber's ultimate success. For example, Uber sold its Chinese business to Didi Chuxing in 2016, putting an end to its very expensive, high-stakes battle over the lucrative Chinese market.

On the other hand, Airbnb growth strategies include developing new services to enhance their guests' travel experience, such as creating "Airbnb Plus - a listing of homes verified for quality and comfort" and identifying "Superhosts" who have consistently been rated highly by previous guests. They have also added "Travel Experiences"

to allow their guests insider access to unexpected places together with a list of restaurants that have been recommended by many of their guests. But, Airbnb's most effective growth strategy has been increasing the number of countries where its services are offered. For example, since Airbnb unveiled its French platform in 2012, it has gone from strength to strength with a staggering 8.5 million French people using Airbnb properties between June 1 and August 31, 2019.

This strategy, however, has presented Airbnb organizers with some very interesting challenges that include handling a total of 65 different currencies, translating host listings between countries, dealing with foreign law agencies, and offering country-specific sign-up methods. For example, although Facebook or Google accounts work in the United States, these are not the best sign-up methods in other parts of the world, and just by allowing travelers to use Weibo (https://www.weibo.com/us) and WeChat (https://www.wechat.com/en), Airbnb is able to grow its customer base in China by 700%.

Uber and Airbnb Retool their Digital Business Models to Build Resilience during the COVID-19 Pandemic

While globalization has presented highly valued start-ups like Uber and Airbnb with huge opportunities for growth, the COVID-19 pandemic presented them with some daunting business challenges as people around the globe were told to stay home. In the early days of the pandemic, both Uber and Airbnb were faced with a significant downturn in demand as far fewer people took rides or sought accommodations for vacation or business, during COVD-19 lockdowns and Airbnb's plans to file a request to 'go public' were waylaid by pandemic-related turmoil in the stock market. This initial reaction has been followed by ongoing government and customer concerns about general health and safety issues associated with the pandemic. As a result, on-demand and sharing economy companies have been forced to make significant adjustments in response to unforeseen events and recent data show that their businesses are growing again thanks to agile thinking and creative adjustments they have made to their business models. For example, Airbnb made efforts to increase the variety of the accommodations they offer and use technology to broadcast their new offerings. In June 2020 Airbnb reported that bookings for entire homes and cabins and cottages in secluded areas increased significantly causing their gross booking value to grow for the first time since February 2020 and on August 19, 2020 it filed with the Security Exchange Commission (SEC) to 'go public'. In another creative move, Uber transformed itself from a solely ridesharing venture to a food delivery service. Consequently, their new mobile app 'Uber Eats' has become their key revenue generator amidst COVID-19. In creating Uber Eats, Uber offered restaurants a new way to connect with their customers and inject a modicum of positivity among the bad news plaguing the world during and after COVID-19. In quickly reacting to the unforeseen events of COVID-19, Uber and Airbnb have demonstrated the power of on-demand and sharing economy companies to make swift and significant adjustments to their business models by digitally transforming themselves.

At the end of the day, it is clear that technology plays a huge part in both enabling innovative products and services to facilitate local and global success by allowing gig workers and consumers in the on-demand and sharing economies to seamlessly connect with business services 24 hours a day, 365 days a year despite important cultural differences and the challenges of COVID-19.

Questions

1. In what ways are the Uber and Airbnb business models similar and different?
2. What challenges did Uber and Airbnb face when they went "global"?
3. What growth strategies are benefiting the global success of Uber and Airbnb? How do they differ?
4. How has technology helped or hindered Uber and Airbnb in the growth of their global business?
5. In what ways has the COVID-19 pandemic impacted Uber and Airbnb?

Sources: Compiled from Solomon (2016), Hawkins (2017), Henshall (2017), Domat (2018), Ledsom (2019), Airbnb.com, and Uber.com, Overstreet (2020).

DID YOU KNOW?

*That **gig economy** is a new buzzword that refers to the rise in contracted work—or "gigs"—that aren't traditional jobs. Examples of these are ridesharing, home and apartment rentals, and food delivery and are made possible using apps and mobile devices. As many as one in every five jobs are currently contracted and it is estimated that over half of the U.S. workforce could find themselves doing contract or freelance work over the next decade. An example of "gig" work and how it affects the economy was offered in our opening case.*

Introduction

IT architectures guide the process of planning, acquiring, building, modifying, and interfacing with deployed IT resources in a single department within an organization.

Legacy systems are older information systems that have been maintained over several decades because they fulfill critical needs.

Many forward-thinking managers and entrepreneurs are digitally transforming their existing business models and reinventing their businesses. In a recent industry study, 87% of senior business leaders said digital transformation is a company priority and 79% of corporate strategists said they are reinventing their business and creating new revenue streams in new ways (Gartner, 2019). By no longer operating and maintaining outdated and complex **IT architectures** with a mix of **legacy systems** that can delay or prevent the release of innovative new products and

services and absorb large portions of the information technology (IT) budget, companies can add value, increase their customer base, expand their business capabilities, and increase profits.

Companies such as Uber (https://www.uber.com), Airbnb (https://www.airbnb.com) Shyp (http://shyp.com), TaskRabbit (https://www.taskrabbit.com), and Lyft (https://www.lyft.com) are leveraging IT to create exciting new business models and revolutionize the way workers, businesses, and customers interact and compete. Peter Hinssen, a well-known business author, university lecturer, and digital consultant, described the change in digital technology as follows:

> *Technology used to be nice. It used to be about making things a little bit better, a little bit more efficient. But, technology stopped being nice: it's disruptive. It's changing our business models, our consumer markets, our organizations. (MacIver, 2015)*

As businesses continue to change their business models to accommodate the needs of the on-demand and sharing economies, IT professionals must constantly scan for innovative new technologies to provide business value, help shape the future of the business, and facilitate performance and growth in local and global markets. For example, smart devices, mobile apps, sensors, and technology platforms—along with increased customer demand for digital interactions and on-demand and shared services—have moved commerce in fresh new directions. We've all heard the phrase "there's an app for that," and that kind of consumer thinking drives the on-demand and sharing economies.

Business leaders today need to know what steps to take to get the most out of mobile, social, cloud, big data, analytics, visualization technologies, artificial intelligence and the Internet of Things (IoT) to move their business forward and enable new on-demand and sharing business models. Faced with opportunities and challenges, managers need to know how to leverage IT earlier and more efficiently than their competitors.

A goal of this book is to empower you to improve your use and management of IT by raising your understanding of IT terminology, practices, and tools and developing your IT skills to transform you into an informed IT user. Throughout this book, you will learn how digital technology is transforming business and society at all levels as the IT function takes on a key strategic role that determines an enterprise's success or failure. You will also be provided with an in-depth look at IT trends that have immediate and future capacity to influence products, services, competition, and business relationships. Along the way, we'll describe many ways in which IT is being used and can be used in business and provide you with the some of the terminology, techniques, and tools that enable organizations to leverage IT to improve their growth, performance, and sustainability.

In this opening chapter, you will learn about the powerful impacts of digital technology on people, business, government, entertainment, and society that are occurring today. You will also discover how leading companies are deploying digital technology and changing their business models, business processes, customer experiences, and ways of working. We will present examples of innovative products, services, and distribution channels to help you understand the digital revolution that is currently shaping the future of business, economy, and society and changing management careers. And, we'll explain why IT is important to you and how becoming an "informed user" of IT will add significant value to your career and overall quality of life.

1.1 Doing Business in the On-Demand and Sharing Economies

LO1.1 Define *the differences between the on-demand and sharing economies and the six business objectives IT should focus on to enhance organizational performance, growth, and sustainability*.

The on-demand and sharing economies are revolutionizing commercial activities in businesses around the world. The businesses in these new economies are fueled by years of technology innovation and a radical change in consumer behavior. As companies become more highly digitized, it becomes more and more apparent that what companies can do depends on what their

IT and data management systems can do. For over a decade, powerful new digital approaches to doing business have emerged. And there is sufficient proof to expect even more rapid and dramatic changes due to IT breakthroughs and advances.

On-demand economy is the economic activity created by technology companies that fulfill consumer demand through the immediate provisioning of products and services.

Sharing economy is an economic system in which goods or services are shared between private individuals, either free or for a fee, typically arranged through an online company or organization.

In market segment after market segment, mobile communications and technology stacks make it financially feasible for companies to bring together consumers and providers to purchase or share products and services. These capabilities have created the **on-demand economy** and the **sharing economy**. As Ev Williams, cofounder of Twitter (https://twitter.com/home) says,

> *The internet makes human desires more easily attainable. In other words, it offers convenience. Convenience on the internet is basically achieved by two things: speed, and cognitive ease. If you study what the really big things on the internet are, you realize they are masters at making things fast and not making people think.*

The proliferation of smartphone-connected consumers, simple and secure purchase flows, and location-based services are a few of the market conditions and technological innovations that are propelling the explosion of on-demand and shared services.

Just as the rapid growth of online-only Amazon (https://www.amazon.com) and eBay transformed retail, the even faster growth of app-driven companies, such as Uber, Airbnb, and Grubhub (https://www.grubhub.com), has disrupted the taxi, hotel, and restaurant markets. As you read in the opening case, in six short years, Uber changed the taxi industry as it rose from start-up to the world's most valuable private technology company, and Airbnb tackled the fiercely competitive hotel market and attracted more than 60 million customers to become the third most valuable venture-capital-backed company in the world. Another example is Grubhub who became No. 1 in online food ordering, controlling over 20% of that $9 billion market. What today's successful technology businesses have in common are platform-based business models. Platforms consist of hardware, software, and networks that provide the connectivity for diverse transactions, such as ordering, tracking, user authentication, and payments. These business models are designed to serve today's on-demand economy, which is all about time (on-demand), convenience (tap an app), and personalized service (my way). For example, millennials want the ease of online payment over cash and insist on efficiency for all aspects of their lives, including shopping, delivery, and travel.

Key strategic and tactical questions that determine an organization's profitability and management performance are shown in **Figure 1.2.** Answers to each question require an understanding of the capabilities of mundane to complex IT, which ones to implement and how to manage them.

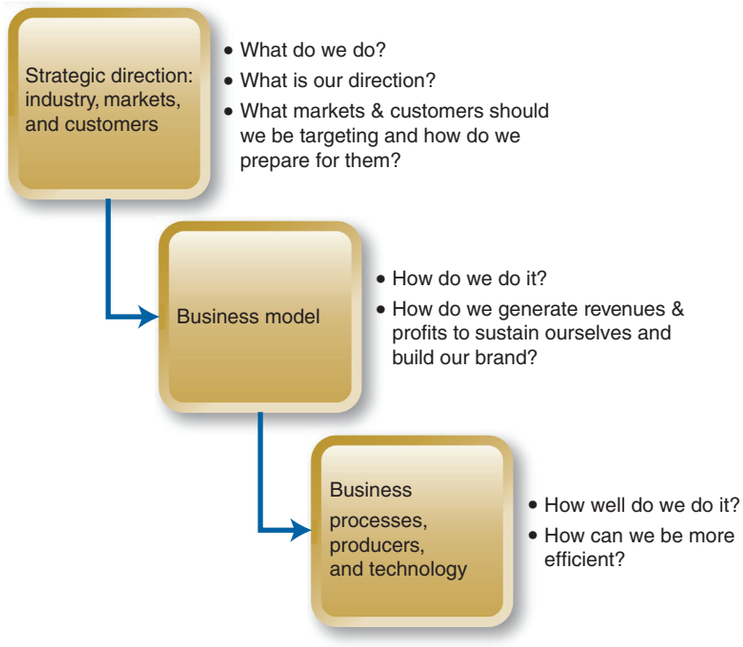

FIGURE 1.2 Key strategic and tactical questions.

Disruptive Digital Business Models

Digital transformation drives radical changes in **business models** to enable organizations to provide goods and services to customers in the way they want them delivered, when they want them, and where they want to have access to them.

Companies that adopt **digital business models** are better positioned to take advantage of business opportunities and survive. **Figure 1.3** describes seven highly disruptive business models and some of the companies that use them to differentiate their products and services.

Today, a top concern of well-established corporations, global financial institutions, born-on-the-Web retailers, and government agencies is how to design their digital business model to

- Deliver an incredible customer experience
- Turn a profit
- Increase market share
- Engage their employees

Business model is a company's core strategy for making a profit. It defines the products and/or services it will sell, its target market, costs associated with doing business, and the company's ongoing plans for achieving its goals.

Digital business model prescribes how businesses make money and meet their goals using digital technology, such as websites, social media, and mobile devices.

Business Model	• Description/Examples
Subscription	• Customer pays monthly payment for continued access to a specific product/service • *Netflix* • *Apple Music*
Freemium	• Customer gets 'basic' or free version of a product/service or a free trial. Has option to upgrade to a paid version of the product/service • *Linkedin* • *Dropbox*
Free	• Customer is the "product". Customer data is the most valuable part of the business along with his/her attention for advertisiing purposes • *Google* • *Facebook*
Access-over-Ownership	• Customer pays for temporary access to the product/service, but does not own it • *Zipcar* • *AirBnb*
Experience	• Customer is given a unique experience for which they are willing to pay a high price • *Tesla* • *Apple*
On-Demand	• Customer pays for a service they don't have time to do themselves, but is fulfilled by people with time, but short on money • *Uber* • *Taskrabbit*
Ecosystem	• Customer is sold an interdependent suite of products/services that when purchased, increase in value based on how many are owned • *Apple* • *Google*

FIGURE 1.3 Disruptive digital business models enable companies to engage customers to create value via websites, social channels, and mobile devices.

Customer experience describes the cumulative impact of multiple interactions over the course of a customer's contact with an organization.

In the digital (online) space, the **customer experience** must measure up to the very best the Web has to offer. Stakes are high for those who get it right—or wrong. There is a strong relationship between the quality of a firm's customer experience and loyalty, which, in turn, increases revenue. As a result, a firm's IT business objectives should be carefully and clearly defined.

IT's Role in the On-Demand and Sharing Economies

The 2018 IT Trends survey conducted by the Society of Information Management (SIM) reflects that the current state of IT management remains stable despite the massive changes present in the IT world today. Responses were analyzed from IT leaders in 793 highly digitized and tightly connected organizations. Results showed that companies are investing heavily in analytics, cybersecurity, cloud, application software development and maintenance, enterprise resource planning (ERP), and customer relationship management (CRM). These levels of investment are consistent with the top ten IT management concerns shown in **Table 1.1**, which clearly demonstrate a need for companies to continue to focus on strategic and organizational priorities such as cybersecurity, business–IT alignment, and **data analytics**.

Data analytics is the process of examining data sets to draw conclusions about the information they contain, usually with the aid of specialized information systems.

TABLE 1.1 Top Ten IT Management Issues

	IT Management Issues
1	Security, Cybersecurity and Privacy
2	Technology Alignment with the Business
3	Data Analytics
4	Compliance and Regulations
5	IT Cost Reduction & Controls
6	Business Cost Reduction & Controls
7	Innovation
8	Digital Transformation
9	Business Agility and Flexibility
10	IT Agility and Flexibility

Source: Adapted from Kappelman et al. (2019).

Respondents also indicated that in addition to cybersecurity, their most worrisome personal IT concerns centered around the skills shortage that has led to difficulties in finding and retaining highly skilled IT talent, the credibility of IT, and perception of IT leadership within an organization. On the business side, they listed alignment of business goals with IT goals, business continuity, and compliance/regulations as areas of concern. Once again, these findings point to one clear message—IT in the on-demand and sharing economies is all about safeguarding data and identifying and meeting customer needs. Each of these concerns will be addressed throughout the following chapters to help you understand how IT is managed to ensure corporate performance, growth, and sustainability goals are met.

IT—Business Objectives

Now, more than ever, IT must be responsive to the needs of consumers who are demanding a radical overhaul of business processes in companies across diverse industry sectors. Intuitive interfaces, around-the-clock availability, real-time fulfillment, personalized treatment, global

consistency, and zero errors—this is the world to which customers have become increasingly accustomed. And, it's not just about providing a superior user or customer experience—when companies get it right, they can also offer more competitive prices because of lower costs, better operational controls, and open themselves up to less risk.

According to Chirantan Basu of Chron (Basu, 2017), to stay abreast of the ever-changing business landscape and customer needs, IT today must concentrate on the following six business objectives to enhance an organization's performance, growth, and sustainability:

1. **Product development** From innovations in microprocessors to efficient drug-delivery systems, IT helps businesses respond quickly to changing customer demands.
2. **Stakeholder integration** Companies use their investor relations websites to communicate with shareholders, research analysts, and others in the market.
3. **Process improvement** An ERP system replaces dozens of legacy systems for finance, human resources, and other functional areas to increase efficiency and cost-effectiveness of internal business processes.
4. **Cost efficiencies** IT allows companies to reduce transaction and implementation costs, such as costs of duplication and postage of e-mail versus snail mail.
5. **Competitive advantage** Companies can use agile development, prototyping, and other systems methodologies to bring a product to market cost-effectively and quickly.
6. **Globalization** Companies can outsource most of their noncore functions, such as HR and finance, to offshore companies and use Information Communication Technology (ICT) to stay in contact with its global employees, customers, and suppliers 24/7.

Every technology innovation triggers opportunities and threats to business models and strategies. With rare exceptions, every business model depends on a mix of IT, knowledge of its potential, requirements for success, and, equally important, its limitations.

Decades of technological innovation have given us smartphone apps, mobile payment platforms, GPS and map technology, and social authentication. These technologies are needed to build the infrastructure needed for on-demand services and sharing services.

This infrastructure—also referred to as a **technology platform** or **technology stack**—supports the exchange and coordination of staggering amounts of data.

Technology platform is the operating system and computer hardware used as a base upon which other applications, processes, or technologies are developed.

Technology stack is the multiple layers of hardware, software, network connectivity, and data analytics capability that comprise a technology platform.

In many consumer markets today, companies that do not have these mobile apps (Apple or Android) or other technology platforms that support the exchange of goods and services—no matter how useful their website—may find themselves losing their competitive edge. This often leads to customer dissatisfaction, which results in a considerably smaller customer base and inevitably leads to an inability to sustain performance and growth followed by decline and, in extreme cases, extinction.

These and many other technologies and their impact on how companies operate and compete will be discussed in the following chapters to enable you to understand the importance of IT for management and become a more informed user of IT.

IT at Work 1.1

Digital Transformation Drives Kroger's Mission to Improve Customer Satisfaction

Grocery store Kroger has long been a leader in customer satisfaction by creating unique, personalized shopping experiences that drive customer loyalty. Every year, they deliver more than 3 billion personalized recommendations to shoppers through their customer insights team and through their *Restock Kroger* project; they have created a seamless digital shopping experience for their customers to access anything, anywhere, anytime.

Promoting an omnichannel approach, Kroger offers its customers in-store and online experiences they don't distinguish between. Its goal is to deliver customers' needs at any point in time. Digital shelving, driverless grocery delivery, automated warehouse operations, on-demand delivery, and mini-grocery store setups in Walgreen's brick-and-mortar-pharmacies are just a few ways that Kroger is meeting customer needs through digital transformation.

Kroger CIO, Chris Hjelm, is proud of Kroger's commitment to data, innovation, and tech savvy initiatives that he has promoted during his time with the company. Some of the other innovative digital solutions already in place or being pilot tested at Kroger include the following:

- **Enhanced display for grocery environment (EDGE)** that displays prices, nutrition and allergy information along with videos and images on shelf-edge high-resolution screens to boost sales
- **Scan, Bag, Go** technology that allows shoppers to scan products using a provided handheld scanner or the Kroger mobile app
- **ClickList** online ordering services that offer targeted, personalized offers to shoppers
- **QueVision** that has lowered checkout times from an average of 4 minutes to less than 30 seconds and improved foot traffic management in stores by combining infrared sensors, predictive analytics, and management tools
- **Food at Safe Temperature (FAST) Alerts** that monitor temperature trends and alert store managers and facilities engineers of negative temperature trends before food safety issues arise

In his role as CIO of Kroger's $115 billion operation, Hjelm sees his key roles as twofold. He must "keep the trains running on time" and "create a sustainable competitive advantage by working on things that aren't being done elsewhere."

Sources: Compiled from The Kroger Co. (2018), Kroger 2019 Sustainability Report, and Zappa (2019).

Questions

1. Name four disruptive business models and describe what they offer to their customers.
2. How is IT contributing to the success of the on-demand and shared economies?
3. List the six IT business objectives.
4. What are the key strategic and tactical questions that determine an organization's profitability and management performance?
5. What is a business model?
6. What is a digital business model?
7. Give two examples of how companies are transitioning to digital business models.
8. What factors are driving the move to digital business models?

1.2 Business Process Improvement and Competition

LO1.2 Explain *the role of IT in improving business processes. Understand the concepts of business process reengineering and competitive advantage*.

Competitive advantage is when an organization differentiates itself by charging less and creating and delivering better quality products or services than its competitors.

Deliverables are tangible or intangible goods or services produced in a project and intended to be delivered to a customer.

One way that a company can gain a **competitive advantage** over its competitors is by improving business processes. Given that a company's success depends on the efficiency of its business processes, even small improvements in key processes can have significant payoff. All functions and departments in the enterprise have tasks they need to complete to produce outputs, or **deliverables**, in order to meet their objectives.

Before you can begin to improve something, you have to understand what it is you are improving. We'll start by defining a business process, looking at its characteristics, and then exploring ways in which a business process can be improved either incrementally or radically through business process reengineering (BPR).

What Is a Business Process?

In the simplest terms, a **business process** consists of activities that convert inputs into outputs by doing work.

Business process is a series of steps by which organizations coordinate and organize tasks to get work done within and across their different business functions.

Table 1.2 shows some examples of common business processes and the business units where they are used. In addition to business processes that are used within a business unit, some business processes can be **cross-functional** and involve two or more functions, for example, order fulfillment and product development, which is used in both sales and production/operations management.

Cross-functional business process involves two or more business functions.

TABLE 1.2 Examples of Business Processes in Business Units

Business Unit	Business Processes in Use
Accounting	Invoicing, reconciling accounts, auditing
Finance	Credit card or loan approval, estimating credit risk and financing terms
Human resources (HR)	Recruiting, hiring, assessing compliance with regulations, evaluating job performance
Information systems (IS/IT)	Generating and distributing reports, data visualizations, data analytics, data archiving
Marketing	Sales, product promotion, design and implementation of sales campaigns, qualifying a lead
Production and operations (POM)	Shipping, receiving, quality control, inventory management

Three Components of a Business Process. Business processes have the three basic components shown in **Figure 1.4**. They involve inputs, activities, and deliverables.

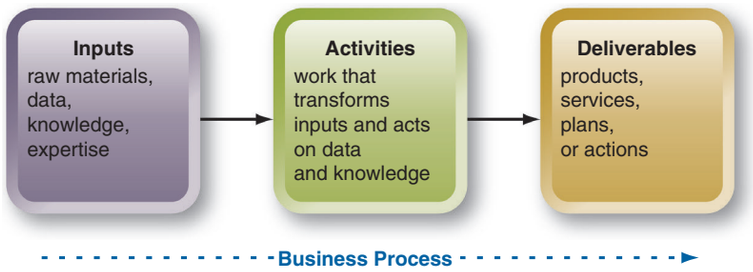

FIGURE 1.4 Three components of a business process.

Formal process is a process that has documented and well-established steps. For example, order taking and credit approval processes.

Informal process is a process that is typically undocumented, has inputs that may not yet been identified, and are knowledge-intensive.

Processes can be **formal** or **informal**. Routine formal processes are typically referred to as **standard operating procedures (SOPs)**. Although enterprises would prefer to formalize their informal processes in order to better understand, share, and optimize them, in many situations process knowledge remains in people's heads and is difficult to formalize.

Standard operating procedures (SOP) is a well-defined and documented way of doing something. An effective SOP states who will perform the tasks; what materials to use; and where, how, and when the tasks are to be performed. SOPs are needed for the handling of food, hazardous materials, or situations involving safety, security, or compliance.

Processes range from slow, rigid to fast-moving, adaptive. Rigid processes can be structured to be resistant to change, such as those that enforce security or compliance regulations. Adaptive processes are designed to respond to change or emerging conditions, particularly in marketing and IT.

Improving Business Processes

Designing an effective process can be complex because you need a deep understanding of the inputs and outputs (also known as deliverables), how things can go wrong, and how to prevent things from going wrong. For example, Dell had implemented a new process to reduce the time that tech support spent handling customer service calls. In an effort to minimize the length of the call, tech support's quality dropped so much that customers had to call multiple times to solve their problems. The new process had backfired—increasing the time to resolve computer problems and aggravating Dell customers.

The importance of efficient business processes and continuous process improvement cannot be overemphasized. Why? Because 100% of an enterprise's performance is the result of its processes. Maximizing the use of inputs in order to carry out similar activities better than one's competitors is a **critical success factor (CSF)**. Poorly designed, flawed, or outdated business processes waste resources, increase costs, cause delays, and aggravate customers. For example, when customers' orders are not filled on time or correctly, customer loyalty suffers, returns increase, and reshipping increases costs. The blame may not be employee incompetence, but a flawed order fulfillment process.

Critical success factor (CSF) is an element that is necessary to ensure the success of an organization or project, that is, access to adequate financial resources, clear definition of goals, realistic calendar of tasks and activities.

Don't Automate, Obliterate!

In today's on-demand economy, incrementally improving a business process isn't always sufficient to create the type of change required. Instead, radical changes need to occur to meet higher customer expectations. To do this, companies have to go beyond simply automating an existing process. They must reinvent the entire business process, including reducing the number of steps required, eliminating documents, developing automated decision-making, and dealing with regulatory and fraud issues. Operating models, skills, organizational structures, and roles need to be redesigned to match the reinvented processes. Data models should be adjusted and rebuilt to enable better decision-making, performance tracking, and customer insights.

Leading organizations have come to recognize that it can take a long time to see the benefits of traditional large-scale projects that migrate all current processes to digital and sometimes they don't work. Instead, successful companies are reinventing processes, challenging everything related to an existing process, and rebuilding it using cutting-edge digital technology. For example, rather than creating technology tools to help back-office employees type customer complaints into their systems, leading organizations create self-serve options for customers to type in their own complaints.

Business Process Reengineering. The process by which these types of radical process change can be achieved to improve productivity, **cycle time**, and quality is referred to as **business process reengineering (BPR)**. Its slogan is "Don't automate, obliterate!" (Hammer and Champy, 2006).

Cycle time is the period to complete one cycle of an operation or to complete a function, job, or task from start to finish.

Business process reengineering (BPR) is the radial redesign of core business processes to achieve a dramatic improvement in productivity, cycle times, and quality.

Consisting of the eight stages shown in **Figure 1.5**, BPR proposes that simply applying IT to a manual or outdated process does not always optimize it. Instead, processes need to be examined to determine whether they are still necessary. After unnecessary processes are identified and eliminated, the remaining ones are redesigned (or reengineered) in order to automate or streamline them. Next, the new process is implemented and put into operation and its performance is evaluated. Finally, the process is reassessed over time to continually improve it.

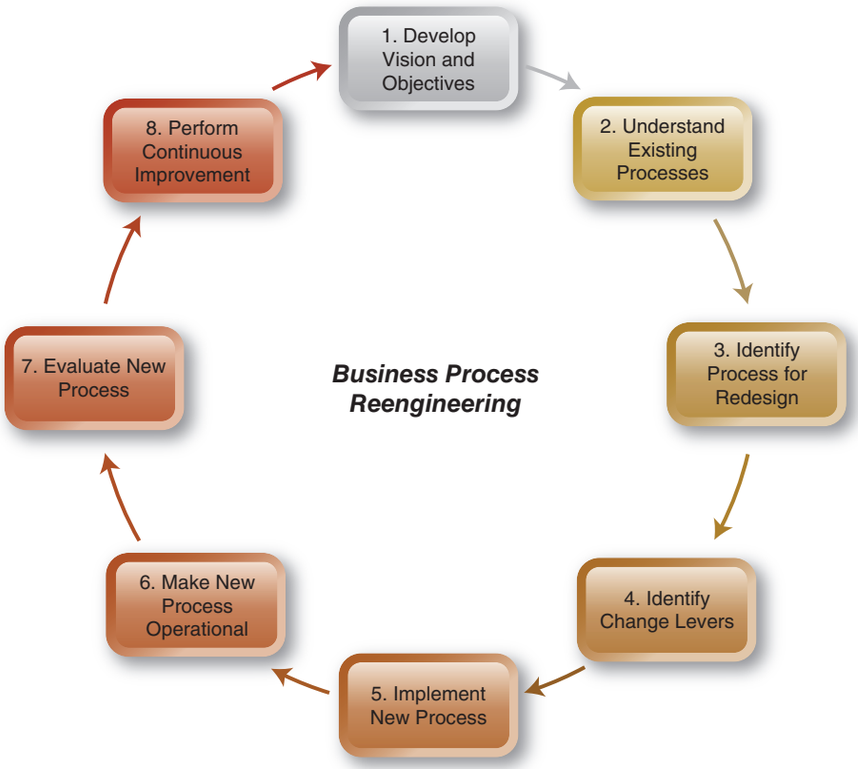

FIGURE 1.5 Eight phases of BPR.

The goal of BPR is to eliminate unnecessary, non-value-added processes and simplify and automate the remaining processes to significantly reduce cycle time, labor, and costs. For example, reengineering the credit approval process cuts time from several days or hours to minutes or less. Simplifying processes naturally reduces the time needed to complete the process, which also cuts down on errors.

After eliminating waste, IT can enhance business processes by (1) automating existing manual processes; (2) expanding the data flows to reach more functions in order to make it possible for sequential activities to occur in parallel; and (3) creating innovative business processes that, in turn, create new business models. For instance, consumers can scan an image of a product and land on an e-commerce site, such as Amazon.com, selling that product. This process flips the traditional selling process by making it customer-centric.

With the help of **business process management (BPM)** software, business processes performed either by computers or manually can be mapped and new ones designed. The software includes built-in templates showing workflows and rules for various functions, such as rules for credit approval. These templates and rules provide consistency and high-quality outcomes. For example, Oracle's WebLogic Server Process Edition includes server software and process integration tools for automating complex business processes, such as handling an insurance claim.

Business process management (BPM) consists of the methods, tools, and technology to support and continuously improve business processes.

However, BPM initiatives can be extremely challenging, and in order to be successful, BPM requires buy-in from a broad cross section of the business, the right technology selection, and highly effective change management processes. You will read more about optimizing business processes and role of BPM in the alignment of IT and business strategy in Chapter 13.

Competition

Understanding trends that affect new ways of doing business and getting ahead of those trends by adding, deleting, and changing existing business processes gives organizations an important advantage over their competitors. Basically, this requires radically improving business processes to offer unique products or services or convince customers your business is a more

attractive alternative to your competitors. Helping a company gain, maintain, and sustain a competitive advantage in the market is a very important function of IT, which will be discussed in detail in Chapter 12.

Influential industry leaders cite "new competition" as their biggest business challenge. Once an enterprise has learned to compete well in the market, it can only continue to excel by continually improving its business processes. Maintaining a competitive advantage requires forecasting market trends, staying abreast of industry changes, and developing innovative strategies to stay ahead of the competition. It also demands continuously tracking competitors and monitoring their future plans and promptly taking corrective action to outmaneuver them. To achieve this, an organization must have an IT function that is agile, flexible, and responsive (discussed in Chapter 12). IT agility, flexibility, and mobility are tightly interrelated and fully dependent on an organization's IT infrastructure and architecture, which are discussed in Chapter 2. **IT at Work 1.2** demonstrates how Coca-Cola transformed Costa Coffee by radically improving its business processes and completely replacing its IT architecture to meet and beat the competition.

IT at Work 1.2

Coca-Cola Gives Costa Coffee a Greenfield IT Opportunity to Ramp Up Global Retail Operations

Coca-Cola recently acquired 4,000-store Costa Coffee chain from Whitbread, a British Hospitality group, for $4.9 billion USD. The acquisition is part of Coca-Cola's strategy to build a coffee brand that will rival Starbucks in a global coffee shop market that is currently valued at $165 billion USD. The acquisition expands the existing Coca-Cola coffee lineup that already includes the market-leading Georgia brand in Japan, plus coffee products in many other countries.

In setting up Costa Coffee as a distinct entity, Coca-Cola also invested in a new foundation of digital platforms to fuel its ambitions of competing with Starbucks on a global scale. The acquisition gives Coca-Cola a strong, global coffee platform with a presence in more than 30 countries in Europe, Asia Pacific, the Middle East, and Africa and the potential for additional expansion. Founded in London, in 1971, Costa Coffee has become a major coffee brand across the world with nearly 4,000 retail outlets with highly trained baristas, a coffee vending operation, for-home coffee formats, and Costa's state-of-the-art Roastery.

Not many companies can create their IT organization from scratch, but with their acquisition by Coca-Cola, Costa Coffee was handed the golden opportunity to swap out its old legacy IT for new platforms, applications, and a ramped-up talent base. For Phil Scully, Costa's CIO, it was a dream come true. "It's as close to a greenfield IT opportunity as you'll ever get," he exuded, and "a rare opportunity that I'm hugely privileged to be able to take."

Usually, when companies are acquired, they must integrate their IT operations and services with those of the company acquiring them. In the Coca-Cola–Costa Coffee acquisition, that was not the case. Instead, Costa Coffee was offered the opportunity to build a brand-new IT function to connect to Coca-Cola's IT systems. To achieve this, Costa Coffee will have to work through a digital transformation to transition from the system it shares with its former parent, Whitbread, under a series of technology service agreements (TSAs) for Human Resources, Entity Resource Planning, CRM, Supply Chain, and other core systems.

Scully took over as Costa Coffee CIO in 2017 and since then he has taken huge strides in digital transformation, most of which has focused on enhancing customer and in-store capabilities. As Costa Coffee takes hold of its own IT destiny, the pressure will be on to build an advanced digital capability that will drive Coca-Cola's and Costa Coffee's goals. Cloud IT will be critical to their plan. Scully aims to move from a completely physical data center to the cloud to unlock opportunities such as fully upgrading its ERP systems to become a cloud-only business. The shift to the cloud is designed to provide IT, systems, and data management that is as consistent, repeatable, and high quality as its coffee is at its thousands of outlets around the world.

The transformation also demands a rapid ramp-up of talent. Scully is recruiting about 50% more IT professionals from around the world to create a blend of 130 to 140 permanent, contract, and outsourced IT staff to help him achieve his vision.

Sources: Compiled from Caballero (2018), Wood and Sweney (2018), MacIver (2019), and https://www.coca-colacompany.com.

Questions

1. What is a business process? Give three examples.
2. What is the difference between business deliverables and objectives?
3. List and give examples of the three components of a business process.
4. Explain the differences between formal and informal processes.
5. What is an SOP?
6. What is the purpose of BPM?

1.3 IT Innovation and Disruption

LO1.3 Describe *how IT is disrupting the way that companies operate, the IT megatrends that are driving organizational performance, growth, and sustainability and how COVID-19 is accelerating digital transformation.*

Digital technology creates new markets, businesses, products, and careers. As digital technology changes the way consumers and retailers buy and sell products, companies must adapt and innovate to ensure their product offerings, platforms, technologies, and search options cater to these changing needs.

To qualify as a digital disruption, it must

1. Be a threat to personal or business goals in the short or long term
2. Must be digital, for example, related to the IoT, a mobile app, a new technology, or anything related to the digital evolution

Social–Mobile–Analytics–Cloud (SMAC) Model

We are in the era of **social–mobile–analytics–cloud (SMAC)** computing that is reshaping business strategies and day-to-day operations (**Figure 1.6**).

Social–mobile–analytics–cloud (SMAC) is the concept that the convergence of four technologies is currently driving business innovation and digital transformation.

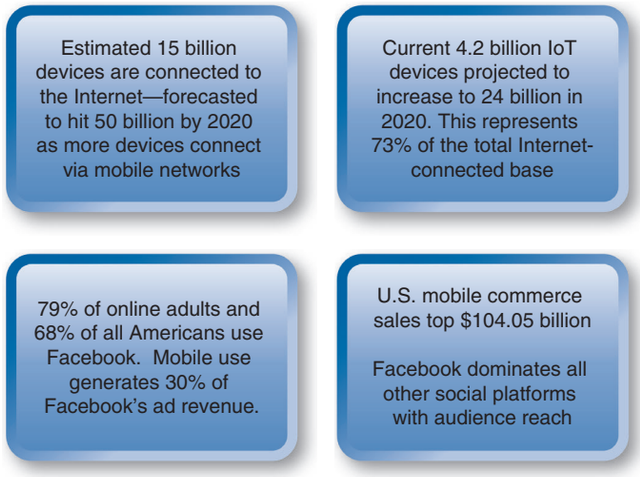

FIGURE 1.6 SMAC reshapes business strategies and day-to-day operations.

The cloud consists of huge data centers accessible via the Internet and forms the core by providing 24/7 access to storage, applications, and services. Handhelds and wearables, such as FitBit, Pebble, and Apple Watch, and their users form the edge. Social channels connect the core and edge. The SMAC integration creates the technical and services infrastructure needed for digital business. This infrastructure makes it possible to meet the expectations of employees, customers, and business partners given that almost everyone is connected (social), everywhere they go (mobile), gets the information they need (analytics), and has 24/7 access to products and services (cloud).

Here are three examples of SMAC's influence:

1. **Powerful social influences impact advertising and marketing** Connections and feedback via social networks have changed the balance of influence. Consumers are more likely to trust tweets from ordinary people than recommendations made by celebrity endorsements. And, negative sentiments posted or tweeted can damage brands.
2. **Consumer devices go digital and offer new services** The Nike+ FuelBand wristband helps customers track their exercise activities and calories burned. The device links to a mobile app that lets users post their progress on Facebook.

3. **eBay's move to cloud technology improves sellers' and buyers' experiences** The world's largest online marketplace, eBay, moved its IT infrastructure to the cloud. With cloud computing, eBay is able to introduce new types of landing pages and customer experiences without the delay associated with having to buy additional computing resources.

The balance of power has shifted as business is increasingly driven by individuals for whom mobiles are an extension of their body and mind. They expect to use location-aware services, apps, alerts, social networks, and the latest digital capabilities at work and outside work. To a growing extent, customer loyalty and revenue growth depend on a business's ability to offer unique customer experiences that wow customers more than competitors can.

Technology Mega Trends

For 21st-century enterprises, connectivity, big data and analytics, artificial intelligence, and **digitization** are technology **mega trends** that cannot be ignored. Business breakthroughs and innovation would be impossible without them. They also mark the difference between outdated 20th-century business models and practices and those of today's on-demand economy.

The most influential IT mega trends driving digital transformation of companies in the on-demand economy are discussed next.

Digitization is the process of transforming any kind of activity or information into a digital format that can be collected, stored, searched, and analyzed electronically and efficiently.

Mega trends are forces that shape or create the future of business, the economy, and society.

Cloud computing is an Internet-based computing system consisting of many computers and other devices where computer infrastructure, access to applications, software, processing power, and so on are shared.

Big data is a process that is used when traditional data mining and handling techniques cannot uncover the insights and meaning of the underlying data that are usually unstructured (text), time sensitive, or extremely large.

Unstructured data is data that either does not have a predefined format or is not organized in a predefined manner. Unstructured data is typically text, although it may also contain some dates and numbers.

Connectivity. Companies need to connect with consumers and business partners across multiple channels and devices using digital platforms that consist of hardware, software (mobile apps), networks (social media), (embedded sensors), and **cloud computing**.

For example, rather than run applications or programs from software stored on a computer or server owned by the company, cloud computing allows companies to access the same kinds of applications through the Internet. Major business cloud computing providers include Amazon Web Services (AWS), Cisco Powered, Dell Cloud Solutions, Google Cloud, IBM Cloud Solutions, and Teradata Cloud. One of the many benefits of cloud is that it provides the flexibility to acquire or expand connectivity and computing power as needed for operations, business transactions, and communication.

Expanded connectivity supports smart products, which can sense, process, report, and take corrective action, such as smart clothing, watches, phones, to smart buildings and smart cities. This IoT is becoming a driving force in the on-demand and sharing economies

Connectivity pushes other sub trends, like **big data**, to create market opportunities for new products and services, such as social sentiment analysis, open innovation, new insurance business models, and micro personalized marketing and medicines.

Big Data and Data Analytics. There is no question that the increasing volume of data can be valuable, but only if they are processed and available when and where they are needed. The problem is that the amount, variety, structure, and speed of data being generated or collected by enterprises differ significantly from traditional data. Big data stream in from multiple channels and sources, including the following:

- Mobile devices and machine-to-machine sensors embedded in everything from airport runways to casino chips (Later in this chapter, you will read more about the IoT.)
- Social content from texts, tweets, posts, blogs
- Clickstream data from the Web and Internet searches
- Video data and photos from retail and user-generated content
- Financial, medical, research, customer, and business-to-business transactions

Big data are 80% to 90% unstructured. **Unstructured data** do not have a predictable format like a credit card application form but may instead consist of large volumes of text. Huge volumes of unstructured data flooding into an enterprise are too much for traditional technology to process and analyze quickly. Big data tend to be more time sensitive than traditional (or small) data. Data collected from social, mobile, and other channels are

analyzed to gain insights and make smart decisions that drive up the bottom line. Machine-generated data from sensors and social media texts are main sources of big data.

Big data has been one of the most disruptive forces businesses have seen in a long time and impacts people, processes, and profits. When an enterprise harnesses its data and can act on analytic insights, it can turn the challenges into opportunities.

Artificial Intelligence and Robotics. To improve their ability to meet evolving customer expectations in a timely manner, digital innovators use technology to automate, streamline, or eliminate their processes. An example of this is robotic process automation that uses software and artificial intelligence to accelerate administrative activities. One bank saw its mortgage application time drop from 20 to 2 days after implementing technology to automate the document-intensive application process. It is estimated that by 2022, artificial intelligence and machine-learning systems will handle most customer interactions. These systems will be highly attuned to individual customer preferences and will tailor each engagement according to a customer's context and current need. Consequently, customers will quickly become accustomed to this level of valet service and won't stay with companies that do not anticipate their needs.

Digitization. Across industries, companies are attempting to transform their disconnected or disjointed approaches to customers, products, services, and operating models to an always-on, real-time, and information-rich marketplace. Some leaders are redesigning their capabilities and operating models to take full advantage of digital technologies to keep step with the "connected" consumer and attract talent. Others are creating qualitatively new business models—and tremendous value—around disruptive digital opportunities. In doing so, these companies secure not only continued relevance but also superior returns.

Digitization often requires that old wisdom be combined with new skills, for example, by training a merchandising manager to program a pricing algorithm and creating new roles, such as user-experience designer. The benefits of digitizing processes, through BPR, are huge. By digitizing information-intensive processes, costs can be cut by up to 90% and turnaround times improved by several orders of magnitude.

Examples span multiple industries. For example, one bank digitized its mortgage application and decision process, cutting the cost per new mortgage by 70% and slashing time to preliminary approval from several days to just one minute. A telecommunications company created a self-serve, prepaid service where customers could order and activate phones without back-office involvement. A shoe retailer built a system to manage its in-store inventory that enabled it to know immediately whether a shoe and size was in stock—saving time for customers and sales staff. An insurance company built a digital process to automatically adjudicate a large share of its simple claims.

In addition, replacing paper and manual processes with software allows businesses to automatically collect data that can be mined to better understand process performance, cost drivers, and causes of risk. Real-time reports and **dashboards** on digital-process performance enable managers to address problems before they get out of control. For example, quality issues in a company's supply chain can be identified and remedied more rapidly by monitoring customer buying behavior and feedback in digital channels.

Dashboards is an easy-to-read, often single-page, real-time user interface, showing a graphical presentation of the current status and historical trends of an organization's key performance indicators to enable instantaneous and informed decisions to be made.

Machine-to-Machine Technology. Sensors can be embedded in most products. Objects that connect themselves to the Internet include cars, heart monitors, stoplights, and appliances. Sensors are designed to detect and react, such as Ford's rain-sensing front wipers that use an advanced optical sensor to detect the intensity of rain or snowfall and adjust wiper speed accordingly. **Machine-to-machine (M2M) technology** and the **Internet of Things (IoT)** are widely used to automate business processes in industries ranging from transportation to health care. By adding sensors to trucks, turbines, roadways, utility meters, heart monitors, vending machines, and other equipment they sell, companies can track and manage their products remotely.

Machine-to-machine (M2M) technology enables sensor-embedded products to share reliable real-time data via radio signals.

Internet of Things (IoT) refers to a set of capabilities enabled when physical things are connected to the Internet via sensors.

When devices or products are embedded with sensors, companies can track their movements or monitor interactions with them. Business models can be adjusted to take advantage of what is learned from this behavioral data. For example, an insurance company

offers to install location sensors in customers' cars. By doing so, the company develops the ability to price the drivers' policies on how a car is driven and where it travels. Pricing is customized to match the actual risks of operating a vehicle rather than based on general proxies—driver's age, gender, or location of residence. **Table 1.3** lists several opportunities for improvement through the application of embedded physical things.

TABLE 1.3 Improvement Opportunities for Embedded Sensors

Industry Sector	Application	Payoff
Oil and gas	Exploration and development rely on extensive sensor networks placed in the earth's crust. Sensors can produce accurate readings of the location, structure, and dimensions of potential fields	Lower development costs and improved oil flows
Health care	Sensors and data links can monitor patients' behavior and symptoms in real time and at low cost, allowing physicians to more precisely diagnose disease and prescribe treatment regimens	Reduce hospitalization and treatment costs by $1 billion per year in the United States
Retail	Sensors can capture shoppers' profile data stored in their membership cards to help close purchases	Additional information and discounts at point of sale
Farming	Ground sensors can take into account crop and field conditions and adjust the amount of fertilizer that is spread on areas that need more nutrients	Reduction in time and cost
Advertising	Billboards can scan people passing by, assessing how they fit consumer profiles, and instantly change displayed messages based on those assessments	Better targeted marketing campaigns; flexibility; increased revenues
Automotive	Systems can detect imminent collisions and take evasive action, such as automatic braking systems	Potential accident reduction savings of more than $100 billion annually

COVID-19 Accelerates Digital Transformation

Recent developments surrounding the COVID-19 global pandemic have had a far-reaching effect on the global economy and the professional and personal lives of individuals. Consequently, companies in all industry sectors have had to act much more quickly to create new business models that address the regulatory requirements of COVID-19 lockdowns along with ensuing health and safety concerns and new purchasing habits of consumers, vendors and partners. Most companies have achieved this goal primarily by integrating new innovative information and communication technologies into their business models to increase personal engagement with consumers, vendors and partners, maintain a competitive advantage in the market and develop the operational resilience needed to safeguard their sustainability. As a result, the rate of digital transformation around the globe has increased significantly.

This accelerated digital transformation has not been limited to on-demand and sharing companies like Uber and Airbnb as described in our opening case. The unexpected events of COVID-19 have forced the pace of digital transformation to increase in all companies – large and small – and in all industry sectors as many struggle not only to compete, but also survive within uncertain times. In a recent survey of 2,500 enterprises across many different industry sectors the *COVID-19 Digital Engagement Report* shows that 97% of enterprise decision makers believed that the pandemic has accelerated companies' digital communications strategies by an average of six years; 95% are seeking new ways to engage customers, and 92% feel that transforming digital communications must be a priority in addressing current business challenges (Sil, 2020).

When people were asked to stay home and social distancing was shown to be the most effective way to slow the spread of the virus many companies saw their sales rapidly decrease, were unable to resume production and lost face-to-face contact with their customers. Small companies that were using limited technology prior to the pandemic have been particularly vulnerable to the impact of the pandemic. The mandated lockdowns and restricted activity caused their customers to engage in fewer activities outside of their own homes and began to replace face-to-face purchases of food, medications and clothing at 'bricks and mortar' establishments with e-commerce transactions for the first time. As a result, small firms have had to change their mindset and business models to include new and innovative technologies to

sustain them. In addition, companies of all sizes have begun to rely heavily on Chatbots and other omni-channel technologies to provide online interactive customer service to consumers. To ensure continuity many companies have also relaxed their policies to allow employees to work from home using information communication technology (ICT) apps like WhatsApp, Skype and Zoom while securing their expanded networks with cloud security tools such as Data Network Solutions (DNS), DHCP, and IP Address Management. Interactions with vendors and partners have followed a similar pattern as sales meetings, stockholder meetings and industry conferences have necessarily evolved into virtual events.

The impact of COVID-19 has not been limited to private sector companies. Education, healthcare, and law enforcement and government agencies around the globe are also responding to the need to more rapidly digitally transform themselves. For example, schools at all levels from elementary to university are training teachers to use the same digital tools that private companies are using to enable an effective and secure virtual learning experience for their students. This transition has not come without issues. For example, one South Carolina county recently had to suspend its entire virtual learning program because of a ransomware attack.

In healthcare more and more patients are being offered 'tele-health' visits and IBM is exploring how artificial intelligence and robotics can be used to drastically speed up timelines to develop drugs and therapies to lessen the severity of COVID-19 when contracted by those in high risk groups.

In law enforcement, agencies are employing innovative technologies to deploy contactless crime investigation techniques. For example, agencies around the globe are intensifying their use of aerial drones to identify and eradicate illegal drug crop production, illegal fishing, contraband smuggling and human trafficking, and in some countries robots and drones are even being used to identify people who are not wearing masks in public places.

Government agencies at all levels have closed their doors and are relying heavily on maintaining virtual communications with their constituents. In many cases this has made the decision process for creating and enforcing public policies more widely available and transparent to constituents with both positive and negative consequences. These and other innovative technologies are discussed in detail in subsequent chapters.

Lessons Learned

Those companies that have adapted quickly to change by exploiting digital technology and software are outperforming their peers. Companies that change the way they view and use technology from being a cost center and operational function to be a genuine competitive differentiator will reap the benefits. The five factors companies attribute these benefits to can be summed up in the following Lessons Learned:

1. **Exploit the power of software** Become "app-centric" and extend core business functions to include software development.
2. **Develop, deliver, disrupt—quickly!** Embrace agile development techniques and broadly implement DevOps.
3. **Boost speed and efficiency with automated programming interfaces (APIs)** Take a managed approach to use APIs for building full-function Web applications (particularly mobile apps) and for integrating back-office systems.
4. **Leverage third-party innovation** Take a more managed approach to use APIs for integrating third-party services into applications and enable external develop access to systems and data.
5. **Maximize returns with smarter IT investments** Get smarter at assessing and prioritizing IT investments to maximize return on investment and put portfolio management in place to prioritize and track IT programs.

Business opportunities presented by today's technology innovations are being realized on an unprecedented scale. **Cloud services**, big data, mobility, digitization, and the IoT are just a few of the emerging technologies that will build operational resilience, disrupt many industries and shake up competitive positions.

Cloud services is any computing resource that is provided over the Internet on demand.

In the pandemic and post-pandemic era, innovation through disruptive technology is necessary for any company to thrive in an on-demand and sharing economy where increased competition, expanded global markets and empowered customers define success. **IT at Work 1.3** demonstrates how one company successfully triumphed over its competition by using disruptive technology to disrupt itself!

IT at Work 1.3

Netflix Digitally Disrupts Itself!

In its first incarnation, Netflix simply provided a better way to rent DVDs. Going head to head with the then giant Blockbuster Video, a company that charged high late fees for DVD returns, Netflix allowed its customers to rent DVDs by mail with no late fees! Although the Netflix model didn't offer the instant gratification of taking home a DVD from a local store, it was simpler to rent from Netflix, and customers preferred the affordability Netflix offered. In this way, Netflix had seriously disrupted Blockbuster's business.

The subsequent introduction of Netflix's subscription streaming service also seriously disrupted major television networks such as ABC, CBS, and NBC. Until a few years ago, viewers could only watch TV shows on their television sets. As a result, TV moguls ABC, CBS, and NBC were able to charge high advertisement rates and high subscription rates. When Netflix came on the scene, traditional TV broadcasting companies had to completely reshape how they delivered their offerings. In doing so, their business operations were significantly disrupted. They no longer had the bulk of the market, their advertisement revenues dropped substantially, and their costs have increased to provide Webcasting services such as video-on-demand and Web delivery of content. However, Netflix didn't stop at disrupting other competitors—it went on to disrupt itself!

With the entry of more and more digital Webcast services such as HULU, ROKU, Sling TV, Amazon Prime Video and Netflix were facing increasingly stiff competition. To survive and prosper, Netflix separated its first-run movie rental offerings from its Web streaming services and runs two business models simultaneously. In its latest incarnation, Netflix is focusing on edging out its competition with original programming. At the 2018 Emmy Awards, Netflix had more Emmy nominations than premium cable giant HBO and took home 23 prestigious awards! In creating a new market, Netflix has avoided being displaced by its competitors and is one of the rare companies that has successfully disrupted itself.

Sources: Compiled from Muck (2017), Romero (2019), and netflix.com.

Questions

1. What are the benefits of cloud computing?
2. What is M2M technology? Give an example of a business process that could be automated with M2M.
3. Describe the relationships in the SMAC model.
4. What impacts does the SMAC model have on business?
5. Why have mobile devices given consumers more power in the marketplace?
6. Explain why connectivity is important in today's on-demand economy.
7. In what ways is IT disrupting business?
8. In what ways has COVID-19 accelerated digital transformation?

1.4 IT and You

LO1.4 Discuss *what it means to be an "informed user" of IT and the ways in which IT can add value to your career path and job performance*.

Today, IT and information systems touch nearly all aspects of our lives. IT is a part of our social life, our work, and every business process, and it is no longer the sole responsibility of the IT department. Just think about much of your day you spend interacting with technology—your iPad, PC, and smartphone. The 2018 Global Mobile Consumer Survey reported that American consumers check their smartphones an average of 52 times each day (Spangler, 2018). Aggregated across the estimated 270 million American smartphone users, that's 12.69 billion "looks" per day!

These findings leave little doubt that IT impacts the way you work, the way you learn, the way you communicate and socialize, and the way you entertain yourself. Today, success in any field, be it health care, marketing, finance, accounting, law, education, sports, entertainment, etc. requires much more than a cursory knowledge of IT. IT is and will remain the foundation of the global economy and is especially important in the on-demand economy.

On-Demand 'Gig' Workers

Currently, approximately 57 million Americans participate as gig workers either through primary or secondary jobs and it is projected that by 2023 more than half of the US workforce will either be gig economy workers or have worked independently (Mitic, 2020). In a recent survey of managers, internal employees and external workers conducted by SHRM and SAP SuccessFactors (Bolden-Barrett, 2019), nearly 20% of all gig workers said they preferred the flexibility and autonomy of gig work and managers also favor gig work because it allows staffing levels to easily be adjusted according to changes in the economy. Approximately one-third also said they earn more as an external worker that they did as an internal employee. The three top reasons respondents gave for becoming gig workers were:

- Want to be an independent contractor, freelancer, temporary worker or consultant (49%).
- Want to choose the number of hours they work (40%).
- Want to be able to work from any location (33%).

Other reasons include work-life balance and family and health concerns which are becoming more pressing amid the COVID-19 pandemic.

Many on-demand workers also have a strong entrepreneurial drive and are working in the on-demand and sharing economies to build a business. This entrepreneurial spirit is reflected in the ways that on-demand workers are compensated. While the 40-hour work week is still alive and well, sources of income have changed. Instead of one paycheck, on-demand workers typically receive their income from three different sources:

1. On-demand work
2. Contracting and consulting
3. Running a business

Along with the start-up companies typically associated with on-demand work, such as Uber, Lyft, Door Dash and TaskRabbit, some of today's largest companies have also begun to incorporate on-demand workers into their growth strategies to cultivate a more nimble, competitive, and specialized workforce that provides higher quality and faster work outcomes at a lower overall cost. A growing number of apps offer excellent work opportunities and the decreased need for a physical presence 'at work', is making it easier than ever for workers to have multiple simultaneous jobs and what was once considered a fringe form or employment is now becoming the 'new normal' because of the increased demand created by the COVID-19 pandemic. Technology platforms where you can post, find, and perform on-demand work include Avvo, Catalant, Field Nation, Kelly Services, OnForce, TaskRabbit, Upwork, and Wonolo.

Changes in Work Status. While the on-demand and sharing economies provides positive opportunities, they can also offer limited benefits and inferior infrastructure. Take, for example, the "contractor" model that companies like Uber use. Initially, Uber set the standard for on-demand business by labeling its drivers "independent contractors" and essentially claiming that all its drivers were self-employed. This pushed many of the costs of doing business onto the independent contractors' shoulders and deprived them of baseline labor protections such as worker's compensation, social security contributions, minimum wage, and discrimination protections.

This business model also allowed companies using the Uber model to sidestep federal, state, and county taxes and insurance premiums and undercuts competitors that used a traditional W-2 hiring model. However, not all on-demand and sharing economy businesses use the Uber model.

Some companies treat their workers as employees from the start, while others have switched to the W-2 model, and both approaches are reaping benefits. Shyp CEO Kevin Gibbon posted on LinkedIn that the move to employee status was "an investment in a longer-time relationship with our couriers, which we believe will ultimately create the best experience for our customers." After moving to the W-2 model, Shyp had only 1 out of 245 employees quit and customer complaints decreased at the package delivery company. And Instacart, a food shopping and delivery service, offered its shoppers the option to convert to part-time employees so they could offer training to ensure a consistent customer experience and greater customer satisfaction.

Regardless of their work status, most gig workers appear to be highly satisfied with their work environment, perhaps because it fits a unique need. Intuit's on-demand economy survey reported the following:

- 70% of on-demand workers are satisfied with their work.
- 81% plan to continue working with the same provider over the next year.
- 63% are happier to be working in the on-demand economy.

Overall, gig workers are forward-looking, eager to embrace new opportunities, and want to take charge of their careers. **Table 1.4** describes eight industries that are poised for disruption by on-demand workers.

TABLE 1.4 Eight Industries Poised for Disruption by On-Demand Workers

Industry	Characteristics	Advantages of On-Demand Workers
IT tech and field services	IT field service technicians are hired to install, repair, and maintain IT hardware. Equipment is often decentralized, needs are unpredictable, and fast response times are demanded to maintain connectivity	Lower costs Reduced response time Improved customer satisfaction
Retail	Geographically dispersed; fluctuating markets; challenging to balance service level needs	Help fill service level gaps Automation quickly identifies and implements optimal coverage
Health care	Growing demand for at-home care; increasing healthcare costs	Access to specialists as needed Help with everyday tasks Greater flexibility and control
Media/marketing	Develop content to drive sales; lack of reliable resources at right time and place	Lower cost, flexibility, availability
Oil and gas	Lack of talent, high overall labor costs, challenge of transferring knowledge of retiring workers, highly specialized skill set, workload imbalances	Lower labor costs Prevent corporate brain drain
Education	Long history of substitute teachers, need for new educational models	Online teaching and tutoring Personal and professional freedom
Property management	Customers demand immediate response times, online payments, and service requests	Right person for the right job at the right time Decrease vacancy rates, increase retention

IT Adds Value to Your Performance and Career

Whether you join the ranks of the gig workers or choose to stay in a traditional job, IT can greatly enhance your performance at work as you move through your career path. Staying current in emerging technologies is an essential skill for knowledge workers, entrepreneurs, managers, and business leaders—not just IT staff and the CIO. This has become particularly true during the COVID-19 pandemic where the ability to use IT has allowed many workers to retain their jobs and income level while working within the safety of their own homes. Despite this, in the current marketplace, organizations are finding it particularly difficult to find qualified IT talent, as illustrated in **IT at Work 1.4**.

IT at Work 1.4

Scott Zulpo Is Facing Stiff Competition

He's adding a senior project manager, a network analyst, and a help desk worker to his 55-member IT staff at BCU, a Vernon Hills, Illinois-based credit union where he is vice president of IT. And, Zulpo will need to add even more people to keep up with an increasing demand for tech-driven innovations.

"The challenge is twofold—first finding talent, and then determining if that talent has the skills, experience and personality to thrive in the position," says Zulpo, who's mindful that "the cost and impact of not hiring an 'A' player is huge."

Zulpo has his work cut out for him. He's hiring at a time when very few IT professionals are out of work. Consequently, competition for tech talent is fierce. The unemployment rate for tech workers is less than 2%, according to reports on recent data from the U.S. Bureau of Labor Statistics (2019).

And, Zulpo isn't the only one who's having a difficult time finding good IT talent. Many of his fellow IT leaders are seeking the same skills. A recent report by Tech Republic and ZDNet listed both network analyst and technical support among the top ten most sought-after skills in the next decade.

"The IT labor market is still very hot. The candidate is very much in the driver's seat," says Jason Hayman, market research manager for IT staffing firm TEKsystems.

Hayman cites a government report that estimates that 500,000 to 1 million IT jobs go unfilled every year and notes that some analysts say the figure is closer to 2 million. He says there's a classic supply-and-demand scenario working here, with demand for talent far exceeding supply.

The takeaway is there are not enough IT workers!

Sources: Compiled from Tech Republic/ZDNet (2017) and Bureau of Labor Statistics (2019).

IT as a Career Locally and Globally. Fueled by corporate growth, systems expansion, need for competitive or unique services to increase business and security initiatives, companies are increasing their IT hires. Companies need new tech hires who have a background in both technology and business and who can articulate IT's value in meeting business goals. In particular, companies are seeking IT employees with skills in programming, application development, technical support, security, cloud, business intelligence, Web development, database administration, and project management. According to the U.S. Department of Labor, IT job growth in the United States is estimated at 12% from 2018 to 2028, faster than the average for all occupations. This increase translates into roughly 546,200 new jobs in the next decade.

Demand for tech workers continues to grow at a pace that's unmatched in other industries.
Raj Mukherjee, Senior Vice President of Product, Indeed.com

As more companies undergo digital transformation, in-demand IT roles will shift by 2020 to include positions focused on advanced technologies such as IoT and block chain technology discussed in Chapter 4, data analytics in Chapter 6, and artificial intelligence and robotics in Chapter 11.

Managing and Interpreting Big Data Are High Demand Skills

Concerns about the analytics skills gap have existed for years. It is increasingly clear that the shortage isn't just in data scientists but also in data engineers, data analysts, and even the executives required to manage data initiatives. As a result, organizations and institutions are expanding their efforts to train, hire, and retain data professionals. Here are two of those skill sets that are in high demand.

Big data specialists manage and package big data collections, analyze, and interpret trends and present their findings in easy- to-understand ways to "C"-level executives. Those who can present the data through user-friendly data visualizations will be particularly sought after. Skills required of these big data professionals include big data visualization, statistical analysis, big data reporting and presentation, Apache Hadoop, Apache Spark, NoSQL database skills, and machine learning.

Business intelligence (BI) analysts use tools and techniques to go beyond the numbers of big data and act based on the findings of the big data analyses. Successful BI professionals use self-service BI platforms, such as Tableau, SAP, Oracle BI, Microsoft BI, and IBM Cognos, to

create BI reports and visualizations to streamline the process and reduce reliance on additional staff. Additional skills of critical thinking, creative problem-solving, effective communication, and presentation skills further enhance their attractiveness to employers (Doyle, 2020).

According to a recent report by Tech Republic and ZDNet, other IT jobs that will be most in demand in 2020 are as follows:

1. Computer vision engineer
2. Machine learning engineer
3. Network analyst
4. Security analyst
5. Cloud engineer
6. App developer
7. BI analyst
8. DevOps lead
9. Database administrator
10. User support specialist

A description of these and other computer and IT occupations, education requirements, and 2018 median pay can be found in the Bureau of Labor Statistics Occupational Outlook Handbook (https://bls.gov/ooh/computer-and-technology/home.htm).

According to the 2019 Global Knowledge survey (Goodison, 2019), global annual wages for IT professionals are at their highest levels ever, averaging $89,732. By region, North American IT professionals earn $109,985 on average—23% higher than the worldwide average—followed by Europe, the Middle East, and Africa at $70,445; the Asia-Pacific region at $65,738; and Latin America at $41,465.

Other than IT executives, cloud computing professionals had the highest paid positions, earning an average of $115,889 per year globally. This is 29% higher than the global IT average annual salary. Of these, cloud architects and cloud engineers were the most popular cloud computing roles listed. Other top-paid IT roles were IT architecture and design with an average annual salary of $98,580, followed by project and program management at $98,344 and cybersecurity at $97,322. The lowest global IT position was service desk and IT support with an average annual salary of $55,689 globally.

About 85% of the surveyed professionals had at least one IT certification, with North America being the only region falling below the average at 81%. In all regions, salaries of certified professionals surpassed that of those without any certifications, and those with more than one certification earned more than those with a single certification.

Career Insight 1.1

Security Analysts Are in High Demand

Cybersecurity analysts are already in great demand, and this demand is expected to continue well into the future as cyberattacks grow more sophisticated and technologies to fight them mature Government, private, and nonprofit organizations all rely heavily on technology. Hackers steal data and/or disrupt operations. Security analysts actively engage in a game of wits between organizations and cyber criminals to out-hack the hackers! Without security analysts, companies can be vulnerable to devastating attacks.

What Does a Security Analyst Do?

A security analyst detects and prevents cyber threats to an organization by planning and carrying out security measures to protect the company's software, hardware, and networks. IT security analysts are heavily involved with creating their company disaster recovery plan, a procedure that IT employees follow in case of emergency. IT security analysts must stay up to date on IT security and on the latest methods cyber attackers are using to infiltrate computer systems. As a security analyst, in the morning you might be researching how effective new security measures are. In the afternoon, you might be dealing with an active security threat.

A security analyst also needs to research new security technology to decide what will most effectively protect company data. As technologies become more sophisticated, the role of security analysts will likely evolve to include more data skills and artificial intelligence skills as the present reactive security approach changes to a more proactive one.

Up the Ante with Certification

Security analysts generally need a bachelor's degree in an IT-related area, and certifications are advantageous in securing, and advancing in, a position. Take, for example, Certification of Ethical Hacker (CEH), a computer certification that indicates proficiency in network security, especially in preventing malicious hacking attacks through preemptive countermeasures, is advantageous in securing a job. The CEH credential is a vendor-neutral certification for IT professionals who want to specialize in stopping and identifying malicious hackers by means of the same knowledge and tools the cyber criminals use. Before the CEH was introduced, private firms and government agencies hired reformed malicious hackers to secure their networks. The CEH is built on this model, which requires that those who earn the certification to agree in writing to abide by the law and honor a code of ethics. The CEH is sponsored by the International Council of E-Commerce Consultants (EC-Council), whose goals are to establish and maintain standards and credentials for the profession of ethical hackers and to educate IT professionals and the public on the role and value of security analysts. In addition to the CEH certification, the EC-Council offers several other security-related certifications, including secure programming and computer forensics. Certification proficiency levels range from entry level to independent contractor.

Growing Need for Security Analysts

Currently, it has been estimated that there are about 112,000 IT security analysts in the workforce, and the demand for IT security analysts is expected to grow by 32% from 2018 to 2028, resulting in an additional 35,500 jobs. The median annual pay for IT security analysts in 2018 was $98,350.

Sources: Bureau of Labor Statistics (2019) and EC-Council Certification (2019).

IT Job Prospects. In 2020, less than 2% of all IT workers in the United States are unemployed. Going forward, workers with specialized technical knowledge and strong communications and business skills, as well as those with an MBA with a concentration in an IT-related area, will have the best prospects. According to the Bureau of Labor Statistics (https://www.bls.gov), job openings will be the result of employment growth and the need to replace workers who transfer to other occupations or leave the labor force because they are reaching the retirement age.

Dow Chemical (www.dupont.com) set up its own social network to help managers identify the talent they need to carry out projects across its diverse business units and functions. To expand its talent pool, Dow extended the network to include former employees and retirees.

Other companies are using networks to tap external talent pools. These networks include online labor markets such as Amazon Mechanical Turk (https://www.mturk.com) and services such as InnoCentive (https://www.innocentive.com) that help solve business problems.

- Amazon Mechanical Turk is a marketplace for work that requires human intelligence. Its Web service enables companies to access a diverse, on-demand workforce.
- InnoCentive is an "open innovation" company that takes R&D problems in a broad range of areas such as engineering, computer science, and business and frames them as "challenge problems" for anyone to solve. It gives cash awards for the best solutions to solvers who meet the challenge criteria.

Becoming an Informed IT User

Informed user is a person knowledgeable about information systems and IT.

Knowing how best to use IT and how and when to interact with IT personnel, and they with you, will help you perform better at home and at work and enable you to become an **informed user** of technology.

The department or functional area that handles the collection, processing, storing, analysis, and distribution of information using a computer-based tool can be referred to by many names—some companies refer to it as information technology (IT), while others refer to it as information systems (IS), management information systems (MIS), IT support, IT services, or computer information systems (CIS). Whatever the name, its purpose is the same—to support a company's information needs by developing, operating, securing, and maintaining one or more information systems.

To become an informed IT user, you will learn how the six components of an information system—hardware, software, procedures, people, networks, and data—interact to provide you with the information that you need, when you need it, and in the format you need. These IT components will be discussed in detail in Chapter 2.

By reading this book, you will not only learn about the many aspects of IT acquisition, use, operation, and maintenance and how IT impacts organizations, but you will also become an informed IT user to improve your on-the-job performance and widen your career opportunities. For example, you will

- Understand how using IT can improve organizational performance
- Understand how and why IT can benefit organizational growth
- Understand how business can use IT to enhance the customer experience
- Understand how companies use IT to analyze business data and offer important insights
- Be able to offer input into the development and use of IT
- Be able to recommend and select IT applications at work
- Know how to find emerging technologies to make radical improvement in business processes
- Understand how IT can facilitate teamwork and improve individual productivity
- Appreciate the importance of ethical behavior when using IT and explain the associated risks and responsibilitiesFoster your entrepreneurial tendencies to start your own on-demand business.

Questions

1. How does IT enable business process engineering?
2. Is on-demand work a viable option for you? Explain.
3. What types of IT careers have the most potential in the current hiring market?
4. Why is IT a major enabler of business performance and success?
5. Why do you think it is beneficial to hold an IT certification?
6. Why do you think IT job prospects are so strong? Explain.
7. Why is important for you to be an "informed user" of IT?

Chapter Summary

LO1.1 ***Define*** the differences between the on-demand and sharing economies and the six business objectives IT should focus on to enhance organizational performance, growth, and sustainability.

The on-demand economy is the economic activity created by technology companies that fulfill individual consumer demands through the immediate provisioning of products and services. In the sharing economy, goods or services are *shared* between private individuals through an online company or organization.

The six business objectives that IT should focus on are as follows:

1. **Product development** to help businesses respond quickly to changing customer demands
2. **Stakeholder integration** to communicate with shareholders, research analysts, and others in the market
3. **Process improvement** to increase efficiency and cost-effectiveness of internal business processes
4. **Cost efficiencies** to reduce transaction and implementation costs
5. **Competitive advantage** to bring a product to market cost-effectively and quickly
6. **Globalization** to stay in contact with its global employees, customers, and suppliers 24/7

LO1.2 ***Explain*** the role of IT in improving business processes. Understand the concepts of business process reengineering and competitive advantage.

Outdated and complex application architectures, with a mix of interfaces, can delay or prevent the release of new products and services, and maintaining these obsolete systems absorbs large portions of the IT budget. As a result, managers and entrepreneurs must integrate digital disruptive technology into their products and services to improve their business processes and stay competitive. BPR is the concept of using IT to radically improve processes rather than simply making incremental positive changes. Competitive advantage is when an organization differentiates itself by charging less and creating and delivering better quality products or services than its competitors.

LO1.3 ***Describe*** how IT is disrupting the way that companies operate, the IT megatrends that are driving organizational performance, growth, and sustainability and how COVID-19 is accelerating digital transformation.

Disruptive technology has a powerful impact on people, business, government, entertainment, and society. IT enables leading companies to change their business models, business processes, customer experiences, and ways of working. Through examples of innovative products, services, and distribution channels, the digital revolution is currently shaping the future of business, the economy, and society and how it is changing management careers. IT megatrends that are driving performance, growth, and sustainability in organizations include connectivity, big data and data analytics, digitization, artificial intelligence and robotics, machine-to-machine learning, and IoT.

The COVID-19 pandemic has significantly accelerated the rate of digital transformation in public and private companies around the globe. In response to the unexpected events of the pandemic, companies in all industry sectors have had to act much more quickly to create new business models that address the regulatory requirements of COVID-19 lockdowns and ensuing health and safety concerns and new purchasing habits of consumers, vendors and partners. They have achieved this primarily by integrating new innovative information and communication technologies into their business models to increase personal engagement with consumers, vendors and partners, maintain a competitive advantage in the market and safeguard their sustainability.

LO1.4 ***Discuss*** what it means to be an "informed user" of IT and the ways in which IT can add value to your career path and job performance.

As an informed user, people have a better understanding of where IT fits in management today and are able to keep up with changes in IT as they evolve. Consequently, they will be better equipped to make recommendations about the adoption and productive use of new technologies at work or when starting their own business. Many career opportunities are available in the IT world that are either managerial or technical in their focus. People who choose not to take up IT jobs can still add significant value to their career and overall quality of life by just learning technology terminology and how to use technology to improve their work performance and overall quality of life.

Key Terms

big data 16
business model 7
business process 11
business process management (BPM) 13
business process reengineering (BPR) 12
cloud computing 16
cloud services 19
competitive advantage 10
critical success factor (CSF) 12
cross-functional business process 11
customer experience 8
cycle time 12
dashboards 17
data analytics 8
deliverables 10
digital business model 7
digitization 16
formal 11
informal 11
informed user 26
Internet of Things (IoT) 17
IT architecture 4
legacy systems 4
machine-to-machine (M2M) technology 17
mega trends 16
on-demand economy 6
sharing economy 6
social–mobile–analytics–cloud (SMAC) 15
standard operating procedures (SOPs) 11
technology platform 9
technology stack 9
unstructured data 16

Assuring Your Learning

Discuss: Critical Thinking Questions

1. Why are businesses experiencing a digital transformation?

2. More data are collected in a day now than existed in the world 10 years ago. What factors have contributed to this volume of data?

3. Assume you had no smartphone, other mobile device, or mobile apps to use for 24 hours. How would that mobile blackout disrupt your ability to function?

4. Name three highly disruptive digital technologies. Give an example of one disruption for each technology.

5. Why are enterprises adopting cloud computing?

6. What is the value of M2M technology? Give two examples.

7. Starbucks monitors tweets and other sources of big data. How might the company increase revenue from big data analytics?

8. Select three companies in different industries, such as banking, retail store, supermarket, airlines, or package delivery, that you do business with. What digital technologies does each company use to engage you, keep you informed, or create a unique customer experience? How effective is each use of digital technology to keeping you a loyal customer?

9. Describe two examples of the influence of SMAC on the financial industry.

10. What is the potential impact of the IoT on the health-care industry?

11. Why does reducing the cycle time of a business process also help to reduce errors?

12. Research firm Gartner defines competitive advantage as a difference between a company and its competitors *that matters to customers*. Describe one use of M2M technology that could provide a manufacturer with a competitive advantage.

13. What IT careers are forecasted to be in high demand? Explain why.

14. Why or how would understanding the latest IT trends influence your career?

Explore: Online Exercises

1. Research the growing importance of the IoT. Find two forecasts of its growth. What do they forecast?

2. Go to "9 Successful Digital Disruption Examples" (https://www.itbusinessedge.com/slideshows/9-successful-digital-disruption-examples.html) on the IT Business Edge website. Close the pop-up to view the slideshow and read the descriptions of each of the ways in which technology is disrupting our lives. Answer the following questions:

a. Which of the disruptions resonated best with you and your lifestyle? Explain.

b. Which of the disruptions was most surprising to you? Why?

c. Rank order the disruptions in their order of importance to you. Write a short report explaining your rankings.

3. Go to "The Impact of COVID-19 on digital transformation" (https://v2.itweb.co.za/event/itweb/the-impact-of-covid-19-on-digital-transformation/) and watch a webinar of your choice. Write a short narrative in which you describe the content of the webinar and discuss how it helped you understand how companies' must digitally transform during and after the COVID-19 pandemic.

Analyze & Decide: Apply IT Concepts to Business Decisions

1. A transportation company is considering investing in a truck tire with embedded sensors. Outline the benefits of this investment. Would this investment create a long-term competitive advantage for company?

2. Visit the website of UPS (https://www.ups.com/us/en/global.page), Federal Express (https://www.fedex.com/en-us/home.html), and one other logistics and delivery company.

a. At each site, describe what information is available to customers before and after they send a package.

b. Compare the customer experiences of these three companies. Which one do you prefer? Why?

c. Based on your experiences, if you want to send a package to another country, which company would you use? Why?

3. Visit Dell.com (https://www.dell.com/en-us) and Apple.com (https://www.apple.com/mac) to simulate buying a laptop computer. Compare and contrast the selection process, degree of customization, and other buying features. What factors are preventing companies from entering into this market, based on what you learned from this exercise?

Reinforce: Ensure Your Understanding of the Key Terms

Solve the online crossword provided for this chapter.

Web Resources

More resources and study tools are located on the student website. You'll find useful Web links and self-test quizzes that provide individualized feedback.

Case 1.2

Business Case: The IoT Comes to Sports

People love sports statistics and the more the better. Responding to this customer demand, the NFL and other sports agencies increased the quality and quantity of statistics available to coaches and fans with radio frequency identification (RFID) chips and football helmets designed to guard against brain injuries.

Player RFID Project

When the New England Patriots hosted the Pittsburgh Steelers in their season opener a few years back, each player was equipped with a set of RFID sensors. Each sensor, about the size of a quarter, will be embedded in players' shoulder pads and emits a unique radio frequency. Every stadium used by the NFL will be equipped with 20 receivers to pick up the RFID signals and pinpoint every player on the field. It also records speed, distance traveled, acceleration in real time, and the direction the player is facing.

The NFL plans to use the data it collects to power an Xbox One and Windows NFL apps to allow fans to call up stats for each player tied into the highlight clips posted on the app. The data will also be fed to broadcasters, leveraged for in-stadium displays, and provided to coaching staff and players.

"We've always had these traditional NFL stats," says Matt Swensson, senior director of Emerging Products and Technology at the NFL. "The league has been very interested in trying to broaden that and bring new statistics to the fans. Along the way, there's been more realization about how the data can be leveraged to make workflow more efficient around the game."

Zebra Technologies Software Vendor

The NFL's technology partner in its IoT push was Zebra Technologies of Lincolnshire, Illinois.

Zebra was well known for its manufacturing and selling marking, tracking and printing technologies such as thermal barcode label and receipt printers, RFID smart label printer/encoders, and card and kiosk printers. As it moved into IoT and M2M applications, Zebra launched its MotionWorks Sports Solution, which powers the NFL IoT initiative. Zebra was able to develop RFID tags that blink up to 85 times per second to track motion of athletes in sub-seconds. Then it had to find a customer for the product—so it turned to the biggest fish in the pond—the NFL. Zebra trialed the tags by equipping more than 2,000 players, 18 NFL stadiums and officials, markers, and pylons. Over the course of the season, more than 1.7 billion sets of XY player coordinates were measured, transmitted, and stored during the games. Every stadium was connected to a command station in San Jose, California, that controls when the data are collected and where they are sent and stores them in the cloud.

The Need for the Right People

An important lesson that Zebra learned is that generic data scientists were not sufficient to gain insight into the data. Zebra needed football experts. "When you look at analytics in football, you really need people. We had to go out and hire football people. The analytics from manufacturing weren't the same as the analytics from football. We could see correlations in the data that seemed important and then found out they weren't. We had to bring in people that had the football expertise who could say 'Look, this is why it matters'," said Jill Stelfox, Zebra Technologies Vice President and General Manager, Location Solutions.

This IoT initiative has even been integrated into NFL's fantasy football offerings and college football.

New Developments—Helmet Sensors

The latest development in the use of this technology is in college football. College football programs across the United States are investing in new cutting-edge helmet technology to measure the hits players take during practice. The helmets have a set of sensors that record the hits taken by players in terms of G-forces, location, direction, and severity. Data from the hit are then sent to a handheld sensor used by training staff. Two types of helmets that are currently gaining favor with college football coaching staff are the Riddell InSite and VICIS Zero 1.

Questions

1. Why did NFL equip its players with RFID tags?
2. What factors contributed to the success of the IoT initiative at the NFL?
3. What are the benefits and drawbacks of using helmet sensors in college level sports?
4. What other types of IoT applications you think of that could be used in professional and college-level sports stadiums?

Sources: Compiled from Lee (2018), Macleod (2018), Moriarty (2018), http://www.riddell.com/insite, and https://vicis.com.

Case 1.3

Video Case: Creating a Digital Vision to Transform a Company and Improve the Customer Experience

Go to the website to view the video on how to create a vision for digital transformation of your company in which Dr. Jeanne Ross, Principal Research Scientist at the MIT Center for IS Research, discusses the need for companies to transform themselves by improving their customers' experience and remain competitive in the digital era. The video is accessible from https://www.techrepublic.com/videos/5-building-blocks-your-company-needs-for-successful-digital-transformation and runs for 5 minutes 15 seconds. After watching the video, answer the following questions:

Questions

1. Why is creating a clear vision of how a company will better engage with customers and solve their problems a major challenge for most companies?
2. What are the five building blocks of a digital transformation?
3. What was the most important thing that you learned from the video?

References

Basu, C. "The Six Important Business Objectives of Information Technology." *Chron*, 2017. http://smallbusiness.chron.com/six-important-business-objectives-information-technology-25220.html; Bolden-Barrett, V. "Research Debunks Myth that most Gig Workers Can't Find Full-Time Jobs." *HRDive*, June 26, 2019.

Bureau of Labor Statistics. *Occupational Outlook Handbook*. U.S. Department of Labor, 2019–2020.

Caballero, M. "Coke Acquires Costa Coffee for $5B." *Bevnet*, 2018.

Domat, C. "Uber's Fight Goes Global." *Global Finance,* 2018.

Doyle, A. "Important Business Intelligence Skills with Examples." *The Balance Careers*, February 5, 2020.

EC-Council Certification. "Hair on Fire? Polish Your Security Skills with CEH Certification." 2019. https://cert.eccouncil.org/certified--ethical-hacker.html.

Gartner Group. "Speed Up Your Digital Business Transformation." 2019. https://www.gartner.com/smarterwithgartner/speed-up--your-digital-business-transformation.

Goodison, D. "Global IT Salaries Hit New High: 2019 IT Skills and Salary Report." 2019. https://www.crn.com/news/global-it-salaries--hit-new-high-2019-it-skills-and-salary-report?itc=refresh.

Hammer, M. and J. Champy. "Re-engineering the Corporation: A Manifesto for Business Revolution." Updated and revised edition. Harper Business Essentials, 2006.

Hawkins, A. "The Ride-Sharing App That Beat Uber in China Is Available in English for the First Time." *The Verge*, 2017.

Henshall, A. "The Aggressive Processes Uber Is Using for Global Expansion." *Business 2 Community*, 2017.

Kappelman, L., R. Torres, E. McLean, C. Maurer, V. Johnson, and K. Kim. "The 2018 SIM IT Issues and Trends Study." *MIS Quarterly Executive*, 2019, *18*(1), Article 7.

Kroger. "Kroger's 2019 Sustainability Report." Available from www.sustainability.kroger.com. Accessed on May 23, 2020.

Ledsom, A. "Airbnb and Its Second Largest Global Market; Can France Rein the Travel Giant In? *Forbes*, 2019.

Lee, B. "How This New Football Helmet Is Designed to Protect the Train." *Forbes*, 2018.

MacIver, K. "Digital Business in an Era of Disruptive Innovation." *I-CIO.com*, November 2015.

MacIver, K. "Costa Coffee Brews a Fresh Digital Blend to Fuel Its Global Ambitions." *Intelligence for the CIO*, 2019.

Macleod, R. "New Football Helmet Sensors Monitor Brain Injuries." *The Global and Mail*, 2018.

Mitic, I. "Gig Economy Statistics 2020: The New Normal in the Workplace." *Fortunly*, May 19, 2020.

Moriarty, J. "Some College Football Teams Are Using Cutting-Edge Helmet Technology to Monitor Hit Data by Position." *SBNation*, 2018.

Muck, A. "From Blockbuster to Netflix: The History of Disruption in Entertainment." *Forbes*, June 5, 2017.

Overstreet, K. "The Future of the Sharing Economy in the COVID-19 Aftermath." *Archdaily*, August 14, 2020.

Pofeldt, E. "On-Demand Work: The New Social Safety Net." *Forbes*, February 21, 2017.

Romero, A. "Everything We Know About Netflix's 2019 Original Series." *Refinery* 29, April 20, 2019.

Sil, D. "97% Enterprises Claim COVID-19 Boosted Their Digital Transformation Efforts: Twilio Report." *Entrepreneur*, July 21, 2020.

Solomon, B. "How Airbnb Expanded to 190 Countries by Thinking Global." *Forbes*, 2016.

Spangler, T. "Are Americans Addicted to Smartphones?" *Variety*, November 14, 2018.

Tech Republic/ZDNet. "IT Jobs in 2020: A Leader's Guide." *ZDNet*, 2017. https://www.zdnet.com/article/the-10-it-jobs-that-will-be--most-in-demand-in-2020.

The Kroger Co. "Kroger to Outline Restock Kroger Growth Model at 2019 Investor Conference." Press Release 2018. Available from http://ir.kroger.com/file/Index?KeyFile=395518885. Accessed on May 23, 2020.

U.S. Bureau of Labor Statistics. "Computer and Information Technology Occupations." 2019. https://www.bls.gov/ooh/computer-and--information-technology/home.htm.

Wood, Z. and M. Sweney. "Coca-Cola Buys Costa Coffee from Whitbread for £3.9bn." *The Guardian*, August 31, 2018.

Zappa, J. "Kroger CEO Offers Closer Look at Grocery Giant's Tech Innovation at NRF 2019." *Street Fight*, January 21, 2019.

CHAPTER **2**

Information Systems, IT Infrastructure, and the Cloud

CHAPTER OUTLINE	LEARNING OBJECTIVES
Case 2.1 Opening Case: The Amazing Story of Tommy Flowers—Creator of the First Programmable Computer	
2.1 IS Concepts and Classifications	**2.1 Identify** the six components of an information system, the various types of information systems to the level of support needed, and the difference between data, information, knowledge, and wisdom.
2.2 IT Infrastructure, IT Architecture, and Enterprise Architecture	**2.2 Describe** IT infrastructure, IT architecture, and enterprise architecture (EA) and their roles in guiding IT growth and sustaining long-term performance and growth.
2.3 Data Centers and Cloud Computing	**2.3 Understand** the different types of data centers, cloud computing and cloud services, and how they each add value to an organization.
2.4 Virtualization and Virtual Machines	**2.4 Describe** the different types of virtualization and the ways in which an organization can benefit from it.
Case 2.2 Business Case: Grupo AGORA Upgrades IT to Quench the Thirst of Millions Throughout Spain	

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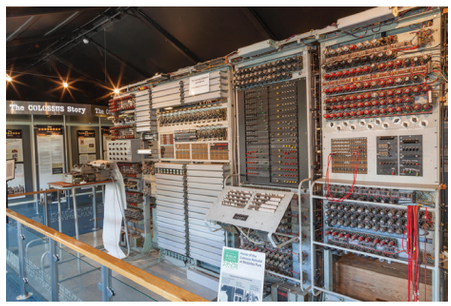
Case 2.1 Opening Case The Amazing Story of Tommy Flowers—Creator of the First Programmable Computer

The History Collection/Alamy Stock Photo



Steve Vidler/Alamy Stock Photo

MGPhoto76/Alamy Stock Photo

If you were asked to name the father of computing you'd probably say, Alan Turing. And, if you were asked to name the first programmable computer, you'd say ENIAC. In each case you would be wrong! To find out why, we need to go back in history to the Allied Forces D-Day Landings of WWII.

On June 6, 1944 Allied Forces landed on the beaches of Normandy, France, and ended German domination in France during WWII. Known as Operation Overlord, the ambitious Allied Forces military operation engaged 150,000 troops from 12 countries, 5,000 ships, and 11,000 airplanes in what is still the largest recorded military operation in history.

The success of D-Day and other Allied operations during WWII can be attributed primarily to one man—telecom engineer and computer pioneer Tommy Flowers. Flowers designed and built Colossus, the world's first electronic programmable computer that broke complex German codes at lightning speed to enable the Allies to gain valuable military information and significantly shorten the duration of WWII.

The Father of Computing

Tommy Flowers was born in London's East End on December 22, 1905. At the age of 16, he began an apprenticeship in mechanical engineering and earned a bachelor's degree in electrical engineering at the University of London. In 1926, he joined the telecommunications branch of the General Post Office (GPO) and in 1930 he was moved to the research station at Dollis Hill on the northwest side of London and later to Bletchley Park in Buckinghamshire. Flowers was particularly interested in the use of electronics for telephone exchanges and by 1939, he was convinced that an all-electronic system was possible. This background in switching electronics would prove crucial for his computer design in WWII.

The First Electronic Programmable Computer

Flowers was initially asked to build a decoder for the Turing–Welchman relay-based Bombe system (https://www.tnmoc.org/bombe) designed to break Enigma codes used by the Germans to send messages within the Third Reich. However, when the Germans began to use the far more complicated Lorenz SZ rotor stream cipher machines, the Bombe system proved to be ineffective. Since the Germans changed their codes at midnight every day, it was essential codes were cracked within a relatively few hours. If not, the information gleaned by the Allies was useless. The Bombe system assisted by the Tunny and Heath Robinson machines (https://www.tnmoc.org/tunny-heath-robinson) could not decode the highly sophisticated Lorenz codes quickly enough for its results to be of use. So, Flowers proposed a radical new design—the use of valves rather than electromechanical switches. His new machine contained over 1,500 thermionic valves rather than the 150 valves used in the most complicated previous electronic device. This departure from electromechanical switches initially caused heated debate since glass valves had proved to be less reliable than the electromechanical switches currently in use. Using his knowledge of electronic switching, Flowers proved that large numbers of electronic circuits could be made to perform reliable calculations at speed by creating a stable environment where the system ran continuously, rather than turning it on and off. The innovative system also used one tape rather than two, thus saving more time by eliminating the need to synchronize the tapes.

Flowers had to use his own money to get the project off the ground when management at the Bletchley Park codebreaking center proved skeptical and encouraged Flowers to continue alone rather than prioritizing the project. Flowers' persistence paid off. He was soon assigned staff and priority access to resources that enabled his development of Colossus, the first electronic programmable computer.

How Does Colossus Work?

When Colossus began operating at Bletchley Park in February 1944, it ran a startling five times faster than its rival, the Heath Robinson electromechanical switch machine!

To decode the German High Command messages, a system of wheels on Colossus guided the single punched paper tape, containing the encrypted message, through an optical reader as a repetitive loop of punched paper tape in 5-bit teleprinter code. Characters on the tape were repeatedly read into Colossus at an astonishing rate of 5,000 characters per second.

When the paper tape was set up and the machine configured, it took no more than four hours to output the results of the statistical analysis of the message. These useable results, together with further work by the Bletchley Park codebreaker team, resulted in breaking the German Lorenz cipher to reveal the strategic message it disguised within an advantageous time frame.

Colossus in WWII and Beyond

On June 1, 1944, when Allied commanders were trying to determine when and where to launch Operation Overlord, a new version of Colossus that contained 2,500 valves and used shift registers to greatly increase processing speed, was pressed into service. Colossus II immediately provided vital intelligence regarding the D-Day landings.

On June 5, 1944, the almost instant information provided by Colossus revealed that Hitler was refusing to send troops into Normandy because he was convinced that any Allied landings would occur at Pas-de-Calais, almost 500 km north of the Normandy beaches. This information prompted Colonel Dwight D. Eisenhower, Commander-in-Chief of Operation Overlord, to immediately order the Allied Forces to land at Normandy the next day—June 6, 1944.

Colossus I and Colossus II continued providing vital intelligence until the end of the war and historians estimate that their use shortened WWII by as much as two years, saving thousands of lives. A total of 10 Colossus units were operational during World War II. All but 2 were dismantled after the war.

Years of Silence

During his lifetime, Flowers never received full recognition for his monumental accomplishments. Flowers' work during WWII was a closely guarded secret. It was tied to the Official Secrets Act administered by Britain's Secretary of Defense and all information related to his vital work for the war effort in WWII was kept secret until the late 1970s. At that time, Flowers was given limited permission to release a technical description of Colossus. The British Government didn't release any information about the functions that Colossus performed during WWII until June 2000, two years after Flowers died. Even Flowers' family didn't know the amazing achievements he had attained and the positive impact he had made on the duration of WWII. All Flowers was allowed to tell them was that his work was "secret and important."

Consequently, the nonclassified work of computer scientist and cryptanalyst, Alan Turing and the February 1946 public announcement of ENIAC, an electronic general-purpose computer designed by the U.S. Army's Ballistic Research Laboratory, led to their designation as firsts in the information technology field.

Recognition

Today, however, the place of Colossus as the first electronic programmable computer is assured, and Tommy Flowers, who was awarded the prestigious distinction of Member of the Order of the British Empire (MBE) for his groundbreaking work during WWII, has been officially acknowledged as the legitimate Father of Computing.

Tommy Flowers died on October 28, 1998 in London, England. He was 92 years old. Colossus II lives on through the Colossus II Rebuild, displayed in the original room where Colossus 9 stood during WII, at the National Museum of Computing (https://www.tnmoc.org/colossus) in Block H, Bletchley Park, Milton Keynes, England.

Questions

1. Why was Alan Turing's work acknowledged and Flowers' work was kept secret?
2. Why was it important that Flowers' work be kept secret?
3. How do you think Flowers came up with the idea to use electronic valves?
4. How did Colossus succeed in breaking the Lorenz codes where previous machines had failed?

Sources: Compiled from McFadden (2018), Centre for Computing (2019a,b), Crypto Museum (2019), and Sparks (2019).

DID YOU KNOW?

The cloud has dramatically changed how IT professionals go about provisioning the IT infrastructure and how app developers approach projects, collaborate on them, and create software.

Introduction

To stay ahead, corporate leaders are constantly seeking new ways to grow their business in the face of rapid technology changes, increasingly empowered consumers and employees, and ongoing changes in government regulation. To do this, they launch new business models and strategies. Because these new business models, strategies, and performance capabilities frequently result from advances in technology, the company's ability to leverage technological innovation over time depends on its approach to its IS and their IT infrastructure, architecture and enterprise architecture.

In this chapter, you will first be introduced to the six components of an IS. Next you will learn about the different categories of IS and in which level of the organization each category of IS is used to solve business problems in businesses of all sizes throughout the global economy. You will also begin to learn the terminology of IT and be able to define and differentiate between IT terms such as IT infrastructure, IT architecture, and enterprise architecture and learn how they are developed, operated, and evaluated. Finally, you will be introduced to the concepts of data centers, cloud computing, and cloud services and how their use improves the performance, growth, and sustainability of businesses around the globe. With this knowledge, you will be able to help your organization more effectively leverage its IT capabilities to achieve sustainable competitive advantage and growth and more effectively and efficiently use IT in your personal life.

2.1 IS Concepts and Classification

LO2.1 Identify *the six components of an information system, the various types of information systems to the level of support needed, and the difference between data, information, knowledge, and wisdom.*

As we begin to explore the value of information technology (IT) to an organization, it's useful to understand what IT is, what it does, what level of systems is typically put in place at different levels of an organization, and how it impacts an organization's performance, growth, and sustainability.

Information system (IS) is a combination of information technology and people's activities using technology to support business processes, operations, management, and decision-making at different levels of the organization.

First, let's look at the value that an **information system** can add in an organization. You probably already know that technology supports organizations and almost every business unit within an organization. The following three examples show how different business units in companies around the globe have improved their performance thanks to technology.

IT Adds Value

Marketing. Utilizing IBM software, Bolsa de Comercio de Santiago (https://sseinitiative.org/fact-sheet/bcs) a large stock exchange in Chile, can process its ever-increasing, high-volume trading in microseconds. The Chilean stock exchange system can do the detective work of analyzing current and past transactions and market information, learning, and adapting to market trends and connecting its traders to business information in real time. Immediate throughput in combination with analytics allows traders to make more accurate decisions.

Sales. Hospital readmissions are a leading topic of health-care policy and practice reform because they are common, costly, and potentially avoidable events. According to the *New England Journal of Medicine*, one in five patients suffers from preventable readmissions, which cost taxpayers over $17 billion a year. In the past, hospitals have been penalized for high readmission rates with cuts to the payments they receive from the government. To meet the current changes and future expectations, organizations are turning to IT for potential strategies to reduce readmissions. Using effective management information systems (MISs), the health-care industry can leverage unstructured information in ways not possible before, according to Matt McClelland, manager of information governance for Blue Cross Blue Shield of North Carolina (https://www.bluecrossnc.com). With proper support, information governance can bridge gaps among the needs to address regulation and litigation risk, generate increased sales and revenue, and cut costs and become more efficient. When performed correctly, information governance positively impacts every facet of business.

Operations Management. Most financial transactions in Ireland start or travel through the Allied Irish Bank (https://aib.ie). This means that AIB plays a major role not just in its customers' lives but also in the Irish economy at large. As such it is heavily intertwined with the Irish quality of life. To serve its constituents and country, AIB uses the agility of a state-of-the-art mainframe computer to deliver open banking and added functionality to make financial transactions from banking to mortgage loans easier, faster, and more secure. Innovative mainframe technology, such as the IBM Z platform, is pivotal to the successful operations at AIB in terms of performance and provides the "behind the scenes" power for its online banking operations.

In addition to supporting decision-making, coordination, and control in an organization, an IS helps managers and workers analyze problems, visualize complex sets of data, and create new products. ISs collect (**input**) and manipulate data (**processing**), and generate and distribute reports (**output**) based on data-specific IT services, such as processing customer orders and generating payroll. Finally, ISs save (**storage)** the data for future use. In addition to the four functions of **IPOS**, an information needs **feedback** from its users and other stakeholders to help improve future systems as demonstrated in **Figure 2.1**.

IPOS is the cycle of inputting, processing, outputting, and storing information in an information system.

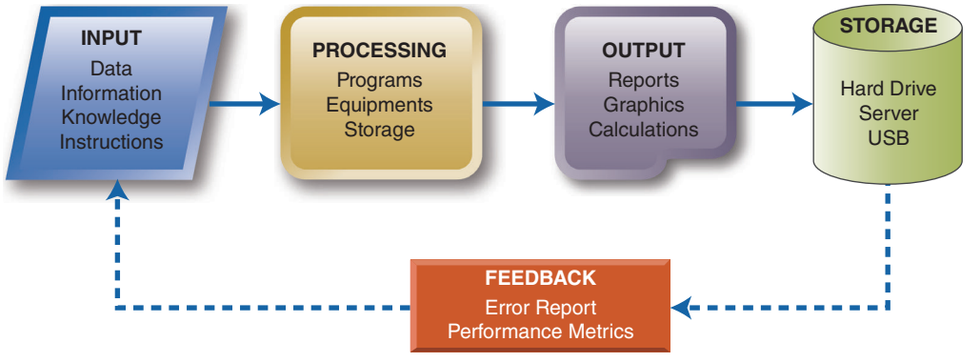


FIGURE 2.1 IPOS cycle.

The following example demonstrates how the components of the IPOS work together: To access a website, Amanda opens an Internet browser using the keyboard and enters a Web address into the browser (input). The system then uses that information to find the correct website (processing) and the content of the desired site is displayed in the Web browser (output). Next, Amanda bookmarks the desired website in the Web browser for future use (storage). The system then records the time it took to produce the output to compare actual versus expected performance (feedback).

Six Components of an IS

A computer IS consists of six interacting components. Regardless of type and where and by whom they are used within an organization, the components of an IS must be carefully managed to provide maximum benefit to the organization. Each of these IS components is shown in **Figure 2.2** and defined below.

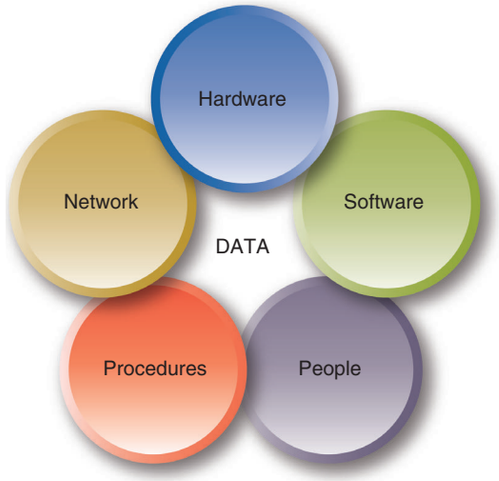


FIGURE 2.2 Components of an IS.

1. **Hardware** Any physical device used in a computerized IS. Examples include central processing unit (CPU), sound card, video card, network card, hard drive, display, keyboard, motherboard, processor, power supply, modem, mouse, and printer.
2. **Software** A set of machine-readable instructions (code) that makes up a computer application that directs a computer's processor to perform specific operations. Computer software is nontangible, contrasted with system hardware, which is the physical component of an IS. Examples include Internet browser, operating system (OS), Microsoft Office, Skype, and so on.
3. **People** Any person involved in developing, operating and using an IS. Examples include analysts, programmers, operators help desk, and end users.

4. **Procedures** Documentation containing directions on how to use the other components of an IS. Examples include operational manual and user manual.
5. **Network** A combination of lines, wires, and physical devices connected to each other to create a telecommunications network. In computer networks, networked computing devices exchange data with each other using a data link. The connections between nodes are established using either cable media or wireless media. Networks can be internal or external. If they are available only internally within an organization, they are called "intranets." If they are available externally, they are called "internets." The best-known example of a computer network is the World Wide Web.
6. **Data** Raw or unorganized facts and figures (such as invoices, orders, payments, customer details, product numbers, product prices) that describe conditions, ideas, or objects.

Data, Information, Knowledge, and Wisdom

As you can see in Figure 2.2, **data** is the central component of any information system. Without data, an IS would have no purpose and companies would find it difficult to conduct business. An IS processes data into meaningful **information** that is transformed into corporate **knowledge** and ultimately creates **wisdom** that fuels corporate strategy, as shown in **Figure 2.3**.

FIGURE 2.3 Examples of data, information, knowledge, and wisdom.

Data describe products, customers, events, activities, and transactions that are recorded, classified, and stored.

Information is data that have been processed, organized, or put into context so that they have meaning and value to the person receiving them.

Data are the raw material from which information is produced; the quality, reliability, and integrity of the data must be maintained for the information to be useful. Data are the raw facts and figures that are not organized in any way. Examples are the number of hours an employee worked in a certain week or the number of new Ford vehicles sold from the first quarter (Q1) of 2018 through the second quarter (Q2) of 2020 (Figure 2.3).

Information is an organization's most important asset, second only to people. Information provides the "who," "what," "where," and "when" of data in a given context. For example,