

BIDGOLI

MIS⁷

MANAGEMENT INFORMATION SYSTEMS

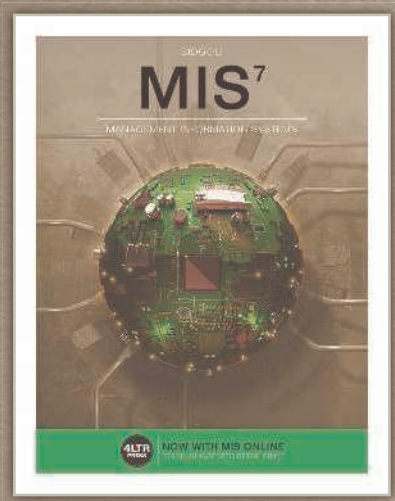


NOW WITH MIS ONLINE
\$75 US SUGGESTED RETAIL PRICE

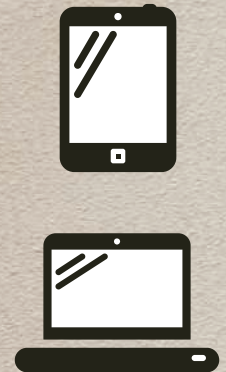
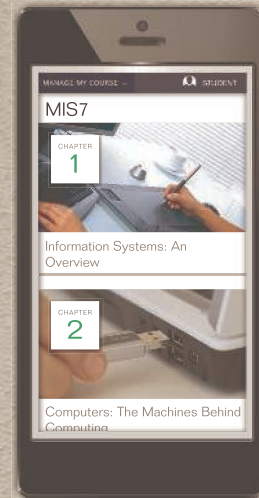
This is an electronic version of the print textbook. Due to electronic rights restrictions, some third party content may be suppressed. Editorial review has deemed that any suppressed content does not materially affect the overall learning experience. The publisher reserves the right to remove content from this title at any time if subsequent rights restrictions require it. For valuable information on pricing, previous editions, changes to current editions, and alternate formats, please visit www.cengage.com/highered to search by ISBN, author, title, or keyword for materials in your areas of interest.

Important notice: Media content referenced within the product description or the product text may not be available in the eBook version.

THE MIS SOLUTION



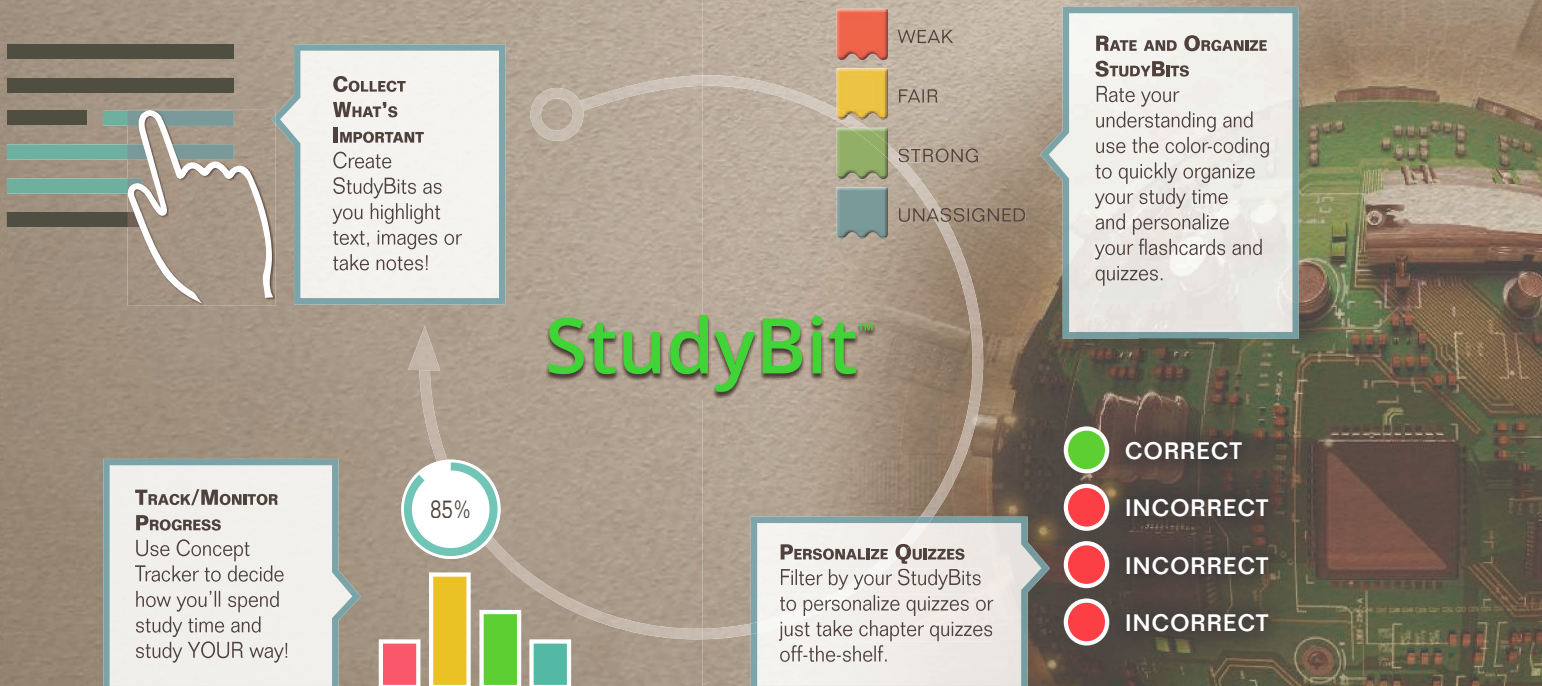
**Print
+
Online**



MIS⁷ delivers all the key terms and core concepts for the **Management Information Systems** course.

MIS Online provides the complete narrative from the printed text with additional interactive media and the unique functionality of **StudyBits**—all available on nearly any device!

What is a StudyBit™? Created through a deep investigation of students' challenges and workflows, the StudyBit™ functionality of **MIS Online** enables students of different generations and learning styles to study more effectively by allowing them to learn their way. Here's how they work:



MIS7**Hossein Bidgoli**

Vice President, General Manager: Liz Covello

Product Director, 4LTR Press: Steven E. Joos

Product Manager: Laura Redden

Content/Media Developer: Patricia Hempel

Product Assistant: Lauren Dame

Content Project Manager: Megan Guiliani

Manufacturing Planner: Ron Montgomery

Production Service: MPS Limited

Sr. Art Director: Bethany Casey

Cover Designer: Lisa Kuhn/ Curio Press, LLC

Internal Designer: Craig Ramsdell

Cover Image: Ryan Etter/Ikon Images/Getty images

Title Page & Back Cover Images: Oleksiy Mark /Shutterstock.com

Intellectual Property Analyst: Diane Garrity

Intellectual Property Project Manager:

Nick Barrows

Ad Images:

Computer and tablet illustration:

© iStockphoto.com/furtaev

Smart Phone illustration: © iStockphoto.com/dashadima

Crowd: Shutterstock.com/Rawpixel.com

To so many fine memories of my mother, Ashraf, my father, Mohammad, and my brother, Mohsen, for their uncompromising belief in the power of education.

–Hossein Bidgoli

© 2017, © 2016 Cengage Learning®

ALL RIGHTS RESERVED. No part of this work covered by the copyright herein may be reproduced or distributed in any form or by any means, except as permitted by U.S. copyright law, without the prior written permission of the copyright owner.

For product information and technology assistance, contact us at
Cengage Learning Customer & Sales Support, 1-800-354-9706

For permission to use material from this text or product,
submit all requests online at **www.cengage.com/permissions**

Further permissions questions can be emailed to

permissionrequest@cengage.com

Unless otherwise noted, all items © Cengage Learning®

Library of Congress Control Number: 2016949012

Student Edition ISBN: 978-1-305-66756-3

Student Edition with Online ISBN: 978-1-305-66757-0

Cengage Learning

20 Channel Center Street

Boston, MA 02210

USA

Cengage Learning is a leading provider of customized learning solutions with employees residing in nearly 40 different countries and sales in more than 125 countries around the world. Find your local representative at **www.cengage.com**

Cengage Learning products are represented in Canada by Nelson Education, Ltd.

To learn more about Cengage Learning Solutions, visit **www.cengage.com**

Purchase any of our products at your local college store or at our preferred online store **www.cengagebrain.com**



PART 1: FUNDAMENTALS OF INFORMATION SYSTEMS 2

- 1 Information Systems: An Overview 2
- 2 Computers: The Machines Behind Computing 24
- 3 Database Systems, Data Warehouses, and Data Marts 46
- 4 Personal, Legal, Ethical, and Organizational Issues of Information Systems 72
- 5 Protecting Information Resources 92

PART 2: DATA COMMUNICATION, THE INTERNET, E-COMMERCE, AND GLOBAL INFORMATION SYSTEMS 118

- 6 Data Communication: Delivering Information Anywhere and Anytime 118
- 7 The Internet, Intranets, and Extranets 144
- 8 E-Commerce 172
- 9 Global Information Systems 198

PART 3: IS DEVELOPMENT, ENTERPRISE SYSTEMS, MSS, AND EMERGING TRENDS 218

- 10 Building Successful Information Systems 218
- 11 Enterprise Systems 244
- 12 Management Support Systems 262
- 13 Intelligent Information Systems 284
- 14 Emerging Trends, Technologies, and Applications 306

Endnotes 330

Index 343

CONTENTS

Part 1

Fundamentals of Information Systems



wavebreakmedia/Shutterstock.com

1 Information Systems: An Overview 2

- 1-1 Computers and Information Systems in Daily Life 3**
 - Smartphones Everywhere and for Everything 4**
 - A New Era of Marketing: YouTube 5**
- 1-2 Computer Literacy and Information Literacy 6**
 - Social Networking and the Vulnerability of Personal Information 7**
- 1-3 The Beginning: Transaction-Processing Systems 7**
- 1-4 Management Information Systems 7**
- 1-5 Major Components of an Information System 8**
 - Information Technologies at Domino's Pizza 8**
 - 1-5a Data 9
 - 1-5b Database 9
 - 1-5c Process 9
 - 1-5d Information 10
 - 1-5e Examples of Information Systems 10
- 1-6 Using Information Systems and Information Technologies 11**
 - 1-6a The Importance of Information Systems 11
 - Information Technologies at The Home Depot 12**
 - Human Resource Information Systems in Action 13**
 - Information Technologies at UPS 13**
 - 1-6b Using Information Technologies for a Competitive Advantage 14

Information Technologies at Walmart 14

1-6c Porter's Five Forces Model: Understanding the Business Environment 15

Information Technologies at Netflix 17

Digital Innovation in Retail Industry Using Information Technologies 18

1-7 The IT Job Market 18

1-7a CTO/CIO 18

1-7b Manager of Information Systems Services 19

1-7c Systems Analyst 19

1-7d Network Administrator 19

1-7e Database Administrator 19

1-7f Computer Programmer 19

1-7g Webmaster 19

1-8 Outlook for the Future 19

Reviews and Discussions 21

Projects 21

Are You Ready to Move On? 22

Case Study 1-1: Using Information Technologies at Federal Express 22

Case Study 1-2: Mobile Technology: A Key Player for Future Shopping 23

2 Computers: The Machines Behind Computing 24

2-1 Defining a Computer 25

2-1a Components of a Computer System 26

2-2 The History of Computer Hardware and Software 28

IBM Watson: A Supercomputer with Artificial Intelligence Capabilities 29

2-3 The Power of Computers 29

2-3a Speed 29

2-3b Accuracy 30

2-3c Storage and Retrieval 30

2-4 Computer Operations 30

A Supercomputer in Your Pocket 31

2-5 Input, Output, and Memory Devices 31

2-5a Input Devices 31

Touchless Computing: The New Paradigm in User System Interface 32

2-5b Output Devices 32

2-5c Memory Devices 33

A Popular Application of Cloud Storage: Keeping Photos Online 35

- 2-6 Classes of Computers 36**
 - Popular iPad Business Applications 36**
 - Ubiquitous Computing 37**
 - 2-6a Server Platforms: An Overview 38*
- 2-7 What Is Software? 38**
 - 2-7a Operating System Software 38*
 - Google Docs: Applications and Challenges 38**
 - IOS: The Brain Behind Apple Devices 39**
 - 2-7b Application Software 39*
- 2-8 Computer Languages 42**
- Reviews and Discussions 44**
- Projects 44**
- Are You Ready to Move On? 44**
- Case Study 2-1: Become Your Own Banker 45**
- Case Study 2-2: iPads: New Productivity Tools for Service Workers 45**

3 Database Systems, Data Warehouses, and Data Marts 46

- 3-1 Databases 47**
 - 3-1a Types of Data in a Database 48*
 - BI in Action: Law Enforcement 49**
 - 3-1b Methods for Accessing Files 50*
- 3-2 Logical Database Design 50**
 - 3-2a The Relational Model 51*
- 3-3 Components of a DBMS 53**
 - 3-3a Database Engine 53*
 - Graph Databases Move Relational Databases One Step Forward 54**
 - 3-3b Data Definition 54*
 - 3-3c Data Manipulation 54*
 - 3-3d Application Generation 55*
 - 3-3e Data Administration 55*
- 3-4 Recent Trends in Database Design and Use 56**
 - 3-4a Data-Driven Web Sites 56*
 - 3-4b Distributed Databases 56*
 - 3-4c Object-Oriented Databases 57*
 - Data Warehouse Applications at Marriott International 58**

- 3-5 Data Warehouses 58**
 - 3-5a Input 58*
 - 3-5b ETL 59*
 - 3-5c Storage 59*
 - 3-5d Output 60*
 - Data Mining and Airline Industries 62**
- 3-6 Data Marts 62**
 - Mobile Analytics in Action: AIRBNB 63**
- 3-7 Business Analytics 63**
 - Predictive Analytics in Action 64**
- 3-8 The Big Data Era 64**
 - 3-8a Who Benefits from Big Data? 65*
 - 3-8b Tools and Technologies of Big Data 65*
 - 3-8c Big Data Privacy Risks 65*
 - Big Data in Action 66**
- 3-9 Database Marketing 66**
 - Database Marketing in Action: Caterpillar Corporation 67**
- Reviews and Discussions 68**
- Projects 69**
- Are You Ready to Move On? 69**
- Case Study 3-1: Data Mining Helps Students Enroll in Courses with Higher Chances of Success 70**
- Case Study 3-2: Data Mining Tools at Pandora Radio 70**

4 Personal, Legal, Ethical, and Organizational Issues of Information Systems 72

- 4-1 Privacy Issues 72**
 - Social Networking Sites and Privacy Issues 73**
 - Employee Monitoring: Improving Productivity or Invasion of Privacy 74**
 - 4-1a E-mail 76*
 - E-Mail and Corporate Data Leakage 77**
 - 4-1b Data Collection on the Web 77*
 - Facebook Experiments: Marketing Tools or Unethical Behavior? 78**
- 4-2 Ethical Issues of Information Technologies 78**
 - Ten Commandments of Computer Ethics 79**
 - 4-2a Censorship 80*
 - Internet Censorship: A Global Problem 81**

4-2b Intellectual Property 81

Software Piracy: A Global Problem 82

Verizon's Cybersquatting Suit 83

4-2c Social Divisions and the Digital Divide 83

4-3 The Impact of Information Technology in the Workplace 83

The Digital Divide in Action 84

4-3a Information Technology and Health Issues 85

Health and Social Issues of Online Gaming 86

4-4 Green Computing 86

Reviews and Discussions 88

Projects 88

Are You Ready to Move On? 89

Case Study 4-1: Telecommuting with a New Twist 89

Case Study 4-2: Privacy and Other Legal Issues at Google 90

5 Protecting Information Resources 92

5-1 Risks Associated with Information Technologies 93

5-1a The Costs of Cyber Crime to the U.S. Economy 93

5-1b Spyware and Adware 94

5-1c Phishing and Pharming 94

5-1d Keystroke Loggers 94

5-1e Sniffing and Spoofing 94

5-1f Computer Crime and Fraud 94

Challenges of Insiders' Threats 95

Identity Theft at Internal Revenue Service 96

5-2 Computer and Network Security: Basic Safeguards 96

Types of Hackers 97

5-3 Security Threats: An Overview 98

5-3a Intentional Threats 98

Nearly All Organizations Get Hacked 99

Protecting Against Data Theft and Data Loss 101

Social Engineering Costs Ubiquiti Networks more than \$39 million 102

5-4 Security Measures and Enforcement: An Overview 102

5-4a Biometric Security Measures 102

5-4b Nonbiometric Security Measures 103

Biometrics at Phoebe Putney Memorial Hospital 104

5-4c Physical Security Measures 106

Lost and Stolen Laptops 107

5-4d Access Controls 107

5-4e Virtual Private Networks 108

5-4f Data Encryption 109

5-4g E-Commerce Transaction Security Measures 110

5-4h Computer Emergency Response Team 111

5-5 Guidelines for a Comprehensive Security System 112

Sarbanes-Oxley and Information Security 112

5-5a Business Continuity Planning 113

Reviews and Discussions 115

Projects 115

Are You Ready To Move On? 116

Case Study 5-1: Vulnerabilities of Medical Devices 116

Case Study 5-2: Data Breach at Home Depot 117

Part 2

Data Communication, the Internet, E-Commerce, and Global Information Systems



6 Data Communication: Delivering Information Anywhere and Anytime 118

6-1 Defining Data Communication 119

6-1a Why Managers Need to Know About Data Communication 120

GoToMeeting: Example of an E-collaboration Tool 120

6-2 Basic Components of a Data Communication System 121

6-2a Sender and Receiver Devices 121

6-2b Modems 121

6-2c Communication Media 122

- Google Invests in Communication Media 123**
- 6-3 Processing Configurations 123**
 - 6-3a Centralized Processing 123
 - 6-3b Decentralized Processing 124
 - 6-3c Distributed Processing 124
 - 6-3d Open Systems Interconnection Model 124
- 6-4 Types of Networks 125**
 - 6-4a Local Area Networks 125
 - 6-4b Wide Area Networks 126
 - 6-4c Metropolitan Area Networks 126
- 6-5 Network Topologies 126**
 - 6-5a Star Topology 127
 - 6-5b Ring Topology 128
 - 6-5c Bus Topology 128
 - 6-5d Hierarchical Topology 129
 - 6-5e Mesh Topology 129
- 6-6 Major Networking Concepts 129**
 - 6-6a Protocols 130
 - 6-6b Transmission Control Protocol/Internet Protocol 130
 - 6-6c Routing 130
 - 6-6d Routers 131
 - 6-6e Client/Server Model 131
- 6-7 Wireless and Mobile Networks 133**
 - Mobile Computing and Mobile Apps 135**
 - 6-7a Wireless Technologies 135
 - 6-7b Mobile Networks 136
 - Mobile Computing in Action: The Apple iPhone 137**
- 6-8 Wireless Security 137**
 - Privacy and Ethical Issues of Wireless Devices 138**
 - Telepresence: A New Use of Data Communication and Convergence 139**
- 6-9 Convergence of Voice, Video, and Data 139**
- Reviews And Discussions 141**
- Projects 141**
- Are You Ready To Move On? 142**
- Case Study 6-1: Data Communication at Walmart 142**
- Case Study 6-2: Protecting the Security and Privacy of Mobile Devices 143**

7 The Internet, Intranets, and Extranets 144

- 7-1 The Internet and the World Wide Web 145**
 - Major Events in the Development of the Internet 147**
 - 7-1a The Domain Name System 148

What Is HTML? 149

7-1b Types of Internet Connections 149

7-2 Navigational Tools, Search Engines, and Directories 150

7-2a Navigational Tools 150

7-2b Search Engines and Directories 150

7-3 Internet Services 152

7-3a E-Mail 152

7-3b Newsgroups and Discussion Groups 152

7-3c Instant Messaging 152

7-3d Internet Telephony 153

7-4 Web Applications 154

7-4a Tourism and Travel 154

7-4b Publishing 154

7-4c Higher Education 154

7-4d Real Estate 155

7-4e Employment 155

7-4f Financial Institutions 155

7-4g Software Distribution 156

7-4h Health Care 156

Electronic Health Records Pays Off for Kaiser Permanente 156

7-4i Politics 157

The Internet in 2020 157

7-5 Intranets 158

7-5a The Internet vs. Intranets 159

7-5b Applications of an Intranet 159

7-6 Extranets 159

7-7 New Trends: The Web 2.0 and Web 3.0 Eras 161

7-7a Blogs 161

7-7b Wikis 162

7-7c Social Networking Sites 162

LinkedIn: A Professional Social Networking Site 163

7-7d Business Application of Social Networks 163

Social Media Applications at Walmart 164

7-7e RSS Feeds 164

7-7f Podcasting 165

7-7g The Internet2 165

Twitter: Real-time Networking with Your Followers 166

7-8 The Internet of Everything and Beyond 166

The Internet of Everything in Action 168

Reviews and Discussions 169

Projects 169

Are You Ready to Move On? 170

Case Study 7-1: Scotts Miracle-Gro's Intranet: The Garden 170

Case Study 7-2: Social Networking in Support of Small Businesses 171

8 E-Commerce 172

8-1 Defining E-Commerce 173

8-1a *The Value Chain and E-Commerce* 173

Twitter Helps Businesses Find Customers 175

Showrooming and Webrooming 175

8-1b *E-Commerce vs. Traditional Commerce* 176

8-1c *Advantages and Disadvantages of E-Commerce* 176

The Home Depot Gets Into E-Commerce 177

8-1d *E-Commerce Business Models* 177

E-Commerce in 2020 178

8-2 Major Categories of E-Commerce 179

8-2a *Business-to-Consumer E-Commerce* 179

8-2b *Business-to-Business E-Commerce* 180

8-2c *Consumer-to-Consumer E-Commerce* 180

8-2d *Consumer-to-Business E-Commerce* 180

8-2e *Government and Nonbusiness E-Commerce* 180

E-gov in Action: City of Louisville, Kentucky 181

8-2f *Organizational or Intra-business E-Commerce* 181

8-3 B2C E-Commerce Cycle 181

8-4 B2B E-Commerce: A Second Look 182

8-4a *Major Models of B2B E-Commerce* 182

E-Procurement at Schlumberger 183

B2B E-Commerce Growth and Best Practices 184

Mobile Commerce in Action: The Fast Food Restaurants 185

8-5 Mobile and Voice-Based E-Commerce 185

8-6 E-Commerce Supporting Technologies 186

8-6a *Electronic Payment Systems* 186

Challenges in using Mobile Payment Systems 187

8-6b *Web Marketing* 188

8-6c *Mobile Marketing* 189

Mobile Marketing at Starbucks 189

Challenges in Using Digital Ads 190

8-6d *Search Engine Optimization* 190

8-7 E-commerce and Beyond: Social Commerce 190

Social Commerce at Coca-Cola Company 191

8-8 Hyper Social Organizations 192

Hyper Social Organization in Action: Spotify 193

Reviews and Discussions 195

Projects 195

Are You Ready to Move On? 195

Case study 8-1: Widespread Applications of Mobile Ads 196

Case study 8-2: Bridging the Gap Between E-Commerce and Traditional Commerce 197

9 Global Information Systems 198

9-1 Why Go Global? 199

9-1a *E-Business: A Driving Force* 200

Global Information Systems at Rohm & Haas 200

9-1b *Growth of the Internet* 201

9-1c *The Rise of Non-English Speakers on the Internet* 201

9-1d *Mobile Computing and Globalization* 201

Making a Company Web site Global 202

9-2 Global Information Systems: An Overview 202

9-2a *Components of a Global Information System* 203

The Internet and Globalization in Action 204

9-2b *Requirements of Global Information Systems* 204

Video Conferencing Systems Support Globalization 205

Globalization in Action: Alibaba 206

9-2c *Implementation of Global Information Systems* 207

9-3 Organizational Structures and Global Information Systems 207

9-3a *Multinational Structure* 207

9-3b *Global Structure* 208

9-3c *International Structure* 209

9-3d *Transnational Structure* 209

Global Information System at FedEx 210

9-3e *Global Information Systems Supporting Offshore Outsourcing* 210

9-4 Obstacles to Using Global Information Systems 211

9-4a *Lack of Standardization* 211

9-4b *Cultural Differences* 212

9-4c *Diverse Regulatory Practices* 212

9-4d *Poor Telecommunication Infrastructures* 212

Privacy Law Differences between the United States and Europe Union 213

9-4e *Lack of Skilled Analysts and Programmers* 213

Reviews and Discussions 214

Projects 215

Are You Ready to Move On? 215

Case study 9-1: Global Information Systems at Toyota Motor Company 216

Case study 9-2: Information Technologies Support Global Supply Chain 216

Part 3

IS Development, Enterprise Systems, MSS, and Emerging Trends



10 Building Successful Information Systems 218

- 10-1 Systems Development Life Cycle: An Overview 219**
- 10-2 Phase 1: Planning 220**
 - 10-2a Formation of the Task Force 221*
 - 10-2b Feasibility Study 222*
 - A Feasible Project Becomes Unfeasible 223**
 - HealthCare.gov: Feasibility Issues 225**
- 10-3 Phase 2: Requirements Gathering and Analysis 225**
- 10-4 Phase 3: Design 228**
 - 10-4a Computer-Aided Systems Engineering 228*
 - 10-4b Prototyping 228*
- 10-5 Phase 4: Implementation 230**
 - 10-5a IT Project Management 230*
 - 10-5b Request for Proposal 232*
 - Failed Order Management System at Avon 233**
 - 10-5c Implementation Alternatives 234*
- 10-6 Phase 5: Maintenance 235**
 - Top 10 Outsourcing Destinations in 2014 236**
- 10-7 New Trends in Systems Analysis and Design 236**
 - 10-7a Service-Oriented Architecture 236*
 - 10-7b Rapid Application Development 237*

Extreme Programming in Action 237

10-7c Extreme Programming 237

10-7d Agile Methodology 238

Agile Methodology at HomeAway, Inc. 239

Reviews and Discussions 240

Projects 240

Are You Ready to Move On? 241

Case study 10-1: Systems Development At SEB Latvia 241

Case study 10-2: Crowdsourcing Pays Off 242

11 Enterprise Systems 244

11-1 Supply Chain Management 245

Supply Chain Management at Coca-Cola Company 247

11-1a SCM Technologies 247

11-2 Customer Relationship Management 251

11-2a CRM Applications 252

CRM at Delta Air Lines 253

11-2b Personalization Technology 253

Amazon's Personalization Assists its Sellers on its Marketplace 255

11-3 Knowledge Management 255

Knowledge Management in Action 256

11-4 Enterprise Resource Planning 257

ERP Streamlines Operations at Naghi Group 258

Reviews and Discussions 259

Projects 260

Are You Ready to Move On? 260

Case Study 11-1: ERP at Johns Hopkins Institutions 261

Case Study 11-2: CRM at Starbucks 261

12 Management Support Systems 262

12-1 Types of Decisions in an Organization 263

12-1a Phases of the Decision-Making Process 264

12-2 Decision Support Systems 266

12-2a Components of a Decision Support System 266

12-2b DSS Capabilities 267

12-2c Roles in the DSS Environment 267

12-2d Costs and Benefits of Decision Support Systems 268

12-3 Executive Information Systems 269

Decision Support Systems at Family Dollar 270

- 12-3a Reasons for Using EISs 270
- 12-3b Avoiding Failure in Design and Use of EISs 271
- 12-3c EIS Packages and Tools 271

12-4 Group Support Systems 272

Executive Information Systems at Hyundai Motor Company 273

Microsoft Office SharePoint Server: A New Type of Groupware 274

12-4a Groupware 274

Groupware and Health IT 275

Remote Collaboration with Google Apps for Work 275

12-4b Electronic Meeting Systems 276

12-4c Advantages and Disadvantages of GSSs 276

New Generations of Electronic Meeting Systems 276

12-5 Geographic Information Systems 277

12-5a GIS Applications 278

GISs for Fighting Disease 279

12-6 Guidelines for Designing a Management Support System 279

Reviews and Discussions 281

Projects 281

Are You Ready to Move On? 281

Case Study 12-1: UPS Deploys Routing Optimization with a Big Payoff 282

Case Study 12-2: GPS Technology and Analytics Combat Crimes 282

13 Intelligent Information Systems 284

13-1 What Is Artificial Intelligence? 285

Computers Understanding Common Sense 286

13-1a AI Technologies Supporting Decision Making 286

13-1b Robotics 287

13-2 Expert Systems 288

Medical Robotics in Action 289

13-2a Components of an Expert System 289

13-2b Uses of Expert Systems 291

Expert Systems in Baltimore County Police Department 292

13-2c Criteria for Using Expert Systems 292

13-2d Criteria for Not Using Expert Systems 292

13-2e Advantages of Expert Systems 293

13-3 Case-Based Reasoning 293

13-4 Intelligent Agents 293

13-4a Shopping and Information Agents 294

13-4b Personal Agents 294

Intelligent Agents in Action 295

13-4c Data-Mining Agents 295

13-4d Monitoring and Surveillance Agents 295

13-5 Fuzzy Logic 296

13-5a Uses of Fuzzy Logic 296

13-6 Artificial Neural Networks 297

Fuzzy Logic in Action 297

Neural Networks in Microsoft and the Chicago Police Department 298

13-7 Genetic Algorithms 298

13-8 Natural-Language Processing 299

NLP in Action: The Healthcare Industry 300

13-9 Integrating AI Technologies into Decision Support Systems 300

AI Technologies for Decision Making 301

13-10 Contextual Computing: Making Mobile Devices Smarter 301

Contextual Computing in Action 302

Reviews And Discussions 303

Projects 303

Are You Ready to Move On? 304

Case Study 13-1: AI-Based Software Helps Businesses Better Understand Customers 304

Case Study 13-2: NLP: Making a Smartphone Smarter 305

14 Emerging Trends, Technologies, and Applications 306

14-1 Trends in Software and Service Distribution 307

14-1a Pull and Push Technologies 307

14-1b Application Service Providers 308

14-2 Virtual Reality 309

14-2a Types of Virtual Environments 310

14-2b Components of a Virtual Reality System 311

14-2c CAVE 311

14-2d Virtual Reality Applications 312

Virtual Reality at Lockheed Martin 313

14-2e Obstacles in Using VR Systems 313

14-2f Virtual Worlds 313

14-2g Augmented Reality 315

14-3 Radio Frequency Identification: An Overview 315

14-3a RFID Applications 316

Coca-Cola Company Uses RFID-Based Dispensers for Generating BI 316

14-4 Quick Response Codes 317

QR Codes in Action 318

14-5 Biometrics: A Second Look 318

Face Recognition Technology in Action 319

14-6 Trends in Networking 319

14-6a Wi-Fi 319

14-6b WiMAX 320

14-6c Bluetooth 320

14-6d Grid Computing 320

14-6e Utility (On-Demand) Computing 321

14-6f Cloud Computing 322

Cloud Computing in Support of Small Businesses 323

14-7 Nanotechnology 325

Reviews and Discussions 326

Projects 327

Are You Ready to Move On? 327

Case Study 14-1: Cloud Computing at Intercontinental Hotels Group (IHG) 328

Case Study 14-2: RFID at Macy's Department Store 328

Endnotes 330

Index 343

1 | Information Systems: An Overview

LEARNING OUTCOMES

After studying this chapter, you should be able to:

- 1-1 Discuss common applications of computers and information systems.
- 1-2 Explain the differences between computer literacy and information literacy.
- 1-3 Define transaction-processing systems.
- 1-4 Define management information systems.
- 1-5 Describe the four major components of an information system.
- 1-6 Discuss the differences between data and information.
- 1-7 Explain the importance and applications of information systems in functional areas of a business.
- 1-8 Discuss how information technologies are used to gain a competitive advantage.
- 1-9 Explain the Five Forces Model and strategies for gaining a competitive advantage.
- 1-10 Review the IT job market.
- 1-11 Summarize the future outlook of information systems.

After you finish
this chapter,
go to **PAGE 21**
for the **STUDY**
TOOLS

© Max Sattana/Shutterstock.com

Organizations use computers and information systems to reduce costs and gain a competitive advantage in the marketplace.

This chapter starts with an overview of common uses for computers and information systems, explains the difference between computer literacy and information literacy, and then reviews transaction-processing systems as one of the earliest applications of information systems. Next, the chapter discusses the components of a management information system (MIS), including data, databases, processes, and information, and then delves into how information systems relate to information technologies. This chapter also covers the roles and applications of information systems and explains the Five Forces Model



used to develop strategies for gaining a competitive advantage. Finally, the chapter reviews the IT job market and touches on the future of information systems.

1-1

COMPUTERS AND INFORMATION SYSTEMS IN DAILY LIFE

Organizations use computers and information systems to reduce costs and gain a competitive advantage in the marketplace. Throughout this book, you will study many information system applications. For now, you will look at some common applications used in daily life.

Computers and information systems are all around you. As a student, you use computers and office suite software and might take online classes. Computers are often

used to grade your exam answers and generate detailed reports comparing the performance of each student in your class. Computers and information systems also calculate grades and GPAs and can deliver this information to you.

Computers and information systems are commonly used in grocery and retail stores as well. For example, a point-of-sale (POS) system speeds up service by reading the universal product codes (UPCs) on items in your

Exhibit 1.1 A point-of-sale system



© hin255/Shutterstock.com

shopping cart (see Exhibit 1.1). This same system also manages store inventory, and some information systems can even reorder stock automatically. Banks, too, use computers and information systems for generating your monthly statement, running ATM machines, and for many other banking activities.

and they can improve the user's efficiency. The information box below highlights several popular applications of smartphones.

The Internet is used for all kinds of activities, from shopping to learning to working. Search engines and broadband communication bring information to

SMARTPHONES EVERYWHERE AND FOR EVERYTHING

With the growing number of apps available for both iPhones and Android phones, individuals and businesses are using their smartphones as a productivity tool and as an intelligent assistant for all sorts of activities. Here are few popular examples:

Group texting app GroupMe is used for sending a message to a group of employees or customers. Samsung iPolis app, a video camera security system, is used to remotely watch the video that monitors the location of a business or home. Apps are available to pay bills, update a company's Web site, market and advertise a product or service, reach out to customers, and keep in touch with employees from anywhere. Some businesses give out the Google Voice phone number to customers so that they can text an order. Google's calendar is used to coordinate events, and Instagram is used to post photos of new merchandise.¹

According to Massimo Marinucci, the owner and president of The Wine Connection, a \$20 million business with six employees, the iPhone does nearly everything for business that a desktop used to do. Using their iPhones, employees check inventory, view sales for the day, run reports, print, change prices, and change inventory quantities. The new POS app allows customers to buy immediately as soon as a new wine becomes available.²

Starwood Hotels & Resorts Worldwide, Inc., plans to offer customers of two of its hotels in Harlem, NY, and Cupertino, CA, a virtual key. Guests can bypass the crowded check-in desk and enter their rooms using their smartphones. Guests receive a message on Starwood's app which will unlock their rooms with a tap or twist of their smartphones, using Bluetooth technology. Marriott International, Inc., also does mobile check-ins at some of their hotels. Loyalty program customers can check in via their smartphones and then go to a separate check-in desk to pick up a key.³

Exhibit 1.2 Examples of smartphones



© Nucleartist/Shutterstock.com

your desktop in seconds. The Internet is also used for social purposes. With social networking sites—such as Facebook, Twitter, Google+, LinkedIn, and Foursquare—you can connect with friends, family, and colleagues online and meet people with similar interests

and hobbies. Twitter (www.twitter.com), for example, is a social networking and short-message service. Users can send and receive brief text updates, called tweets. These posts are displayed on one's profile page, and other users can sign up to have them delivered to their in-boxes. As an example, the author of this textbook sends daily tweets that consist of links to current articles about information systems applications, new developments, breaking news, IT jobs, and case examples. You can read these tweets in Twitter, Facebook, or LinkedIn.

Organizations also use social networking sites to give customers up-to-date information and how-to support via videos. These sites can reduce organizations' costs by providing an inexpensive medium for targeting a large customer base.

In addition, people use video-sharing sites to watch news, sporting events, and entertainment videos. One of the most popular sites is YouTube (www.youtube.com). You can upload and share video clips via Web sites, mobile devices, blogs, and e-mail. Users upload most of the content on YouTube, although media corporations such as CBS, BBC, Sony Music Group, the Sundance Channel, and others also provide content.

A NEW ERA OF MARKETING: YOUTUBE

Companies use newspapers, magazines, TV shows, and search engines to promote their products, services, and brands. YouTube is a popular video-sharing service that can be used as a marketing tool. The videos on YouTube are very well indexed and organized. They are categorized and sorted by "channels." The channels range from film and animation to sports, short movies, and video blogging. Individual YouTube users have used this marketing tool to share videos and stories. One of the popular applications is watching how-to videos for repairing cars, home appliances, and so forth. Corporations can also take advantage of this popular platform. YouTube represents a great opportunity for marketers to reach consumers who are searching for information about a brand or related products and services. It can also be used as a direct marketing tool. The following are examples of corporations that are using YouTube to promote their products and services:

Quiksilver—This manufacturer of apparel and accessories, including the Roxy brand, frequently posts new videos of its products, continually renewing its Web presence.

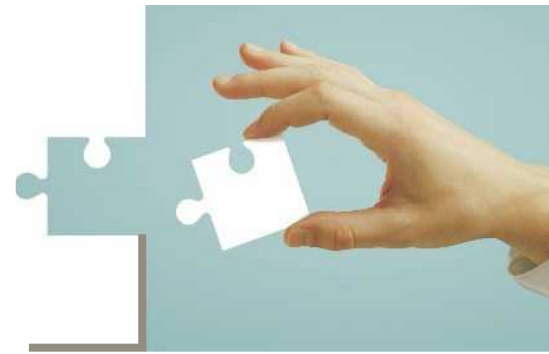
Ford Models—Since 2006, it has uploaded over 554 videos promoting its brand.

University of Phoenix Online—This site has hundreds of video testimonials, reviews, and documentaries that promote the university's degree programs.

The Home Depot—Here you will find free content, including practical knowledge and money-saving tips for home improvements.

Nikefootball—Nike maintains several distinct YouTube channels that cater to specific audiences. Consumers can find content that is relevant to their needs without having to sift through everything.^{4,5}

In the 21st century, knowledge workers need two types of knowledge to be competitive in the workplace: computer literacy and information literacy.



and productively, no matter what profession they choose. In addition, these workers will be able to connect to the rest of the world to share information, knowledge, videos, ideas, and almost anything else that can be digitized. Throughout this book, these opportunities, as well as the power of computers and information systems, are explored.

As you read, keep in mind that the terms *information systems* and *information technologies* are used interchangeably. Information systems are broader in scope than information technologies, but the two overlap in many areas.

Anyone can watch videos on YouTube, but you must register to upload videos. (This book has a YouTube channel on which you can watch many practical videos related to information systems.) Businesses are increasingly using YouTube to promote their products and services. See the information box on the previous page, which highlights a few such companies.

So what do all these examples mean to you? Computers and information technology will help the knowledge workers of the future perform more effectively

Both are used to help organizations be more competitive and to improve their overall efficiency and effectiveness. Information technologies offer many advantages for improving decision making but involve some challenges, too, such as security and privacy issues. The information box on the next page describes one of the potential challenges.

1-2

COMPUTER LITERACY AND INFORMATION LITERACY

In the 21st century, knowledge workers need two types of knowledge to be competitive in the workplace: computer literacy and information literacy. **Computer literacy** is skill in using productivity software, such as word processors, spreadsheets, database management systems, and presentation software, as well as having a basic knowledge of hardware and software, the Internet, and collaboration tools and technologies. **Information literacy**, on the other hand, is understanding the role of information in generating and using business intelligence. **Business intelligence (BI)**

Computer literacy is skill in using productivity software, such as word processors, spreadsheets, database management systems, and presentation software, as well as having a basic knowledge of hardware and software, the Internet, and collaboration tools and technologies.

Information literacy is understanding the role of information in generating and using business intelligence.

Business intelligence (BI) provides historical, current, and predictive views of business operations and environments and gives organizations a competitive advantage in the marketplace.

SOCIAL NETWORKING AND THE VULNERABILITY OF PERSONAL INFORMATION

The popularity of social networking sites such as Facebook, Twitter, Google+, and Foursquare is on the rise. As of September 30, 2015, Facebook had over 1.55 billion monthly active users, and the number is increasing on a daily basis.⁶ But so is the potential risk. According to an InfoWorld study published on May 4, 2010, over half of all users of social networks in this country are putting themselves at risk by posting information that could be misused by cybercriminals. Many social networkers post their full birth dates, their home addresses, photos of themselves and their families, and the times when they will be away from home. This information could be used by cybercriminals for malicious purposes. According to the report, 9 percent of the 2,000 people who participated in the study had experienced some kind of computer-related trouble, such as malware infections, scams, identity theft, or harassment. To reduce risk and improve the privacy of your personal information, the study offers several tips:⁷

- Always use the privacy controls offered by the social networking sites.
- Use long passwords (8 characters or longer) that mix uppercase and lowercase letters with numbers and symbols.
- Do not post a phone number or a full address.
- Do not post children's names, even in photo tags or captions.
- Do not be specific when posting information about vacations or business trips.

is more than just information. It provides historical, current, and predictive views of business operations and environments and gives organizations a competitive advantage in the marketplace. (BI is discussed in more detail in Chapter 3.) To summarize, knowledge workers should know the following:

- Internal and external sources of data
- How data is collected
- Why data is collected
- What type of data should be collected
- How data is converted to information and eventually to business intelligence
- How data should be indexed and updated
- How data and information should be used to gain a competitive advantage

1-3 THE BEGINNING: TRANSACTION-PROCESSING SYSTEMS

For the past 60 years, **transaction-processing systems (TPSs)** have been applied to structured tasks such as record keeping, simple clerical operations, and inventory control. Payroll, for example, was one of the first applications to be automated. TPSs focus on data collection and processing, and they have provided enormous reductions in costs.

Computers are most beneficial in transaction-processing operations. These operations are repetitive, such as printing numerous checks, or involve enormous volumes of data, such as inventory control in a multinational textile company. When these systems are automated, human involvement is minimal. For example, in an automated payroll system, there is little need for managerial judgment in the task of printing and sending checks, which reduces personnel costs.

1-4 MANAGEMENT INFORMATION SYSTEMS

A **management information system (MIS)** is an organized integration of hardware and software technologies, data, processes, and human elements designed to produce timely, integrated, relevant, accurate, and useful information for decision-making purposes.

Transaction-processing systems (TPSs) focus on data collection and processing; the major reason for using them is cost reduction.

A **management information system (MIS)** is an organized integration of hardware and software technologies, data, processes, and human elements designed to produce timely, integrated, relevant, accurate, and useful information for decision-making purposes.

The hardware components, which are discussed in more detail in Chapter 2, include input, output, and memory devices and vary depending on the application and the organization. MIS software, also covered in Chapter 2, can include commercial programs, software developed in-house, or both. The application or organization determines the type of software used. Processes are usually methods for performing a task in an MIS application. The human element includes users, programmers, systems analysts, and other technical personnel. This book emphasizes users of MISs.

In designing an MIS, the first task is to clearly define the system's objectives. Second, data must be collected and analyzed. Finally, information must be provided in a useful format for decision-making purposes.

Many MIS applications are used in both the private and public sectors. For example, an MIS for inventory control provides data (such as how much of each product is on hand), what items have been ordered, and what items are back-ordered. Another MIS might forecast sales volume for the next fiscal period. This type of system uses recent historical data and mathematical or statistical models to generate the most accurate forecast, and sales managers can use this information

for planning purposes. In the public sector, an MIS for a police department, for example, could provide information such as crime statistics, crime forecasts, and allocation of police units. Management can examine these statistics to spot increases and decreases in crime rates or types of crimes and analyze this data to determine future deployment of law enforcement personnel.

As you will see in this book, many organizations use information systems to gain a competitive advantage. The information box on Domino's Pizza describes one example of this. (*Note:* MISs are often referred to as just *information systems*, and these terms are used interchangeably in this book.)

1-5

MAJOR COMPONENTS OF AN INFORMATION SYSTEM

In addition to hardware, software, and human elements, an information system includes four major components, which are discussed in the following sections: data, a database, a process, and information (see Exhibit 1.3).⁸

INFORMATION TECHNOLOGIES AT DOMINO'S PIZZA

In 1960, Domino's Pizza opened its first store. Today, there are nearly 11,000 stores, half of them outside the United States. In 2007, Domino's started online and mobile ordering. Today, customers can order online at www.dominos.com or they can use apps for the iPhone, Android, or Kindle Fire.⁹ This allows them to customize their pizzas with any combination of ingredients, enhancing their sense of participation while also saving Domino's the labor costs associated with phone orders. After placing the order, the customer can track it all the way to when it is sent out for delivery, keeping an eye on an estimated delivery time.

In 2012, for the first time, Domino's surpassed \$1 billion in annual sales through its Web site, proving that electronic sales will continue to play a large role in the company's success.¹⁰

At Domino's, online ordering seamlessly accomplishes multiple objectives without the customer even taking notice. First, it creates the feeling among customers that they are an active part of the pizza-making process. Second, it results in greater efficiency at the various stores because employees do not have to spend as much time taking orders. They merely need to prepare the orders, which appear in an instant order queue, with all the customers' specifications.

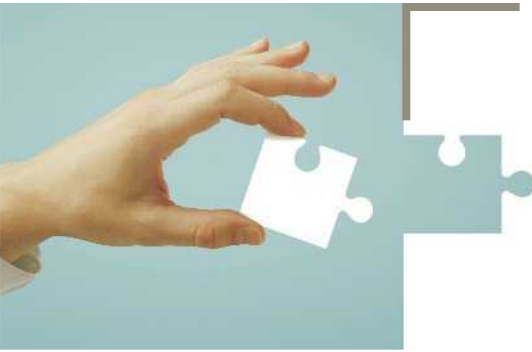
Domino's now has the ability to store its online orders in its database. This data can then be used for many purposes, including target marketing and deciding which pizzas to offer in the future. The company is also actively using social media, including Facebook and Twitter, to promote its products and gather customers' opinions.

In 2014, Domino's began allowing customers to order pizza using a voice app called "Dom," powered by Nuance Communications. It enables users of iOS and Android devices to place orders using their voices.

Twitter is now a part of the ordering system at Domino's. As of May 2015, U.S. customers can order pizza by tweeting a pizza emoji.¹¹



© Susan Montgomery/Shutterstock.com



If an organization has defined its strategic goals, objectives, and critical success factors, then structuring the data component to define what type of data is collected and in what form is usually easy.

1-5a Data

The **data** component of an information system is considered the input to the system. The information that users need affects the type of data that is collected and used. Generally, there are two sources of data: external and internal. An information system should collect data from both sources, although organizational objectives and the type of application also determine what sources to use. Internal data includes sales records, personnel records, and so forth. The following list shows some examples of external data sources:

- Customers, competitors, and suppliers
- Government agencies and financial institutions
- Labor and population statistics
- Economic conditions

Typically, data has a time orientation, too. For example, past data is collected for performance reports, and current data is collected for operational reports. In addition, future data is predicted for budgets or cash flow reports. Data can also be collected in different forms, such as aggregated (e.g., subtotals for categories of information) or disaggregated (e.g., itemized lists). An organization might want disaggregated data to analyze sales by product, territory, or salesperson. Aggregated data can be useful for reporting overall performance during a particular sales quarter, for example, but it limits the ability of decision makers to focus on specific factors.

If an organization has defined its strategic goals, objectives, and critical success factors, then structuring the data component to define what type of data is collected and in what form is usually easy. On the other hand, if there are conflicting goals and objectives or the company is not aware of critical success factors, many problems in data collection can occur, which affects an information system's reliability and effectiveness.

1-5b Database

A **database**, the heart of an information system, is a collection of all relevant data organized in a series of integrated files. (You learn more about databases in Chapter 3.) A comprehensive database is essential for the success of any information system. To create, organize, and manage databases, a database management system (DBMS) is used, such as Microsoft Access or FileMaker Pro for home or small-office use. In a large organization, a DBMS such as Oracle or IBM DB2 might be used.

Databases are also important for reducing personnel time needed to gather, process, and interpret data manually. With a computerized database and a DBMS, data can be treated as a common resource that is easy to access and use.

1-5c Process

The purpose of an information system's **process** component is generating the most useful type of information for making decisions. This component generally

Exhibit 1.3

Major components of an information system



Data consists of raw facts and is a component of an information system.

A **database** is a collection of all relevant data organized in a series of integrated files.

The **process** component of an information system generates the most useful type of information for decision making, including transaction-processing reports and models for decision analysis.