

BIDGOLI

STUDENT EDITION **5**

MIS

ISBN-10: 0-13-035957-1 \$69.95 US

4LTR
PRESS

Management Information Systems



Online Resources:

-  **Interactive eBook**
-  **Flashcards**
-  **Quizzing**
-  **NEW Trackable Activities**

4LTR Press uses a **Student-Tested, Faculty-Approved** process to meet the unique needs of each course. Here are the results for the **Management Information Systems** course:

Students Say

Students taking their first MIS course need a comprehensive view of the activities, applications, and issues that businesses face regarding information systems. Students requested current examples from a wide variety of industries and wanted to see how real businesses are incorporating information systems into their operations.

Instructors Require

MIS5 offers today's most current IS statistics, hardware, software, and applications. The textbook and digital supplements employ state-of-the-art coverage of the subject through numerous practical applications and offers emerging cases from the information systems field that will engage students.

Delivers

MIS5 is a visually engaging textbook with up-to-date examples, both in print, on CourseMate, and through its social media sites. CourseMate includes an interactive eBook, autograded quizzes, flashcards, games, videos and more. Author Hossein Bidgoli provides a daily article link on current MIS topics via Facebook (4LTR Press for MIS) and Twitter (@4LTRPress_MIS)

YOUR FEEDBACK MATTERS.



Follow us at
www.facebook.com/4ltrpress

THE MIS SOLUTION

MIS

STUDENT RESOURCES

- Interactive eBook
- Graded Quizzes
- New Practice Quiz Generator
- New Trackable Activities
- Flashcards
- Videos
- Games
- Case Studies
- Review Cards

Students sign in at www.cengagebrain.com

INSTRUCTOR RESOURCES

- All Student Resources
- Engagement Tracker
- LMS Integration
- Instructor's Manual
- Test Bank
- PowerPoint® Slides
- Instructor Prep Cards
- Discussion Questions
- Online Supplemental Chapters

Instructors log in at www.cengage.com/login



Print

MIS5 delivers all the key terms and all the content for the **Management Information Systems** course through a visually-engaging and easy to reference print experience.

CourseMate

CourseMate provides access to the full **MIS5** narrative, alongside a rich assortment of quizzing, flashcards, and interactive resources for convenient reading and studying.

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.

MISS**Hossein Bidgoli**Vice President, General Manager:
Neil Marquardt

Product Director: Steve Joos

Product Manager: Laura Redden

Content Developer: Adam Goetz

Product Assistant: Mandira Jacob

Marketing Manager: Eric La Scola

Content Project Manager: Darrell E. Frye

Media Developer: Tricia Hempel

Manufacturing Planner: Ron Montgomery

Production Service: Integra Software
Services Pvt. Ltd

Sr. Art Director: Stacy Jenkins Shirley

Internal and Cover Designer: Craig Ramsdell

Cover Image: © AzmanJaka/iStock Photo

Intellectual Property

Analyst: Sara Crane

Project Manager: Kathryn Kucharek

Internal Ads:

© iStockphoto.com/A-Digit | © Cengage
Learning 2011

© Go Media | © Cengage Learning 2011

© iStockphoto.com/A-Digit | © Cengage
Learning 2011

Common Art: © iStockphoto.com/hrstklkr

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

© 2015, 2014 Cengage Learning

WCN: 02-200-203

ALL RIGHTS RESERVED. No part of this work covered by the copyright herein may be reproduced, transmitted, stored, or used in any form or by any means graphic, electronic, or mechanical, including but not limited to photocopying, recording, scanning, digitizing, taping, Web distribution, information networks, or information storage and retrieval systems, except as permitted under Section 107 or 108 of the 1976 United States Copyright Act, without the prior written permission of the publisher.

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

Library of Congress Control Number: 2014945778

Student Edition ISBN: 978-1-285-83646-1

Student Edition with CourseMate PAC ISBN: 978-1-285-83645-4

Cengage Learning20 Channel Center Street
Boston, MA 02210
USA

Cengage Learning is a leading provider of customized learning solutions with office locations around the globe, including Singapore, the United Kingdom, Australia, Mexico, Brazil, and Japan. Locate your local office at:
www.cengage.com/global

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 22
- 3 Database Systems, Data Warehouses, and Data Marts 44
- 4 Personal, Legal, Ethical, and Organizational Issues of Information Systems 66
- 5 Protecting Information Resources 84

PART 2: DATA COMMUNICATION, THE INTERNET, E-COMMERCE, AND GLOBAL INFORMATION SYSTEMS 110

- 6 Data Communication: Delivering Information Anywhere and Anytime 110
- 7 The Internet, Intranets, and Extranets 136
- 8 E-Commerce 162
- 9 Global Information Systems 182

PART 3: IS DEVELOPMENT, ENTERPRISE SYSTEMS, MSS, AND EMERGING TRENDS 200

- 10 Building Successful Information Systems 200
- 11 Enterprise Systems 224
- 12 Management Support Systems 242
- 13 Intelligent Information Systems 262
- 14 Emerging Trends, Technologies, and Applications 282

Endnotes 304

Index 313

CONTENTS

Part 1

Fundamentals of Information Systems



© iStockphoto.com/Baranoztemir

1 Information Systems: An Overview 2

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

Information Technologies at Walmart 13

- 1-6c Porter's Five Forces Model: Understanding the Business Environment 14

Information Technologies at Netflix 16

1-7 The IT Job Market 16

- 1-7a CTO/CIO 17
- 1-7b Manager of Information Systems Services 17
- 1-7c Systems Analyst 17
- 1-7d Network Administrator 17
- 1-7e Database Administrator 17
- 1-7f Computer Programmer 17
- 1-7g Webmaster 17

1-8 Outlook for the Future 17

Key Terms 19

Reviews and Discussions 19

Projects 19

Are You Ready to Move On? 20

Case Study 1-1: Using Information Technologies at Federal Express 20

Case Study 1-2: Mobile Technology: A Key Player for Future Shopping 21

2 Computers: The Machines Behind Computing 22

2-1 Defining a Computer 23

- 2-1a Components of a Computer System 24

2-2 The History of Computer Hardware and Software 26

IBM Watson Wins Jeopardy 27

2-3 The Power of Computers 27

- 2-3a Speed 27
- 2-3b Accuracy 28
- 2-3c Storage and Retrieval 28

2-4 Computer Operations 28

2-5 Input, Output, and Memory Devices 29

- 2-5a Input Devices 29

Touchless Computing: The New Paradigm in User System Interface 30

- 2-5b Output Devices 30
- 2-5c Memory Devices 31

- 2-6 Classes of Computers 33**
 - Popular iPad Business Applications 34**
 - Ubiquitous Computing 34**
 - 2-6a *Server Platforms: An Overview 35*
- 2-7 What Is Software? 35**
 - 2-7a *Operating System Software 35*
 - Google Docs: Applications and Challenges 35**
 - 2-7b *Application Software 36*
 - iOS: The Brain Behind Apple Devices 36**
- 2-8 Computer Languages 38**
- Key Terms 40**
- Reviews and Discussions 40**
- Projects 40**
- Are You Ready to Move On? 41**
- Case Study 2-1: Become Your Own Banker 41**
- Case Study 2-2: Laptop Versus Tablet: Which One to Buy? 42**

3 Database Systems, Data Warehouses, and Data Marts 44

- 3-1 Databases 45**
 - 3-1a *Types of Data in a Database 47*
 - BI in Action: Law Enforcement 47**
 - 3-1b *Methods for Accessing Files 48*
- 3-2 Logical Database Design 48**
 - 3-2a *The Relational Model 50*
- 3-3 Components of a DBMS 51**
 - 3-3a *Database Engine 52*
 - 3-3b *Data Definition 52*
 - 3-3c *Data Manipulation 52*
 - 3-3d *Application Generation 53*
 - 3-3e *Data Administration 53*
- 3-4 Recent Trends in Database Design and Use 53**
 - 3-4a *Data-Driven Web Sites 53*
 - 3-4b *Distributed Databases 54*
 - 3-4c *Object-Oriented Databases 54*
- 3-5 Data Warehouses 55**
 - Data Warehouse Applications at Marriott International 56**

- 3-5a *Input 57*
- 3-5b *ETL 57*
- 3-5c *Storage 57*
- 3-5d *Output 57*

Data Mining and Airline Industries 59

- 3-6 Data Marts 59**
- 3-7 Business Analytics 60**
 - Predictive Analytics in Action 60**
- 3-8 The Big Data Era 61**
 - 3-8a *Who Benefits from Big Data? 61*
 - 3-8b *Tools and Technologies of Big Data 61*
- Big Data in Action 62**

Key Terms 63

Reviews and Discussions 63

Projects 64

Are You Ready to Move On? 64

Case Study 3-1: Data Mining Helps Students Enroll in Courses with Higher Chances of Success 65

Case Study 3-2: Data Mining Tools at Pandora Radio 65

4 Personal, Legal, Ethical, and Organizational Issues of Information Systems 66

- 4-1 Privacy Issues 66**
 - Social Networking Sites and Privacy Issues 67**
 - Employee Monitoring: Improving Productivity or Invasion of Privacy 68**
 - 4-1a *E-mail 70*
 - E-Mail and Corporate Data Leakage 71**
 - 4-1b *Data Collection on the Web 71*
- 4-2 Ethical Issues of Information Technologies 72**
 - Unethical Issues at the News of the World 72**
 - Ten Commandments of Computer Ethics 73**
 - 4-2a *Censorship 74*
 - 4-2b *Intellectual Property 75*
 - Verizon's Cybersquatting Suit 76**
 - 4-2c *Social Divisions and the Digital Divide 76*
- 4-3 The Impact of Information Technology in the Workplace 77**
 - 4-3a *Information Technology and Health Issues 78*

Health and Social Issues of Online Gaming 79

4-4 Green Computing 79

Key Terms 81

Reviews and Discussions 81

Projects 81

Are You Ready to Move On? 82

Case Study 4-1: Telecommuting with a New Twist 82

Case Study 4-2: Privacy and Other Legal Issues at Google 83

5 Protecting Information Resources 84

5-1 Risks Associated with Information Technologies 85

5-1a *The Costs of Cyber Crime to the U.S. Economy* 85

5-1b *Spyware and Adware* 86

5-1c *Phishing and Pharming* 86

5-1d *Keystroke Loggers* 86

5-1e *Sniffing and Spoofing* 86

5-1f *Computer Crime and Fraud* 87

Identity Theft at The Internal Revenue Service 87

Types of Hackers 88

5-2 Computer and Network Security: Basic Safeguards 88

Nearly All Organizations Get Hacked 88

5-3 Security Threats: An Overview 90

5-3a *Intentional Threats* 90

Protecting against Data Theft and Data Loss 93

5-4 Security Measures and Enforcement: An Overview 94

5-4a *Biometric Security Measures* 94

5-4b *Nonbiometric Security Measures* 94

Biometrics at Phoebe Putney Memorial Hospital 94

5-4c *Physical Security Measures* 97

Lost and Stolen Laptops 99

5-4d *Access Controls* 99

5-4e *Virtual Private Networks* 100

5-4f *Data Encryption* 100

5-4g *E-Commerce Transaction Security Measures* 102

5-4h *Computer Emergency Response Team* 102

5-5 Guidelines for a Comprehensive Security System 103

Sarbanes-Oxley and Information Security 103

5-5a *Business Continuity Planning* 104

Key Terms 106

Reviews and Discussions 106

Projects 106

Are You Ready To Move On? 107

Case Study 5-1: Computer Viruses Target Medical Devices 107

Case Study 5-2: Security Breach at Sony's Playstation Network 108

Part 2

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



6 Data Communication: Delivering Information Anywhere and Anytime 110

6-1 Defining Data Communication 111

6-1a *Why Managers Need to Know About Data Communication* 112

GoToMeeting: Example of an E-Collaboration Tool 112

6-2 Basic Components of a Data Communication System 113

6-2a *Sender and Receiver Devices* 113

6-2b *Modems* 113

6-2c *Communication Media* 114

6-3 Processing Configurations 115

6-3a *Centralized Processing* 115

6-3b *Decentralized Processing* 115

- 6-3c *Distributed Processing* 115
- 6-3d *Open Systems Interconnection Model* 116
- 6-4 Types of Networks 117**
 - 6-4a *Local Area Networks* 117
 - 6-4b *Wide Area Networks* 118
 - 6-4c *Metropolitan Area Networks* 118
- 6-5 Network Topologies 119**
 - 6-5a *Star Topology* 119
 - 6-5b *Ring Topology* 120
 - 6-5c *Bus Topology* 120
 - 6-5d *Hierarchical Topology* 120
 - 6-5e *Mesh Topology* 121
- 6-6 Major Networking Concepts 121**
 - 6-6a *Protocols* 121
 - 6-6b *Transmission Control Protocol/Internet Protocol* 121
 - 6-6c *Routing* 122
 - 6-6d *Routers* 123
 - 6-6e *Client/Server Model* 123
- 6-7 Wireless and Mobile Networks 126**
 - Mobile Computing and Mobile Apps 127**
 - 6-7a *Wireless Technologies* 127
 - 6-7b *Mobile Networks* 128
 - Mobile Computing in Action: The Apple iPhone 129**
- 6-8 Wireless Security 129**
 - Privacy and Ethical Issues of Wireless Devices 130**
- 6-9 Convergence of Voice, Video, and Data 130**
 - Telepresence: A New Use of Data Communication and Convergence 131**
- Key Terms 132**
- Reviews And Discussions 133**
- Projects 133**
- Are You Ready To Move On? 134**
- Case Study 6-1: Data Communication at Walmart 134**
- Case Study 6-2: Protecting the Security and Privacy of Mobile Devices 135**

7 The Internet, Intranets, and Extranets 136

- 7-1 The Internet and the World Wide Web 137**
 - 7-1a *The Domain Name System* 139
 - Major Events in the Development of the Internet 139**
 - What Is HTML? 141**

- 7-1b *Types of Internet Connections* 141
- 7-2 Navigational Tools, Search Engines, and Directories 141**
 - 7-2a *Navigational Tools* 142
 - 7-2b *Search Engines and Directories* 142
- 7-3 Internet Services 143**
 - 7-3a *E-Mail* 143
 - 7-3b *Newsgroups and Discussion Groups* 144
 - 7-3c *Instant Messaging* 144
 - 7-3d *Internet Telephony* 145
- 7-4 Web Applications 145**
 - 7-4a *Tourism and Travel* 145
 - 7-4b *Publishing* 146
 - 7-4c *Higher Education* 146
 - 7-4d *Real Estate* 146
 - 7-4e *Employment* 146
 - 7-4f *Financial Institutions* 147
 - 7-4g *Software Distribution* 147
 - 7-4h *Health Care* 147
 - 7-4i *Politics* 148
 - Electronic Health Records Pays Off for Kaiser Permanente 148**
 - The Internet in 2020 149**
- 7-5 Intranets 149**
 - 7-5a *The Internet vs. Intranets* 150
 - 7-5b *Applications of an Intranet* 151
- 7-6 Extranets 151**
- 7-7 New Trends: The Web 2.0 and Web 3.0 Eras 153**
 - 7-7a *Blogs* 154
 - 7-7b *Wikis* 154
 - 7-7c *Social Networking Sites* 154
 - LinkedIn: A Professional Social Networking Site 154**
 - Twitter: Real-Time Networking with Your Followers 155**
 - 7-7d *RSS Feeds* 155
 - 7-7e *Podcasting* 156
 - 7-7f *The Internet2* 156
- 7-8 The Internet of Everything: The Next Big Network 157**
 - The Internet of Everything in Action 158**
- Key Terms 159**
- Reviews and Discussions 160**

Projects 160

Are You Ready to Move On? 160

Case Study 7-1: Scotts Miracle-Gro's Intranet:
The Garden 161

Case Study 7-2: Social Networking in Support of
Small Businesses 161

8 E-Commerce 162

8-1 Defining E-Commerce 163

8-1a *The Value Chain and E-Commerce* 164

8-1b *E-Commerce vs. Traditional Commerce* 165

Twitter Helps Businesses Find Customers 165

8-1c *Advantages and Disadvantages of
E-Commerce* 166

8-1d *E-Commerce Business Models* 166

E-Commerce in 2020 168

8-2 Major Categories of E-Commerce 168

8-2a *Business-to-Consumer E-Commerce* 168

8-2b *Business-to-Business E-Commerce* 169

8-2c *Consumer-to-Consumer E-Commerce* 169

8-2d *Consumer-to-Business E-Commerce* 169

8-2e *Government and Nonbusiness E-Commerce* 169

E-Gov in Action: City of Louisville, Kentucky 170

8-2f *Organizational or Intra-business E-Commerce* 170

8-3 B2C E-Commerce Cycle 170

8-4 B2B E-Commerce: A Second Look 171

8-4a *Major Models of B2B E-Commerce* 171

E-Procurement at Schlumberger 172

8-5 Mobile and Voice-Based E-Commerce 174

8-6 E-Commerce Supporting Technologies 175

8-6a *Electronic Payment Systems* 175

Challenges in Using Mobile Payment Systems 176

8-6b *Web Marketing* 176

8-6c *Search Engine Optimization* 177

Challenges in Using Digital Ads 177

Key Terms 179

Reviews and Discussions 179

Projects 179

Are You Ready to Move On? 180

Case Study 8-1: E-Commerce Applications in Online
Travel 180

Case Study 8-2: Bridging the Gap Between E-Commerce
and Traditional Commerce 181

9 Global Information Systems 182

9-1 Why Go Global? 183

9-1a *E-Business: A Driving Force* 184

**Global Information Systems at Rohm &
Haas 184**

Making a Company Web Site Global 185

9-1b *Growth of the Internet* 185

9-2 Global Information Systems: An Overview 185

9-2a *Components of a Global Information System* 186

The Internet and Globalization in Action 187

**Video Conferencing Systems Support
Globalization 188**

9-2b *Requirements of Global Information Systems* 188

9-2c *Implementation of Global Information
Systems* 189

9-3 Organizational Structures and Global Information Systems 190

9-3a *Multinational Structure* 190

9-3b *Global Structure* 191

9-3c *International Structure* 192

9-3d *Transnational Structure* 192

Global Information System at FedEx 193

9-3e *Global Information Systems Supporting Offshore
Outsourcing* 194

9-4 Obstacles to Using Global Information Systems 194

9-4a *Lack of Standardization* 195

9-4b *Cultural Differences* 195

9-4c *Diverse Regulatory Practices* 196

9-4d *Poor Telecommunication Infrastructures* 196

9-4e *Lack of Skilled Analysts and Programmers* 196

Key Terms 197

Reviews and Discussions 198

Projects 198

Are You Ready to Move On? 198

Case Study 9-1: Global Information Systems at Toyota
Motor Company 199

Case Study 9-2: Information Technologies Support
Global Supply Chain 199

Part 3

IS Development, Enterprise Systems, MSS, and Emerging Trends



© agsandrew/Shutterstock.com

10 Building Successful Information Systems 200

- 10-1 Systems Development Life Cycle: An Overview 201**
- 10-2 Phase 1: Planning 202**
 - 10-2a Formation of the Task Force 203
 - 10-2b Feasibility Study 204
 - A Feasible Project Becomes Unfeasible 204**
 - HealthCare.gov: Feasibility Issues 207**
- 10-3 Phase 2: Requirements Gathering and Analysis 207**
- 10-4 Phase 3: Design 209**
 - 10-4a Computer-Aided Systems Engineering 210
 - 10-4b Prototyping 210
- 10-5 Phase 4: Implementation 212**
 - 10-5a Project Management Tools and Techniques 212
 - 10-5b Request for Proposal 214
 - 10-5c Implementation Alternatives 214
 - China and IT Outsourcing 217**
- 10-6 Phase 5: Maintenance 217**
- 10-7 New Trends in Systems Analysis and Design 217**
 - 10-7a Service-Oriented Architecture 217
 - 10-7b Rapid Application Development 218
 - 10-7c Extreme Programming 218
 - Extreme Programming in Action 219**
 - 10-7d Agile Methodology 219
 - Agile Methodology at HomeAway, Inc. 219**

- Key Terms 220
- Reviews and Discussions 221
- Projects 221
- Are You Ready to Move On? 221
- Case Study 10-1: Systems Development at Seb Latvia 222
- Case Study 10-2: Crowdsourcing Pays Off 222

11 Enterprise Systems 224

- 11-1 Supply Chain Management 225**
 - Supply Chain Management at Coca-Cola Company 227**
 - 11-1a SCM Technologies 227
- 11-2 Customer Relationship Management 231**
 - CRM in Action 233**
 - 11-2a CRM Applications 233
 - 11-2b Personalization Technology 233
 - Amazon's Personalization Assists Its Sellers on Its Marketplace 235**
- 11-3 Knowledge Management 235**
 - Knowledge Management in Action 237**
- 11-4 Enterprise Resource Planning 237**
 - ERP Streamlines Operations at Naghi Group 238**

- Key Terms 239
- Reviews and Discussions 240
- Projects 240
- Are You Ready to Move On? 240
- Case Study 11-1: ERP at Johns Hopkins Institutions 241
- Case Study 11-2: CRM at Starbucks 241

12 Management Support Systems 242

- 12-1 Types of Decisions in an Organization 243**
 - 12-1a Phases of the Decision-Making Process 244
- 12-2 Decision Support Systems 246**
 - 12-2a Components of a Decision Support System 246
 - 12-2b DSS Capabilities 247
 - 12-2c Roles in the DSS Environment 248
 - 12-2d Costs and Benefits of Decision Support Systems 248
- Decision Support Systems at Family Dollar 249**

12-3 Executive Information Systems 250

12-3a Reasons for Using EISs 250

12-3b Avoiding Failure in Design and Use of EISs 251

12-3c EIS Packages and Tools 251

Executive Information Systems at Hyundai Motor Company 252

12-4 Group Support Systems 252

12-4a Groupware 253

Microsoft Office SharePoint Server: A New Type of Groupware 254

Groupware and Health IT 254

12-4b Electronic Meeting Systems 255

12-4c Advantages and Disadvantages of GSSs 255

New Generations of Electronic Meeting Systems 255

12-5 Geographic Information Systems 256

12-5a GIS Applications 257

GISs for Fighting Disease 258

12-6 Guidelines for Designing a Management Support System 258

Key Terms 259

Reviews and Discussions 260

Projects 260

Are You Ready to Move On? 260

Case Study 12-1: UPS Deploys Routing Optimization with a Big Payoff 261

Case Study 12-2: Mobile Medical Collaboration Tools Gaining in Popularity 261

13 Intelligent Information Systems 262

13-1 What Is Artificial Intelligence? 263

Computers Understanding Common Sense 264

13-1a AI Technologies Supporting Decision Making 264

13-1b Robotics 265

13-2 Expert Systems 266

13-2a Components of an Expert System 266

13-2b Uses of Expert Systems 269

13-2c Criteria for Using Expert Systems 269

Expert Systems in Baltimore County Police Department 269

13-2d Criteria for Not Using Expert Systems 269

13-2e Advantages of Expert Systems 270

13-3 Case-Based Reasoning 270

13-4 Intelligent Agents 270

13-4a Shopping and Information Agents 271

13-4b Personal Agents 272

13-4c Data-Mining Agents 272

13-4d Monitoring and Surveillance Agents 272

Intelligent Agents in Action 272

13-5 Fuzzy Logic 273

13-5a Uses of Fuzzy Logic 274

Fuzzy Logic in Action 274

13-6 Artificial Neural Networks 274

Neural Networks in Microsoft and the Chicago Police Department 275

13-7 Genetic Algorithms 276

13-8 Natural-Language Processing 276

13-9 Integrating AI Technologies into Decision Support Systems 277

13-10 Contextual Computing: Making Mobile Devices Smarter 277

Key Terms 279

Reviews And Discussions 279

Projects 279

Are You Ready to Move On? 280

Case Study 13-1: Medical Robotics in Action 280

Case Study 13-2: NLP: Making a Smartphone Smarter 281

14 Emerging Trends, Technologies, and Applications 282

14-1 Trends in Software and Service Distribution 283

14-1a Pull and Push Technologies 283

14-1b Application Service Providers 284

14-2 Virtual Reality 285

14-2a Types of Virtual Environments 286

14-2b Components of a Virtual Reality System 287

14-2c CAVE 287

14-2d Virtual Reality Applications 288

Virtual Reality at Lockheed Martin 289

14-2e Obstacles in Using VR Systems 289

14-2f Virtual Worlds 290

14-3 Radio Frequency Identification: An Overview 291

Coca-Cola Company Uses RFID-Based Dispensers for Generating BI 292

14-3a RFID Applications 292

14-4 Quick Response Codes 292

QR Codes in Action 293

14-5 Biometrics: A Second Look 293

14-6 Trends in Networking 294

14-6a Wi-Fi 294

14-6b WiMAX 294

14-6c Bluetooth 295

14-6d Grid Computing 295

14-6e Utility (On-Demand) Computing 296

14-6f Cloud Computing 296

Cloud Computing in Action 298

14-7 Nanotechnology 299

Key Terms 300

Reviews and Discussions 301

Projects 301

Are You Ready to Move On? 302

**Case Study 14-1: Cloud Computing at Intercontinental
Hotels Group (IHG) 302**

Case Study 14-2: RFID at Macy's Department Store 303

Endnotes 304

Index 313

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 19**
for the **STUDY**
TOOLS

© Monkey Business Images/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 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

Exhibit 1.1 A point-of-sale system



© Petrenko Andriy/Shutterstock.com

computers and information systems for generating your monthly statement, running ATM machines, and for many other banking activities.

Many workers are now telecommuters who perform their jobs at home, and others often use their PDAs (personal digital assistants) to conduct business while on the go. The most common PDA is a smartphone (such as an iPhone, Galaxy, Droid, or a Blackberry). A typical PDA includes a calendar, address book, and task-listing programs; more advanced PDAs often allow for wireless connection to the Internet and have built-in MP3 players. Smartphones are mobile phones with advanced capabilities, much like a mini PC. They include e-mail and Web-browsing features, and most have a built-in keyboard or an external USB keyboard (see Exhibit 1.2). Increasingly, tablet computers, such as iPads, are being used as PDAs. These tablets come with apps (small programs) for common applications, and they can improve the user's efficiency.

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

Exhibit 1.2 Examples of smartphones



© iStockphoto.com/SKrow



© iStockphoto.com/pressureUA

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.^{1,2}

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. 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 above, 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 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.



© StockLite/Shutterstock.com



Computers and information technology will help the knowledge workers of the future perform more effectively and productively, no matter what profession they choose.

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. 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.

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.

The information box below 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.

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 March 31, 2013, Facebook had more than 1.11 billion registered users, and the number is increasing on a daily basis.³ 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 tips⁴:

- 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.

Business intelligence (BI) 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.

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.)

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

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.

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.⁵ 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.⁶

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.

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).⁷

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.

Exhibit 1.3

Major components of an information system



© Cengage Learning®

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



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.

1-5b 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 includes transaction-processing reports and models for decision analysis that can be built into the system or accessed from external sources.

An information system can include a wide range of models to support all levels of decision making. Users should be able to query an information system and generate a variety of reports. In addition, an information system should be able to grow with the organization so users can redefine and restructure models and incorporate new information into their analyses.

1-5a Information

Although they might seem the same, data and information are different. Data consists of raw facts and by itself is difficult to use for making decisions. **Information**—the output of an information system—consists of facts that have been analyzed by the process component and are therefore more useful to the MIS user. For example,

XYZ Company's total sales last month were \$5,000,000. This number is data, because it does not tell you how the company performed. Did it meet the sales goal? Did sales increase or decrease from the previous month? How did the company perform against its top competitors? These questions and more can be answered by the information that an information system provides.

The quality of information is determined by its usefulness to users, and its usefulness determines the success of an information system. Information is useful if it enables decision makers to make the right decision in a timely manner. To be useful, information must have the following qualities:

- Timeliness
- Integration with other data and information
- Consistency and accuracy
- Relevance

If information lacks any of these qualities, the results are incorrect decisions, misallocation of resources, and overlooked windows of opportunity. If the system cannot give users a minimum level of confidence in its reliability, it will not be used or users might dismiss the reports it generates. Information must provide either a base for users to explore different options or insight into tasks.

Another factor affecting the usefulness of information is the information system's user interface. Because this interface must be flexible and easy to use, most information systems make use of graphical user interfaces (GUIs), with features such as menus

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.

Information consists of facts that have been analyzed by the process component and is an output of an information system.