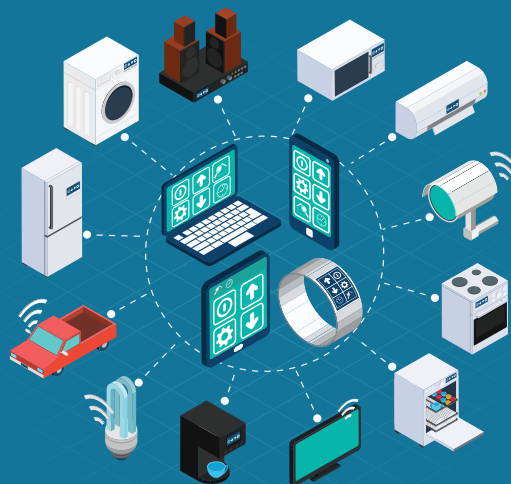


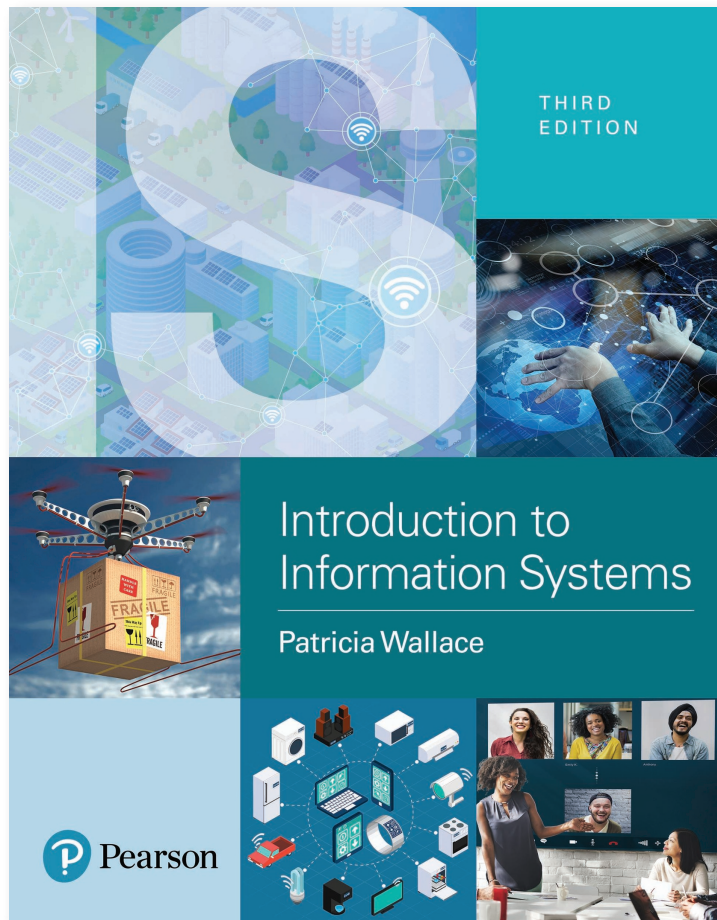
THIRD
EDITION



Introduction to Information Systems

Patricia Wallace





The cover images feature important themes in this edition, showing how information systems and emerging technologies continue to break new ground. Some images highlight how their growing power supports globalization and worldwide teamwork, with advanced collaborative technologies and user-friendly interfaces that span great distances and cultural divides. Another image illustrates the surging *Internet of Things*, in which sensors are embedded in everything from medical devices to kitchen appliances. The drone hints at yet another innovation on the horizon—autonomous vehicles—that will create new waves of change in supply chains, traffic conditions, driving habits, and much more. Fully updated, the 3rd edition of *Introduction to Information Systems* engages students in this expanding world, showing the important roles such systems play in business, government, and in each of our lives.

Introduction to Information Systems

This page intentionally left blank

Third Edition

Introduction to Information Systems

Patricia Wallace

Johns Hopkins University



330 Hudson Street, NY NY 10013

VP Editorial Director: *Andrew Gilfillan*
Senior Portfolio Manager: *Samantha Lewis*
Content Development Team Lead: *Laura Burgess*
Program Monitor: *Ann Pulido/SPi Global*
Editorial Assistant: *Michael Campbell*
Product Marketing Manager: *Kaylee Carlson*
Project Manager: *Katrina Ostler/Cenveo® Publisher Services*
Text Designer: *Cenveo® Publisher Services*
Cover Designer: *Brian Malloy/Cenveo® Publisher Services*

Cover Art: *Macrovector/Shutterstock; Everything possible/Shutterstock; Rawpixel.com/Shutterstock; Chombosan/Shutterstock; Ktsdesign/Science Photo Library/Getty Images*
Full-Service Project Management: *Cenveo® Publisher Services*
Composition: *Cenveo® Publisher Services*
Printer/Binder: *Menasha*
Cover Printer: *Phoenix Color*
Text Font: *10/12 Times LT Pro Roman*

Credits and acknowledgments borrowed from other sources and reproduced, with permission, in this textbook appear on the appropriate page within text.

Microsoft and/or its respective suppliers make no representations about the suitability of the information contained in the documents and related graphics published as part of the services for any purpose. All such documents and related graphics are provided “as is” without warranty of any kind. Microsoft and/or its respective suppliers hereby disclaim all warranties and conditions with regard to this information, including all warranties and conditions of merchantability, whether express, implied or statutory, fitness for a particular purpose, title and non-infringement. In no event shall Microsoft and/or its respective suppliers be liable for any special, indirect or consequential damages or any damages whatsoever resulting from loss of use, data or profits, whether in an action of contract, negligence or other tortious action, arising out of or in connection with the use or performance of information available from the services.

The documents and related graphics contained herein could include technical inaccuracies or typographical errors. Changes are periodically added to the information herein. Microsoft and/or its respective suppliers may make improvements and/or changes in the product(s) and/or the program(s) described herein at any time. Partial screen shots may be viewed in full within the software version specified.

Microsoft®, Windows®, and Microsoft Office® are registered trademarks of the Microsoft Corporation in the U.S.A. and other countries. This book is not sponsored or endorsed by or affiliated with the Microsoft Corporation.

Copyright © 2018, 2015, 2013 by Pearson Education, Inc., All rights reserved. Manufactured in the United States of America. This publication is protected by Copyright, and permission should be obtained from the publisher prior to any prohibited reproduction, storage in a retrieval system, or transmission in any form or by any means, electronic, mechanical, photocopying, recording, or likewise. To obtain permission(s) to use material from this work, please submit a written request to Pearson Education, Inc., Permissions Department, One Lake Street, Upper Saddle River, New Jersey 07458, or you may fax your request to 201-236-3290.

Many of the designations by manufacturers and sellers to distinguish their products are claimed as trademarks. Where those designations appear in this book, and the publisher was aware of a trademark claim, the designations have been printed in initial caps or all caps.

Library of Congress Cataloging-in-Publication Data

On file with the Library of Congress.

10 9 8 7 6 5 4 3 2 1

ISBN 10: 0-13-463519-1
ISBN 13: 978-0-13-463519-4



**To Callie, Julian, and a bright future
of human-centered computing.**

This page intentionally left blank

About the Author



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



This page intentionally left blank

Brief Contents



CHAPTER	1	Information Systems and <i>People</i>	2
CHAPTER	2	Information Systems and <i>Strategy</i>	32
CHAPTER	3	Information and Communications Technologies: <i>The Enterprise Architecture</i>	62
CHAPTER	4	Databases and <i>Data Warehouses</i>	94
CHAPTER	5	Information Systems for the <i>Enterprise</i>	130
CHAPTER	6	The Web, <i>Social Media, E-Commerce, and M-Commerce</i>	164
CHAPTER	7	Business Intelligence and <i>Decision Making</i>	198
CHAPTER	8	Collaborating with <i>Technology</i>	228
CHAPTER	9	Knowledge Management and <i>E-Learning</i>	260
CHAPTER	10	Ethics, Privacy, and <i>Security</i>	294
CHAPTER	11	Systems Development and <i>Procurement</i>	328
CHAPTER	12	Project Management and <i>Strategic Planning</i>	358
CASE STUDIES		Facebook and Instagram: Privacy Challenges	389
		Enabling the Sharing Economy: The Case of Uber Technologies	393
		Apple: Can the Company Pull Off Another Disruptive Innovation?	396
		Managing the Federal Government's IT Project Portfolio	399
		Glossary	403
		Index	411

This page intentionally left blank

Contents



CHAPTER 1


Preface	xxiii
Acknowledgments	xxxi
Information Systems and People	2
Learning Objectives	2
Introduction	2
Information Systems in Action	4
MANAGING OPERATIONS	4
SUPPORTING CUSTOMER INTERACTIONS	6
MAKING DECISIONS	6
COLLABORATING ON TEAMS	7
GAINING COMPETITIVE ADVANTAGE	8
IMPROVING INDIVIDUAL PRODUCTIVITY	8
The Nature of Information	8
WHAT MAKES INFORMATION VALUABLE?	9
The Components of an Information System	10
PEOPLE	10
TECHNOLOGY	11
PROCESSES	12
DATA	14
Information Systems, the Discipline	14
Information Systems throughout the Organization	16
INFORMATION SYSTEMS IN BUSINESS	17
INFORMATION SYSTEMS IN NONPROFITS AND GOVERNMENT	17
INSIDE THE IT DEPARTMENT	17
COLLABORATING ON INFORMATION SYSTEMS	19
IMPROVING YOUR OWN PRODUCTIVITY	19
Promises, Perils, and Ethical Issues	21
PRIVACY BREACHES AND AMPLIFICATION EFFECTS	21
 THE ETHICAL FACTOR: Ethical Issues Surrounding Information Systems	22
Online Simulation	22
Chapter Summary	23
Key Terms and Concepts	23
Chapter Review Questions	24
Projects and Discussion Questions	24
Application Exercises	25
EXCEL APPLICATION: STAFF PLANNING SPREADSHEET	25
ACCESS APPLICATION: INFORMATION SYSTEMS IN BUSINESS	26
Case Study #1 Nasdaq's Information Challenges: Facebook's Botched Public Opening and High-Frequency Trading	26
Case Study #2 Breaking News: Twitter's Growing Role in Emergencies and Disaster Communications	28

E-Project 1 Analyzing the May 6 “Flash Crash” with Excel Charts 29
 E-Project 2 Gathering, Visualizing, and Evaluating Reports from Twitter and Other Sources During a Disaster 29
 Chapter Notes 30

CHAPTER 2

Information Systems and Strategy 32

Learning Objectives 32
 Introduction 32
 Porter’s Five Competitive Forces 34
 THREAT OF NEW ENTRANTS 35
 POWER OF BUYERS 36
 POWER OF SUPPLIERS 36
 THREAT OF SUBSTITUTES 37
 RIVALRY AMONG EXISTING COMPETITORS 38
 Factors that Affect How the Five Forces Operate 38
 DISRUPTIVE TECHNOLOGY AND INNOVATIONS 38
 GOVERNMENT POLICIES AND ACTIONS 40
 COMPLEMENTARY SERVICES AND PRODUCTS IN THE ECOSYSTEM 40
 ENVIRONMENTAL EVENTS AND “WILDCARDS” 42
 The Value Chain and Strategic Thinking 42
 EXTENDING THE VALUE CHAIN: FROM SUPPLIERS TO THE FIRM TO CUSTOMERS 43
 BENCHMARKING COMPONENTS OF THE VALUE CHAIN 44

 **THE ETHICAL FACTOR: Ethical Responsibility in an Extended Value Chain 44**

 IT BENCHMARKS 44
 Competitive Strategies in Business 46
 THE ROLE OF INFORMATION SYSTEMS IN STRATEGY 47
 INFORMATION SYSTEMS: RUN, GROW, AND TRANSFORM THE BUSINESS 48
 Information Strategies and Nonprofit Organizations 49
 FUND-RAISING 50
 VOLUNTEERING 50
 INFORMATION STRATEGIES AND GOVERNMENT 50
 Does I.T. Matter? 51
 SPENDING ON RUNNING, GROWING, AND TRANSFORMING 52
 LEVELING UP!: A STRATEGIC ANALYSIS 52
 Online Simulation 53
 Chapter Summary 54
 Key Terms and Concepts 55
 Chapter Review Questions 55
 Projects and Discussion Questions 55
 Application Exercises 56
 EXCEL APPLICATION: IT BENCHMARKS 56
 ACCESS APPLICATION: TELETHON CALL REPORTS 56
 Case Study #1 Can GameStop Survive with Its Brick-and-Mortar Stores? 57
 Case Study #2 The Battle for Net Neutrality 58
 E-Project 1 Identifying Company Strategy with Online Financial Chart Tools 59
 E-Project 2 Analyzing Media Download Times with Excel 59
 Chapter Notes 60

CHAPTER 3**Information and Communications Technologies: *The Enterprise Architecture* 62**

Learning Objectives 62

Introduction 62

The Hardware 64

INPUT AND OUTPUT 64

PROCESSING 68

STORAGE 69

 **THE ETHICAL FACTOR:** Ethical Implications of Big Data 70

The Software 70

TYPES OF SOFTWARE 70

HOW IS SOFTWARE CREATED? 72

Networks and Telecommunications 74

TRANSMISSION MEDIA AND PROTOCOLS 74

NETWORKING BASICS 76

NETWORK PROTOCOLS 78

STRATEGY AND COMPETITION IN TELECOMMUNICATIONS 80

The Enterprise Architecture 81

TRENDS IN ENTERPRISE ARCHITECTURES 81

GUIDING THE ENTERPRISE ARCHITECTURE 85

Online Simulation 86

Chapter Summary 87

Key Terms and Concepts 88

Chapter Review Questions 88

Projects and Discussion Questions 88

Application Exercises 89

EXCEL APPLICATION: ANALYZING GROWTH IN COMPUTER STORAGE CAPACITIES 89

ACCESS APPLICATION: MANAGING ICT ASSETS WITH A DATABASE 89

Case Study #1 Google Glass and Wearable Technologies 90

Case Study #2 Rolling Out Its 4G Network, Sprint Corporation Competes with Rivals 91

E-Project 1 Voluntary Distributed Computing 92

E-Project 2 Using Excel to Analyze Cost Effectiveness for 4G Rollouts 92

Chapter Notes 93

CHAPTER 4**Databases and *Data Warehouses* 94**

Learning Objectives 94

Introduction 94

The Nature of Information Resources 96

STRUCTURED, UNSTRUCTURED, AND SEMI-STRUCTURED INFORMATION 96

METADATA 97


THE QUALITY OF INFORMATION 97

Managing Information: From Filing Cabinets to the Database 98

TABLES, RECORDS, AND FIELDS 99


THE RISE AND FALL OF FILE PROCESSING SYSTEMS 100

DATABASES AND DATABASE MANAGEMENT SYSTEMS 102

Developing and Managing a Relational Database	105
PLANNING THE DATA MODEL	105
ACCESSING THE DATABASE AND RETRIEVING INFORMATION	109
 THE ETHICAL FACTOR: Ethical Issues in Database Design: The Case of Ethnic Identification	110
MANAGING AND MAINTAINING THE DATABASE	112
Multiple Databases and the Challenge of Integration	114
SHADOW SYSTEMS	114
INTEGRATION STRATEGIES AND MASTER DATA MANAGEMENT	114
Data Warehouses and Big Data	115
BUILDING THE DATA WAREHOUSE	116
THE CHALLENGE OF BIG DATA	117
STRATEGIC PLANNING, BUSINESS INTELLIGENCE, AND DATA MINING	119
The Challenges of Information Management: The Human Element	119
OWNERSHIP ISSUES	119
DATABASES WITHOUT BOUNDARIES	120
BALANCING STAKEHOLDERS' INFORMATION NEEDS	120
Online Simulation	121
Chapter Summary	122
Key Terms and Concepts	123
Chapter Review Questions	123
Projects and Discussion Questions	123
Application Exercises	124
EXCEL APPLICATION: MANAGING CATERING SUPPLIES	124
ACCESS APPLICATION: DD-DESIGNS	125
Case Study #1 UK Police Track Suspicious Vehicles in Real Time with Cameras and the License Plate Database	126
Case Study #2 How eBay Scales Its Database Architecture with SQL and NoSQL	127
E-Project 1 Identifying Suspects with a License Plate Database: Constructing Queries with Access	128
E-Project 2 Building a Database for Customer Records	128
Chapter Notes	129

CHAPTER 5

Information Systems for the Enterprise 130

Learning Objectives	130
Introduction	130
Finance Management	132
COMPONENTS OF FINANCIAL INFORMATION SYSTEMS	132
FINANCIAL REPORTING, COMPLIANCE, AND TRANSPARENCY	134
Human Capital Management	135
COMPONENTS OF HUMAN CAPITAL MANAGEMENT SYSTEMS	135
HCM METRICS	137
Managing the Supply Chain	138
SUPPLY CHAIN FUNDAMENTALS	138
 THE ETHICAL FACTOR: Ethics and Talent Management	138
MEASURING PERFORMANCE IN SUPPLY CHAINS	139
INFORMATION SYSTEMS AND TECHNOLOGY FOR SUPPLY CHAIN MANAGEMENT	142

Customer Relationship Management	145
CRM GOALS AND METRICS	145
CRM STRATEGIES AND TECHNOLOGIES	147
Enterprise Resource Planning (ERP): Bringing It All Together	150
ERP COMPONENTS	150
ERP INTEGRATION STRATEGIES	152
IMPLEMENTATION ISSUES	153
Online Simulation	155
Chapter Summary	156
Key Terms and Concepts	157
Chapter Review Questions	157
Projects and Discussion Questions	157
Application Exercises	158
EXCEL APPLICATION: PERFORMANCE BICYCLE PARTS	158
ACCESS APPLICATION: VSI CONSULTANTS	158
Case Study #1 Salesforce.com: Taking CRM to the Cloud	160
Case Study #2 Winning the War for Talent: The Mandarin Oriental's Talent Management System	161
E-Project 1 CRM for Human Services Agencies	162
E-Project 2 Evaluating Employment and Recruitment Websites	162
Chapter Notes	163

CHAPTER **6**

The Web, Social Media, E-Commerce, and M-Commerce 164

Learning Objectives	164
Introduction	164
Developing a Web Strategy	166
CHOOSING A GOAL	166
NAMING THE WEBSITE	168
Building the Website	170
WEBSITE DESIGN	170

THE ETHICAL FACTOR: Website Accessibility: Why Is Progress So Slow? 175


SOFTWARE DEVELOPMENT STRATEGIES FOR THE WEB	175
E-Commerce	178
THE ONLINE TRANSACTION AND E-COMMERCE SOFTWARE	178
E-COMMERCE SECURITY	178
E-COMMERCE TRUST	179
Mobile Devices and M-Commerce	179
WHY MOBILE MATTERS	179
DESIGNING WEBSITES AND APPS FOR MOBILE DEVICES	180
M-COMMERCE AND MOBILE PAYMENTS	181
Digital Marketing	181
SEARCH ENGINE OPTIMIZATION	181
SOCIAL AND MOBILE MARKETING	184
Web 2.0 and Beyond	185
CROWDSOURCING AND COLLECTIVE INTELLIGENCE	186
EXPANDING DATA AND SENSORY INPUT: THE INTERNET OF THINGS	186
THE LEARNING WEB	187

Online Simulation 188
 Chapter Summary 189
 Key Terms and Concepts 190
 Chapter Review Questions 190
 Projects and Discussion Questions 191
 Application Exercises 192
 WEBSITE APPLICATION: HERITAGE DOGS 192
 EXCEL APPLICATION: HERITAGE DOGS WEBSITE METRICS 192
 ACCESS APPLICATION: SPRINGFIELD ANIMAL SHELTER 192
 Case Study #1 Mobile Payments and the Digital Wallet 193
 Case Study #2 LinkedIn: The Social Network and E-Marketplace for Professionals 194
 E-Project 1 Examining Top M-Commerce Sites 195
 E-Project 2 Exploring LinkedIn's Web Analytics 195
 Chapter Notes 196

CHAPTER 7

Business Intelligence and Decision Making 198

Learning Objectives 198
 Introduction 198
 Levels of Decision Making 200
 OPERATIONAL LEVEL 200
 TACTICAL LEVEL 200
 STRATEGIC LEVEL 201
 Sources of Business Intelligence 202
 TRANSACTIONAL DATABASES, DATA WAREHOUSES, AND INTERNAL DATA SOURCES 202
 EXTERNAL DATA SOURCES AND BIG DATA 202

 **THE ETHICAL FACTOR:** The Ethics of Tagging Faces in Photos 204


Data Mining and Analytics 204
 ANALYZING PATTERNS, TRENDS, AND RELATIONSHIPS 204
 SIMULATING, OPTIMIZING, AND FORECASTING 207
 ARTIFICIAL INTELLIGENCE 209
 Achieving Success with Digital Analytics 212
 CAPTURING DIGITAL METRICS 212
 ANALYZING DATA AND ACHIEVING SUCCESS 215
 Putting It All Together: Dashboards, Portals, and Mashups 216
 DASHBOARDS 216
 PORTALS 216
 MASHUPS 218
 BUSINESS INTELLIGENCE: THE HUMAN ELEMENT 219

Online Simulation 220
 Chapter Summary 221
 Key Terms and Concepts 221
 Chapter Review Questions 222
 Projects and Discussion Questions 222
 Application Exercises 223
 EXCEL APPLICATION: ANALYZING REVENUE AND EXPENSES FOR CITY HOSPITAL SEMINARS 223
 ACCESS APPLICATION: MARKETING CITY HOSPITAL SEMINARS 223

Case Study #1 Cracking Fraud with Government's Big Data	224
Case Study #2 TV and Twitter: How Nielsen Rates Programs with "Social TV"	225
E-Project 1 Detecting Suspicious Activity in Insurance Claims	226
E-Project 2 Analyzing Nielsen TV Ratings with Excel	226
Chapter Notes	227

CHAPTER 8

Collaborating with *Technology* 228

Learning Objectives	228
Introduction	228
The Evolution of Collaborative Technologies	230
EMAIL TECHNOLOGY, CONTACTS, AND CALENDARS	230
DISCUSSION FORUMS	232
INSTANT MESSAGING AND TEXTING	232
GROUP DECISION SUPPORT SYSTEMS (GDSS)	235
WEB CONFERENCING	235
INTERACTIVE VIDEO	236
SHARED WORKSPACES	237
Web 2.0 Collaborative Technologies	238
BLOGS	238
WIKIS	239
SOCIAL NETWORKING	239
MICROBLOGGING	240
VIRTUAL WORLDS AND VIRTUAL REALITY	241
Unified Communications	243
CAPABILITIES FOR UNIFIED COMMUNICATIONS	243
UNIVERSAL DASHBOARDS	244
The Human Element and Collaborative Technologies	244
PSYCHOLOGICAL CHARACTERISTICS OF ONLINE ENVIRONMENTS	244
 THE ETHICAL FACTOR: Flash Mobs and Free Speech: Should Police Block Mobile Messaging Services?	246
MANAGING ONLINE IMPRESSIONS	247
GROUP DYNAMICS IN VIRTUAL TEAMS	247
MAKING VIRTUAL TEAMS WORK	249
Online Simulation	250
Chapter Summary	251
Key Terms and Concepts	251
Chapter Review Questions	252
Projects and Discussion Questions	252
Application Exercises	253
EXCEL APPLICATION: GOING GREEN!	253
ACCESS APPLICATION: CLOUD 9	253
Case Study #1 Telepresence Robots Support Remote Collaboration	254
Case Study #2 The Pros and Cons of Telecommuting	255
E-Project 1 Estimating Breakeven Pricing for Telepresence Robots Using a Spreadsheet	256
E-Project 2 Estimating Savings for Virtual Work Using an Excel Model	256
Chapter Notes	257

CHAPTER 9

Knowledge Management and E-Learning 260

Learning Objectives	260
Introduction	260
The Nature of Intellectual Capital	262
TYPES OF INTELLECTUAL CAPITAL	262
TYPES OF KNOWLEDGE	262
MANAGING INTELLECTUAL CAPITAL	263
Knowledge Management Strategies and Technologies	264
IDENTIFY THE GOAL	264
LOCATE THE SOURCES	264
CAPTURE THE KNOWLEDGE	267
ORGANIZE, SHARE, AND VALUE KNOWLEDGE	268
Knowledge Management: Pitfalls and Promises	272
THE HUMAN ELEMENT: WHY SHARE KNOWLEDGE?	272
INCENTIVES FOR KNOWLEDGE SHARING	272

 **THE ETHICAL FACTOR: Knowledge Sharing in Fast-Paced Industries: The Case of Formula One Racing 273**

TECHNOLOGY HURDLES AND CONTENT ISSUES	274
THE SEMANTIC WEB	274
PRACTICAL TIPS FOR LAUNCHING A KNOWLEDGE MANAGEMENT PROJECT	274

E-Learning	275
COMPARING E-LEARNING APPROACHES	275
Creating an E-Learning Program	277
COURSE DEVELOPMENT	277
LEARNING OBJECTS	277
CONTENT AUTHORING TOOLS	278
COLLABORATION TOOLS	280
STRATEGIES TO PREVENT CHEATING	281
LEARNING MANAGEMENT SYSTEMS	281
E-Learning in Education	282
DIFFERENCES BETWEEN CORPORATE AND EDUCATION E-LEARNING	283
COMPARING E-LEARNING AND CLASSROOM LEARNING	283

Online Simulation	285
Chapter Summary	286
Key Terms and Concepts	287
Chapter Review Questions	287
Projects and Discussion Questions	287
Application Exercises	288
EXCEL APPLICATION: TOP TALENT	288
ACCESS APPLICATION: TOP TALENT	288
Case Study #1 Lynda.com: How an E-Learning Entrepreneur Rides Waves of Change	289
Case Study #2 Diplopedia: Managing State Department Knowledge with a Wiki	290
E-Project 1 Exploring the World of Online Courses	291
E-Project 2 Managing the Human Element on Wikipedia with Technology	291
Chapter Notes	292

CHAPTER 10**Ethics, Privacy, and Security 294**

Learning Objectives	294
Introduction	294
Ethics	296
ETHICAL FRAMEWORKS	296
ETHICS AND THE LAW	296
ETHICAL ISSUES AND INFORMATION AND COMMUNICATIONS TECHNOLOGIES	297
Information Ethics	298
INTELLECTUAL PROPERTY AND DIGITAL RIGHTS MANAGEMENT	298
PLAGIARISM	300
Privacy	301
TRADING PRIVACY FOR CONVENIENCE AND FREEBIES	302
ANONYMITY	303
SURVEILLANCE	304
"THE RIGHT TO BE FORGOTTEN"	305
Information Security	306
RISK MANAGEMENT	306
IDENTIFYING THREATS	306
 THE ETHICAL FACTOR: Ethical Dilemmas in a Distributed Denial of Service Attack	309
ASSESSING VULNERABILITY	309
ADMINISTRATIVE SECURITY CONTROLS	311
TECHNICAL SECURITY CONTROLS	311
INFORMATION SECURITY AND CLOUD COMPUTING	314
The Human Element in Information Ethics, Security, and Privacy	315
COGNITIVE ISSUES AND PRODUCTIVITY	315
SOCIAL ENGINEERING AND INFORMATION SECURITY	316
SECURITY AWARENESS AND ETHICAL DECISION MAKING	316
Online Simulation	318
Chapter Summary	319
Key Terms and Concepts	319
Chapter Review Questions	320
Projects and Discussion Questions	320
Application Exercises	321
EXCEL APPLICATION: CITYWIDE COMMUNITY COLLEGE	321
ACCESS APPLICATION: CITYWIDE COMMUNITY COLLEGE	321
Case Study #1 Zynga Kills Petville and Angers Virtual Pet Owners	322
Case Study #2 Community Policing on the Internet: Spamhaus Targets Worldwide Spammers	323
E-Project 1 Tracking the Trackers: Investigating How Third-Party Cookies Steer the Ads You See	325
E-Project 2 Analyzing Spammers by Country Using Excel Pivot Tables	325
Chapter Notes	326

CHAPTER 11


Systems Development and Procurement 328

Learning Objectives 328
 Introduction 328
 Systems Development Life Cycle 330
 PLANNING 330
 ANALYSIS 331
 DESIGN PHASE 333
 DEVELOPMENT PHASES 335
 TESTING PHASE 336
 IMPLEMENTATION 337
 MAINTENANCE 338
 Software Development Strategies 339

 **THE ETHICAL FACTOR:** Developing Systems That Promote Ethical Decision Making and Social Responsibility 340

 WATERFALL SOFTWARE DEVELOPMENT 340
 ITERATIVE METHODS 341
 AGILE METHODS 342
 Comparing Software Development Approaches 342
 TYPE OF PROJECT 342
 ORGANIZATIONAL CULTURE 343
 IS WATERFALL DEAD? 343
 Software Procurement: The “Buy” Strategy 343
 PROS AND CONS OF BUILD AND BUY 344
 THE PROCUREMENT PROCESS 344
 ADAPTATION AND CUSTOMIZATION 346
 The Human Element in Systems Development and Procurement 346
 WORKING IN TEAMS 346
 THE ROLE OF SENIOR MANAGEMENT 347
 WORKING WITH CONSULTANTS 347
 Online Simulation 349
 Chapter Summary 350
 Key Terms and Concepts 350
 Chapter Review Questions 351
 Projects and Discussion Questions 351
 Application Exercises 352
 EXCEL APPLICATION: JAY’S BIKES 352
 ACCESS APPLICATION: MANAGING A RECIPE COLLECTION 352
 Case Study #1 Baby Steps toward Scrum: How BabyCenter.com Made the Cultural Transition to Agile Software Development 353
 Case Study #2 Extreme Programming at the U.S. Strategic Command 354
 E-Project 1 Watching Babycenter.com Change over Time with the Internet Archive 355
 E-Project 2 Analyzing Software Defect Rates Using Excel 355
 Chapter Notes 356

CHAPTER 12**Project Management and Strategic Planning 358**

Learning Objectives	358
Introduction	358
What is a Project?	360
PROJECTS VERSUS PROCESSES	360
THE TRIPLE CONSTRAINT: TIME, COST, AND SCOPE	361
Project Management	361
THE FIVE PROJECT MANAGEMENT PROCESSES	362
THE ROLE OF THE PROJECT MANAGER	365
 THE ETHICAL FACTOR: Code of Ethics for Project Managers	366
Project Management Software	366
MANAGING TIME	366
MANAGING PEOPLE AND RESOURCES	366
MANAGING COSTS	367
Why Projects Succeed and Why They Fail	368
WHY DO PROJECTS FAIL?	368
SUCCESS FACTORS FOR PROJECT MANAGEMENT	368
Strategic Planning for Information Systems	369
VISION, PRINCIPLES, AND POLICIES	369
PROJECT PORTFOLIO MANAGEMENT	372
DISASTER RECOVERY AND BUSINESS CONTINUITY	374
TECHNOLOGY AND INDUSTRY TRENDS	374
Planning for the Future: The Human Element	375
COGNITIVE BIASES AND STRATEGIC PLANNING	376
THE BLACK SWAN	377
Online Simulation	379
Chapter Summary	380
Key Terms and Concepts	381
Chapter Review Questions	381
Projects and Discussion Questions	381
Application Exercises	382
EXCEL APPLICATION: CREATING A GANTT CHART WITH EXCEL	382
ACCESS APPLICATION: APPRENTICE PROJECT MANAGERS	383
Case Study #1 Predicting the Future: Gartner's Research Informs Strategic Planning	384
Case Study #2 JetBlue and WestJet: A Tale of Two Software Implementations	385
E-Project 1 Checking on Gartner's Predictions	387
E-Project 2 Analyzing Airline Performance with Excel Pivot Tables	387
Chapter Notes	388
End-of-Book Comprehensive Case Studies	389
Case Study #1 Facebook and Instagram: Privacy Challenges	389
Case Study #2 Enabling the Sharing Economy: The Case of Uber Technologies	393
Case Study #3 Apple: Can the Company Pull Off Another Disruptive Innovation?	396
Case Study #4 Managing the Federal Government's IT Project Portfolio	399
Glossary	403
Index	411

This page intentionally left blank

Preface



What's New in the 3rd Edition

The information systems field is fast-moving, and this 3rd edition features a number of new trends that affect organizations around the world. All chapters and case studies have been fully updated with current information and sources.

Major new features include the following:

- Extended coverage of the **Internet of Things** throughout, discussing the explosive increase in connected devices and the data they manage
- Updated Chapter 3 to introduce recent technologies and trends in enterprise architectures
- Revised Chapters 6 and 7 to expand coverage of social media, social and mobile marketing, and digital analytics
- Added several new case studies:
 - *How eBay Scales Its Database Architecture with SQL and NoSQL* (Chapter 4)
 - *Salesforce.com: Taking CRM to the Cloud* (Chapter 5)
 - *LinkedIn: The Social Network and E-Marketplace for Professionals* (Chapter 6)
 - *Enabling the Sharing Economy: The Case of Uber Technologies* (End-of-book comprehensive case)

Chapter-Specific Changes

CHAPTER 1: INFORMATION SYSTEMS AND PEOPLE

- New key term introduces the **Internet of Things**, a subject that receives expanded attention in this edition
- Updated tables showing social network usage
- Updated table showing important MIS research topics
- New information on Google's Project Loon, to bring Internet access to developing countries
- Updated information on recent data breaches
- Updated case studies on Nasdaq and Twitter with current information and recent sources

CHAPTER 2: INFORMATION SYSTEMS AND STRATEGY

- Updated figure showing net profit margins of selected industries
- New examples of recent disruptive innovations and strategic enablers, such as ride-hailing services, 3-D printing, and self-driving vehicles
- Improved figure illustrating cloud computing
- Updated graphs showing average IT spending by industry and per employee
- Updated cases on GameStop and net neutrality using current information and recent sources

CHAPTER 3: INFORMATION AND COMMUNICATIONS TECHNOLOGIES: THE ENTERPRISE ARCHITECTURE

- Added **infrastructure as a service (IaaS)** and **platform as a service (PaaS)** as new key terms with discussion
- Updated figures showing market share data for operating systems
- Added recently released 802.11 standards to table

- Added new productivity tips on using speech recognition technology to handle routine tasks, and taking advantage of personal cloud computing
- Reorganized Section 3 on networks and telecommunications to improve flow
- Added discussion of “cord-cutting” to highlight strategic challenges in the telecom industry
- Described software-defined networks in discussion of trends in virtualization
- Updated cases about wearable technologies and Sprint drawing on current information and recent sources
- Deleted older technologies as key terms (WiMax and circuit-switched networks)

CHAPTER 4: DATABASES AND *DATA WAREHOUSES*

- Added **NoSQL DBMS** as new key term, with expanded discussion
- Added new case study “How Ebay Scales Its Database Architecture with SQL and NoSQL,” replacing the case study on Colgate-Palmolive
- Add new table to illustrate a “pets” entity for a veterinarian’s database
- Updated table showing jobs related to databases with average salaries

CHAPTER 5: INFORMATION SYSTEMS FOR THE *ENTERPRISE*

- Updated discussion of requirements for financial systems
- New “Did You Know?” box about Netflix’s supply chain for streaming video
- Added discussion of drones in supply chains
- Added new case study, “Salesforce.com: Taking CM to the Cloud,” which replaces the case study about CRM in government agencies

CHAPTER 6: THE WEB, SOCIAL MEDIA, *E-COMMERCE*, AND *M-COMMERCE*

- Revised title and chapter contents to add more emphasis to social media
- Added new “Did You Know?” box about cybersquatting on valuable domain names
- Added two new bullets to the features of mobile computing: location awareness and their role in the Internet of Things
- Expanded the digital marketing section to include discussion of social and mobile marketing
- Added new “Did You Know?” box about MOOCs and crowdsourcing
- Added **Bluetooth low-energy (BLE) beacon** as new key term, with discussion of the technology’s role in marketing
- Added new case study about LinkedIn, replacing the case study on Pandora Internet Radio

CHAPTER 7: BUSINESS INTELLIGENCE AND *DECISION MAKING*

- Added sections describing different types of metrics used to evaluate websites, social media, and e-commerce applications
- Expanded discussion of artificial intelligence to include emerging technologies
- Added new “Did You Know?” about Microsoft’s misguided AI experiment with a chat bot
- Added new table showing sample metrics for mobile apps
- Updated case studies with new information and current sources

CHAPTER 8: COLLABORATING WITH *TECHNOLOGY*

- Added new section on group conversation software, such as Slack
- Added new productivity tip about software to support team projects
- Added new productivity tip about using open source media to enliven student presentations
- Revised and updated data on social networking usage patterns
- Added new “Did You Know?” describing how companies monitor social media for warning signs

- Updated section on virtual reality technology, such as the Oculus Rift headset
- Revised and updated case studies with new information and recent sources

CHAPTER 9: KNOWLEDGE MANAGEMENT AND *E-LEARNING*

- Added new “Did You Know?” box on using knowledge management techniques to combat the Zika virus
- Updated section on organizing knowledge, emphasizing **enterprise content management**, a new key term that describes how organizations manage all types of content through the life cycle
- Deleted expert location system as key term, as these capabilities are embedded in other software
- Added new section on **serious games**, including new key term
- Added brief discussion of the specification called Learning Tools Interoperability (LTI) and the use of badges in learning management systems

CHAPTER 10: ETHICS, PRIVACY, AND *SECURITY*

- New figure summarizing data about organizational policies about software piracy
- New figure and productivity tip advising students to check their own digital footprints occasionally
- Added section on **ransomware**, including new key terms (**ransomware** and **bitcoins**)
- Added new data on the prevalence of insider attacks
- Added new productivity tip suggesting that students adopt multifactor authentication whenever services they use offer this capability
- Updated table on recent events involving information leakage
- Updated case studies on Zynga and Spamhaus using new data and recent sources

CHAPTER 11: SYSTEMS DEVELOPMENT AND *PROCUREMENT*

- Added new section on **application programming interfaces (API)**, including new key term and a discussion of the ways in which APIs improve software development
- Reorganized and revised section on the role of senior managers in procurement, discussing the need to develop policies about software implemented outside of IT departments
- Added new “Did You Know?” about software bugs in computer chips
- Deleted unified modeling language as key term, since its use is declining

CHAPTER 12: PROJECT MANAGEMENT AND *STRATEGIC PLANNING*

- Added new table that compares different IT funding models
- Added brief discussion of disaster recovery as a service
- Updated discussion of technology and industry trends, with revised table showing emerging trends
- Updated case study on Gartner’s predictions, using new figure showing recent hype cycle entries with current sources
- Updated case study on JetBlue and WestJet with recent financial figures and current sources

End-of-Book Comprehensive Case Studies

- New case study #2, “Enabling the Sharing Economy: The Case of Uber Technologies” (replaces case on the Red Cross supply chain)
- Facebook case updated and revised to include recent usage and financial data and discussion of “interest-based ads”
- Apple case updated with recent statistics and strategic moves, including self-driving cars
- Federal Government IT case updated with recent examples and data and discussion of changing strategies to manage the immense portfolio

To the Student

Any college student thinking about the job market can't help but notice how valuable it is to have skills related to information systems. In this course you will learn what information systems are all about and why they are so fundamental to business and society. It will be an exciting journey, filled with revelations about business strategies, technology trends and innovations, and also tips that will help you work smarter as a student. Here are the main features of this text and its supplements:

Learn by Doing: The Interactive, Online Role-Playing Simulations

A course on information systems should tap their power for active, experiential learning. This text includes interactive role-playing simulations in MyMISLab™ (mymislab.com) in which students can apply their knowledge and actually experience what each chapter is about, not just memorize key terms and concepts. You will enter realistic and often tense situations, interacting with the characters via a simulated smartphone or laptop, and using email, text messaging, web conferencing, video chat, voicemail, dashboards, ordering screens, and other applications. Each simulation is scored and students receive extensive feedback on the choices they make. Each one also includes key terms from the chapter (with rollover definitions) so you see how they are used in context, which will help you more easily remember their meanings.

The simulations bring the chapter alive, as you enter authentic settings in which people struggle to solve a problem involving information systems. Some examples:

- In World of Mammals (Chapter 1), you help the harried director of a wild animal preserve interview candidates for the CIO position, after the former CIO leaves abruptly. What skills does a CIO need? What kind of experience would fit best?
- Chocolate Lovers Unite (Chapter 7) challenges you to resolve a heated debate over which online marketing pitch works best by conducting tests, analyzing the results, and drawing on data-driven decision making.
- In Green Wheeling, the simulation on software development and procurement (Chapter 11), you join a task force charged with replacing a college's obsolete fund-raising system. You and your team members weigh the pros and cons of "build" or "buy," and you will see how the outcome can change based on your decisions.
- Vampire Legends drops you into a fast-paced, tense situation in which the material in Chapter 10 (Ethics, Privacy, and Security) comes to life in an online game company that is racing to launch a sequel. When troubling things begin happening that involve the company's data center and information security, you will have difficult choices to make.

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

The Human Element in Information Systems

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

In Chapter 8 on collaborative technologies, for example, students learn how different channels affect the tone of human communications, and how to choose the best technologies for

each task to support virtual teamwork, management, negotiation, and leadership. Chapter 12 on project management and strategic planning for information systems shows how human biases can creep into the process.

The text also stresses the processes and policies that people devise to manage information systems. Why do some high-tech companies ban telecommuting, even though employees have well-equipped home offices? Why do organizations implement surveillance?

Exploring Technology Battlegrounds

Grand battles over technology directions help students understand the close links between competitive business strategies and information systems. The stakes are very high in debates about topics such as net neutrality, 4G standards, wireless spectrum auctions, cloud computing, programming languages, mobile operating systems, mobile payment systems, and social network privacy. Billions of dollars are on the line for winners and losers. Yet most people know little about these battlegrounds because the underlying technology issues are out of reach. After reading this text, students will look at online ads, privacy policies, social networks, and their own smartphones with a new appreciation for the fierce business competitions unfolding before their eyes.

Reaching a Changing Student Body

The text recognizes the growth in the number of women, minorities, international students, online students, and nontraditional students who enroll in this course, drawing on examples and settings that will resonate with them. Devon, for instance, is starting her own web design business, and students learn about relational databases by helping her build one for her small business (Chapter 4). International student Prakash is the cofounder of *Leveling UP!*, a smartphone app that is the centerpiece for the interactive role-playing simulation on business strategy (Chapter 2). In the chapter on knowledge management and e-learning (Chapter 9), Sally takes an online course in nonprofit management as she nears retirement and helps her own company build an e-learning course for the coworkers she's leaving behind.

Balancing Coverage of Business, Government, and Nonprofits

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

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

Changing Student Roles

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

Examples in the text, case studies, and simulations feature all these different roles, showing how successful information systems emerge from a broad base of stakeholders with different perspectives and specialties. Carlos, for instance, is the instructional designer on a corporate e-learning development team, adding his knowledge of usability and accessibility

for people with disabilities (Chapter 9). In Chapter 11, Lily is a senior manager for an online grocery who comes up with a clever website to capture a valuable market—busy singles who forgot to buy groceries.

Emphasizing Ethics

Ethical concerns weave throughout the text, touching on very human ethical dilemmas such as the one Wikipedia founder Jimmy Wales faced when asked to delete any posts that mentioned the name of a journalist kidnapped by the Taliban. That action was directly opposed to his site’s fervent commitment to free speech, and Wales raised a firestorm within the Wikipedia community when he had to make a choice.

A special feature in each chapter titled “The Ethical Factor” explores timely ethical issues such as corporate responsibility in extended supply chains (Chapter 5), or the ethics of massive surveillance and collection of big data by governments and corporations (Chapter 3). In Chapter 10 on ethics, privacy, and security, students take a survey to learn more about how they judge situations that touch on information ethics. The online simulation for that chapter immerses students in a tense situation in which security is compromised and they face some difficult ethical dilemmas.

Here is a list of all the “Ethical Factor” boxes:

1. Ethical Issues Surrounding Information Systems, p. 22
2. Ethical Responsibility in an Extended Value Chain, p. 44
3. Ethical Implications of Big Data, p. 70
4. Ethical Issues in Database Design: The Case of Ethnic Identification, p. 110
5. Ethics and Talent Management, p. 138
6. Website Accessibility: Why Is Progress So Slow? p. 175
7. The Ethics of Tagging Faces in Photos, p. 204
8. Flash Mobs and Free Speech: Should Police Block Mobile Messaging Services? p. 246
9. Knowledge Sharing in Fast-Paced Industries: The Case of Formula One Racing, p. 273
10. Ethical Dilemmas in a Distributed Denial of Service Attack, p. 309
11. Developing Systems That Promote Ethical Decision Making and Social Responsibility, p. 340
12. Code of Ethics for Project Managers, p. 366

Working Smarter, Not Harder: Productivity Tips for Students

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

In Chapter 2 on information systems and strategy, for instance, a tip invites students to check out the software trial versions that came preinstalled on their computers to see how companies leverage this valuable product positioning, and then remove them to save space and improve the computer’s performance. A tip in the section on neural networks in Chapter 7 advises students to alert their credit card companies before traveling abroad because a neural net may trigger a very ill-timed block on the card. Another tip points to solid productivity gains for people who use two monitors, which is especially helpful for students with laptops.

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

Highlighting Globalization and International Contexts

Information systems play a key role in globalization, especially through the Internet and all the creative destruction it unleashed. Examples abound throughout the text, highlighting how Baidu captured the search engine market in China (Chapter 2) or how Ikea manages a global supply chain (Chapter 5). The global financial crises underscore the important work of the International Accounting Standards Board—to promote transparent and enforceable financial reporting for companies around the world using XBRL tags—from the XML family of standards (Chapter 5). The international emphasis also unfolds in working relationships across

national borders. For example, the chapter on collaboration (Chapter 8) discusses virtual teams with members from different countries, and offers tips on strategies to use collaborative technologies effectively.

Inspiring Students to Pursue Promising Careers

Finally, an important goal of this text and its supplements is to convey the sheer excitement and limitless potential of this field, with an eye toward inspiring students to go further. Inside are countless examples of how savvy men and women leverage information systems to transform organizations of all stripes, and even build new empires. The text includes many job descriptions, job growth rates, and projected salaries, as well.

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

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

If students catch some of this energy and enthusiasm, they may decide to pursue this field. Those who do will have outstanding career prospects in the private and public sectors, and they’ll never be bored.

Supplements

The following supplements are available at the Online Instructor Resource Center, -accessible through www.pearsonhighered.com/wallace:

Instructor’s Manual

The Instructor’s Manual, assembled by John Hupp, includes a list of learning objectives and answers to all end-of-chapter questions.

Test Item File

The Test Item File, prepared by ANSR Source, Inc., contains more than 1,300 questions, including multiple choice, true/false, and essay. Each question is followed by the correct answer, the learning objective it ties to, a course learning objective, and difficulty rating. In addition, certain questions are tagged to the appropriate AACSB category.

Powerpoint Presentations

The Instructor PowerPoints, prepared by John Hupp, highlight text learning objectives and key topics and serve as an excellent aid for classroom presentations and lectures.

Image Library

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

TestGen

Pearson Education’s test-generating software is available from www.pearsonhighered.com/irc. The software is PC/MAC compatible and preloaded with all of the Test Item File questions.

You can manually or randomly view test questions and drag-and-drop to create a test. You can add or modify test-bank questions as needed. Our TestGens are converted for use in BlackBoard, WebCT, Moodle, D2L, and Angel. These conversions can be found on the Instructor's Resource Center. The TestGen is also available in Respondus and can be found on www.respondus.com.

Alternate Electronic Versions

Pearson is proud to offer alternate versions for students seeking an electronic version of the Wallace text. VitalSource (www.vitalsource.com) provides one option, where students simply select their eText by title or author and purchase immediate access to the content for the duration of the course using a major credit card. Students can also find eBooks through Barnes & Noble, Kindle versions on Amazon, and more through various other eBook retailers.

Available in MyMISLab

- MIS Video Exercises – Videos illustrating MIS concepts, paired with brief quizzes
- Interactive Online Role-Playing Simulations – Require students to apply their knowledge and actually experience what each chapter is about, not just memorize key terms and concepts
- Auto-Graded writing exercises – taken from the end of chapter
- Assisted-Graded writing exercises – taken from the end of chapter, with a rubric provided
- Chapter Warm Ups, Chapter Quizzes – objective-based quizzing to test knowledge
- Discussion Questions – taken from the end of chapter
- Dynamic Study Modules – on the go adaptive quizzing, also available on a mobile phone
- Learning Catalytics – bring-your-own-device classroom response tools
- Enhanced eText – an accessible, mobile-friendly eText
- Excel & Access Grader Projects – live in the application auto-graded Grader projects provided inside MyMISLab to support classes covering Office tools

Acknowledgments



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

Dennis Adams, *University of Houston*
Joni Adkins, *Northwest Missouri State University*
Sven Aeltermann, *Troy University*
Solomon Antony, *Murray State University*
John Appleman, *State University of New York College at Brockport*
Bay Arinze, *Drexel University*
Janine Aronson, *University of Georgia*
John Kirk Atkinson, *Western Kentucky University*
Robert Balicki, *Cleary University*
Cynthia Barnes, *Lamar University*
Stephen Barnes, *Regis University*
Peggy Batchelor, *Furman University*
Jon Beard, *George Mason University*
Hossein Bidgoli, *California State University—Bakersfield*
Robert Bonometti, *MGB Enterprises LLC*
Ted Boone, *University of Kansas*
Uptal Bose, *University of Houston; Rainer*
David Bradbard, *Winthrop University*
Jason Chen, *Gonzaga University*
Joselina Cheng, *University of Central Oklahoma*
Steve Clements, *Eastern Oregon University*
Phillip Coleman, *Western Kentucky University*
Emilio Collar, Jr., *Western Connecticut State University*
Steve Corder, *Williams Baptist College*
Dave Croasdell, *University of Nevada, Reno*
Albert Cruz, *National University*
Mohammad Dadashzadeh, *Oakland University*
Don Danner, *San Francisco State University*
Dessa David, *Morgan State University*
Carolyn Dileo, *Westchester Community College*
Michael Douglas, *Millersville University*
Doris Duncan, *California State University—East Bay*

Barbara Edington, *St. Francis College*
Kurt Engemann, *Iona College*
John Erickson, *University of Nebraska at Omaha*
William Figg, *Dakota State University*
David Firth, *The University of Montana*
Anne Formalarie, *Plymouth State University*
Saiid Ganjalizadeh, *The Catholic University of America*
Richard Glass, *Bryant University*
Tanya Goette, *Georgia College & State University*
Sandeep Goyal, *University of Southern Indiana*
Martin Grossman, *Bridgewater State University*
Bin Gu, *University of Texas at Austin*
Laura Hall, *University of Texas—El Paso*
Rosie Hauck, *Illinois State University*
Jun He, *University of Michigan—Dearborn*
Devanandham Henry, *Stevens Institute of Technology*
Michelle Hepner, *University of Central Oklahoma*
John Hupp, *Columbus State University*
Jerry Isaacs, *Carroll University*
Brian Janz, *University of Memphis*
Jon (Sean) Jaspersen, *Texas A&M University*
Brian Jones, *Tennessee Technological University*
Junghwan Kim, *Texas Tech University*
Philip Kim, *Walsh University*
Sung-kwan Kim, *University of Arkansas at Little Rock*
Charles S. Knode, *University of Maryland University College*
Brian Kovar, *Kansas State University*
Bill Kuechler, *University of Nevada at Reno*
Louis LeBlanc, *Berry College*
Albert Lederer, *University of Kentucky*
Ingyu Lee, *Troy University*
Mary Locke, *Greenville Technical College*
Sanchita Mal-Sarkar, *Cleveland State University*

xxxii ACKNOWLEDGMENTS

Nancy Martin, *Southern Illinois University Carbondale*
Prosenjit Mazumdar, *George Mason University*
Roger McHaney, *Kansas State University*
William McMillan, *Madonna University*
Tonya Melvin-Bryant, *North Carolina Central University*
Kimberly Merritt, *Oklahoma Christian University*
Allison Morgan, *Howard University*
Fui Hoon (Fiona) Nah, *University of Nebraska—Lincoln*
Sandra Newton, *Sonoma State University*
Ravi Paul, *East Carolina University*
Adriane Randolph, *Kennesaw State University*
Betsy Ratchford, *University of Northern Iowa*
Mandy Reininger, *Chemeketa Community College*
Nicolas Rouse, *Phoenix College*
Paula Ruby, *Arkansas State University*
Werner Schenk, *University of Rochester*
Daniel Schmidt, *Washburn University*
Aaron Schorr, *Fashion Institute of Technology*

Paul Seibert, *North Greenville University*
Narcissus Shambare, *College of St. Mary*
Larry Smith, *Charleston Southern University*
Toni Somers, *Wayne State University*
Todd Stabenow, *Hawkeye Community College*
James Stewart, *University of Maryland
University College*
Joe Teng, *Troy University Troy Campus*
Evelyn Thrasher, *Western Kentucky University*
Jan Tucker, *Argosy University*
Jonathan Whitaker, *University of Richmond*
Bruce White, *Quinnipiac University*
Anita Whitehill, *Mission College*
G. W. Willis, *Baylor University*
Charles Willow, *Monmouth University*
Marie Wright, *Western Connecticut State University*
Jigish Zaveri, *Morgan State University*
Chen Zhang, *Bryant University*

Many thanks to John Hupp of Columbia State University for his outstanding work on the end of chapter materials and the instructor's manual, and to Jollean Sinclair of Arkansas State University who contributed to those as well. I am grateful to Robert Mills of Utah State University, who applied his expertise to the questions in the Learning Catalytics system.

Thanks also to the excellent work and innovative ideas of my editor, Samantha Lewis, and also the editors who worked with me in the past, Bob Horan and Nicole Sam. The production team, led by Katrina Ostler at Cenveo Publishing Services, and Ann Pulido with SPi did an outstanding job as well. It is a pleasure to work with all of these people to create a comprehensive set of learning materials that offer faculty unique teaching tools and time-saving strategies, and at the same time, engage students with lively and innovative learning experiences.

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

Your Feedback Is Welcome

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

Patricia Wallace, Ph.D.
pwallace@jhu.edu

Introduction to Information Systems

Information Systems and *People*

MyMISLab™

- Online Simulation: The World of Mammals: A Role-Playing Simulation on Choosing a New CIO for an Animal Preserve
- Discussion Questions: #1-1, #1-2, #1-3
- Writing Assignments: #1-9, #1-14

LEARNING OBJECTIVES

- 1 Describe the main roles that information systems play in organizations.
- 2 Compare the terms *data*, *information*, and *knowledge*, and describe three characteristics that make information valuable.
- 3 Describe the four main components of an information system and the role that each plays.
- 4 Identify several research areas in the discipline of management information systems (MIS).
- 5 Provide examples of how business, nonprofit, and government managers, as well as information technology departments, depend on information systems knowledge.
- 6 Explain how information systems present both promises and perils, and pose ethical questions.

An online, interactive decision-making simulation that reinforces chapter contents and uses key terms in context can be found in [MyMISLab™](#).

INTRODUCTION

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

Consider The World of Mammals, for example, the animal preserve featured in the interactive simulation for this chapter. Director Yolanda Whalen is a veterinarian, but she knows very well that this preserve won't succeed without top-notch

information systems and a qualified person to provide leadership. She is asking you, as an enthusiastic volunteer and a student learning about information systems, to help interview potential candidates and join the team that will decide who is best suited for this role. What skills, knowledge, and abilities should this person have—beyond managing payroll and ticket sales—to take advantage of innovative technologies that will make The World of Mammals the most successful preserve in the country?

This opening chapter highlights information systems in action, the nature of information itself, and the four main components of every information system. You will see how the information systems (IS) discipline is changing

MyMISLab Online Simulation

THE WORLD OF MAMMALS

A Role-Playing Simulation on Choosing a New CIO for an Animal Preserve



© Meoita/Shutterstock.

and growing and why a solid understanding of this subject will give you a critical edge, regardless of your major or career path. Finally, the chapter examines the promises and perils of information systems and the many ethical issues that arise with the phenomenal power within everyone's reach.

Information is an organization's most important asset. Creating, capturing, organizing, storing, retrieving, analyzing, and acting on information are fundamental activities in every organization. The skill with which you carry out those tasks will be the deciding factor not just for your company's success but for your own as well. This book is about information and the systems that people develop and manage to perform all those tasks and more.

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

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

Describe the main roles that information systems play in organizations.

1 Information Systems in Action

- *Dancing with the Stars* became a smash reality TV hit by engaging millions of viewers in judging the contestants. Hopeful celebrity couples compete each week with a novel dance routine, and audience members cast a vote for their favorite by phoning, sending text messages, or logging into the show’s website. An information system on the back end tallies the results, which count for half the couple’s score. The system must be able to handle enormous incoming volume in a very short time period to get accurate tallies.
- Hurricane Sandy arrived just before the November 2012 elections in the United States, and many voters could not make it to the polls. Officials in New Jersey decided to let people vote by email, but county clerks were overwhelmed by the volume in their inboxes. Although glitches and security concerns are not uncommon with electronic voting, information systems are playing a more important role every year. Disabled voters, for instance, can now use tablets to vote, eliminating the need for expensive custom-made voting machines.
- Walmart, with more than \$485 billion in net sales in 2015, pioneered the globe’s most efficient information system to track shipments as they move from supplier factories to warehouses to retail stores. Tags attached to pallets transmit information wirelessly, so Walmart execs know exactly where merchandise is in the supply chain and can spot trouble immediately.

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

Multinational firms, small businesses, nonprofits, governments, volunteer organizations, self-employed entrepreneurs, universities, and other organizations rely on information systems for a host of reasons, and they continue to adapt, expand, and interconnect them to achieve their strategic objectives. These systems play critical roles in six major areas (Figure 1-1).

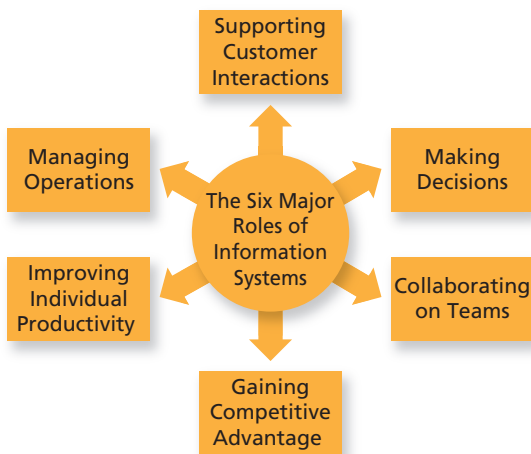
Managing Operations

Every successful organization must excel at **operations management**, which involves the design, operation, and improvement of the systems and processes the organization uses to deliver its goods and services. Some of these deal with several very basic functions that are part of every business. Information systems are crucial for tracking employee payroll, taxes, benefits, and timesheets. Accounting information systems are essential to track accounts

receivable, to process transactions, to procure goods and services, and to pay the suppliers. Organizations also must manage their assets and inventories, from the computers and the desks they sit on to the massive factories and equipment located in far corners of the globe. Eric Schmidt, former CEO of Google, once remarked that he had no idea how many data centers Google actually managed. He might not have known, but his back-office information systems certainly did.

Information systems designed to handle the processes involved in these functions must also meet compliance standards set by governments and other regulatory agencies, which may change from time to time and also vary by country or state. Reports must be filed, audits passed, and changing regulations followed. Extensive regulations put into place after the global financial crisis of 2009, for example, set tighter standards for accounting practices—particularly in banking—and demanded more transparent reporting.

FIGURE 1-1
The major roles of information systems in organizations.



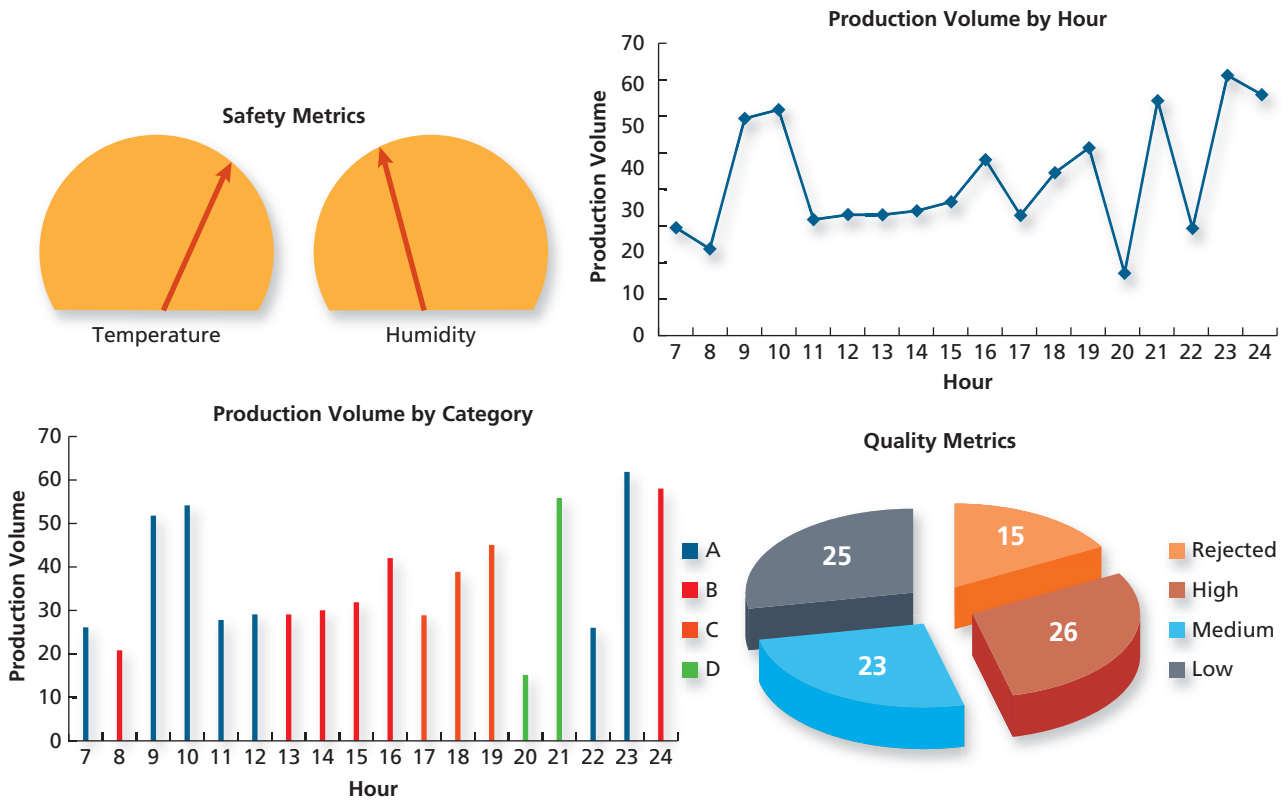
Many organizations choose commercially produced information systems to handle their back-office information needs, relying on software packages such as SAP, Oracle, NetSuite, or QuickBooks. Some organizations are moving these functions to service providers or even outsourcing them entirely. India became known as the world’s “back office” because so many companies moved these applications there,¹ and now the Philippines is becoming the world’s biggest operator of call centers.²

Depending on their missions, organizations also need information systems to manage industry-specific operations, such as these:

- Manufacturers need systems to manage assembly lines, product quality, production schedules, and just-in-time supply deliveries (Figure 1-2).
- Colleges and universities need systems to manage student academic records, class scheduling, faculty assignments, and student financial aid (Figure 1-3).

FIGURE 1-2

Manufacturing information system displaying production volumes and other metrics.



MyCollege	MyTools	MyClasses	MyProfile
Update contact info		Course	Days
View schedules		Bus 111	MW
Submit request		Bus 111	MW
View requirements		Bus 112	T-TH
Register for courses		Bus 112	-
		Bus 112	M
		Bus 113	W
			Time
			14:00–15:00
			15:00–16:00
			9:00–10:45
			-
			9:00–11:45
			1:00–2:45
			Location
			Macintyre
			Doyle
			Student Services
			Online
			Garcia
			Doyle

FIGURE 1-3

Student information system with online services for students and faculty.

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

- Transportation companies rely on information systems equipped with GPS to track their fleets, optimize routes, and conserve gas.
- Companies that buy products from suppliers around the globe need real-time updates on their global supply chains to manage inventories and reduce costs.

Achieving excellence in operations can provide enormous cost savings and competitive advantage, as companies squeeze every ounce of fat out of their processes without sacrificing quality. UPS drivers, for instance, know to avoid left turns on their delivery routes when possible because they take a few seconds longer, wasting time and gas. Systems that support operations are discussed in Chapter 5.

Supporting Customer Interactions

Interactions with customers, clients, students, patients, taxpayers, citizens, and others who come to your organization desiring a product or service are fundamental to success. Your customers pay the bills. **Customer relationship management (CRM) systems**, discussed in Chapter 5, build and maintain relationships and support all the processes that underlie them.

A brick-and-mortar retail store, for example, needs a sales system that identifies each product in the shopper's basket, tallies the total, feeds the data to the inventory system, and accepts various kinds of payment. Shoppers want fast checkouts, and they get annoyed by clumsy, inefficient processes. When an item lacks its barcode, impatient customers may just abandon it rather than wait for a salesclerk to track it down. Strategies to prevent theft, such as the check on weights added to the bag, also anger shoppers when they do not function properly.

Web-based shopping and self-service transform relationships with customers, freeing them from time-consuming phone calls. These web-based processes often mimic the brick-and-mortar versions, with “shopping carts” and “checkouts” clearly labeled. A web application offers many opportunities to build stronger relationships and also better understand the motives and desires of each person who visits.

Scattered throughout *Amazon.com*'s site, for example, are recommendations based on previous purchases, encouragements to “review this book” or “rate this item,” special discounts and coupons, storage space for your wish lists and gift ideas, and many other innovative features to map out your preferences and build a stronger relationship. All of this data contributes to Amazon's customer relationship management excellence and the company's understanding of what each customer wants.

Infinite variations in customer interaction exist, from Southwest Airlines's text reminders about your upcoming flight to the Internal Revenue Service's e-file system. Developing these

relationships is not just about improving sales and collecting receipts. It is about building long-term loyalty and satisfaction by listening to customers and learning what is most important to them. That also includes sensitivity to their privacy concerns, as we discuss in Chapter 10.

FIGURE 1-4

How do managers answer questions like these?



Source: liza54500/Shutterstock

Making Decisions

How should a restaurant manager make decisions like the ones in Figure 1-4?

Managers make decisions every day, and many rely mainly on their own judgment. In fact, researchers surveyed 250 executives and learned that 40% of major corporate decisions were based on gut instincts.³ Smart managers, however, know that information systems support **data-driven decision making**, which draws on the billions of pieces of data to reveal important trends and patterns. For example, the sales system will show how much the restaurant makes in the last hour of business, and that data will help the manager make a good decision about closing early.

Business intelligence refers to all the information managers use to make decisions, and it can come from many sources beyond the organization’s own information systems. The restaurant manager, for example, might combine customer records with publicly available information about income levels by zip code to help make a smart decision about where to open another branch.

Decision support systems and business intelligence, discussed in Chapter 7, encompass a growing and varied category that blends rapid analysis of information sources with artificial intelligence and human knowledge. For knowledge workers, in particular, the value of knowing how to draw upon those vast mountains of information to make wise decisions is extremely high.

Your online behavior is one of the most important sources of business intelligence. The sites you visit and “like,” the apps you download, and the links you click reveal your interests and intentions, and marketers track that data closely. Spending for mobile ads, for instance, could reach \$250 per user by 2018.⁴



Collaborating on Teams

Collaboration and teamwork have considerable support from innovative information systems that allow people to work together at any time and from any place. Regardless of where they live and work, participants can hold online meetings, share documents and applications, and interact using microphones, video cameras, and whiteboards. **Social networking sites** support online communities of people who create profiles for themselves, form ties with others with whom they share interests, and make new connections based on those ties. These social groups exploded in popularity as people jumped at the chance to share news, photos, videos, and tidbits. Figure 1-5 shows usage rates for the larger social networking sites. Services that target business users, such as Microsoft’s SharePoint, offer additional useful services such as shared calendars and group document editing.

Developing information systems for collaboration takes ingenuity and attention to the ways in which people really do work together. The possibilities are endless, and different groups have different preferences. In online university courses, for example, debates about whether students should turn on their webcams during virtual class sessions are common. Many prefer to keep them turned off, valuing the privacy that invisibility creates. (One can doze off in a virtual class with little concern for detection.)

The information systems that support virtual teamwork, discussed in Chapter 8, are in some respects still in their infancy—especially compared with the more mature systems used to manage operations. Expect many improvements as we learn more about what features work best for different people and different situations.

FIGURE 1-5

Estimated usage for major social networking sites.

Social Networking Site	Estimated Unique Monthly Visitors
Facebook	1,100,000,000
Twitter	310,000,000
LinkedIn	255,000,000
Pinterest	250,000,000
Google+	120,000,000
Tumblr	110,000,000
Instagram	100,000,000
VK	80,000,000

Source: Data from <http://www.ebizmba.com/articles/social-networking-websites>, eBizMBA, © 2016.

customer relationship management (CRM) system

An information system used to build customer relationships, enhance loyalty, and manage interactions with customers.

data-driven decision making

Decision making that draws on the billions of pieces of data that can be aggregated to reveal important trends and patterns.

business intelligence

The information managers use to make decisions, drawn from the company’s own information systems or external sources.

social networking sites

Online communities of people who create profiles for themselves, form ties with others with whom they share interests, and make new connections based on those ties.

Gaining Competitive Advantage

Information systems play what could be their most valuable role when they are tied closely to strategy and to the major initiatives that will help achieve competitive advantage—a topic we take up in Chapter 2. **Competitive advantage**, which is anything that gives a firm a lead over its rivals, can be gained through the development and application of innovative information systems. Information systems are a fundamental part of a company’s strategic vision. Indeed, the vision itself is often shaped by what these systems can achieve today and what is possible for the future.

Consider how Apple’s iPhone got the jump on smartphone competitors with Siri, the intelligent personal assistant. Siri responds to spoken commands such as “Tell my brother I’ll be late” and also answers questions like “Any Italian restaurants near here?” Initially, the iPhone’s market share rose to more than 50%, in part because no other smartphone had anything like Siri. But competitive advantage can be fleeting. Microsoft entered the market with Cortana, Google launched Google Now, and Amazon followed up with Echo. Time will tell which personal assistant wins the most hearts.⁵

Strategy is equally important to nonprofit organizations and government agencies, and their information systems break new ground by offering handy services to the public, streamlining operations, and improving decision making. For instance, U.S. citizens can apply for Social Security benefits online rather than wait in line. Government strategies to combat terrorism also involve information systems—and analysis of immense volumes of data. Those strategies raise important ethical dilemmas, discussed in Chapters 3 and 10.

Improving Individual Productivity

Tools to help people improve their own productivity abound, from the smartphones that combine voice calls with web browsing, contact databases, email, music, and games to the many software applications that eliminate tedious work. Even word processing has transformed work in every organization, and many students aren’t aware of all the ways that software can

make them more productive. You can, for example, automatically create and properly format your term paper references by integrating a bibliographic manager such as Zotero, which captures the citation from a web page.

To improve productivity at work, people can choose from a

bewildering variety of computer software and electronic devices, but more is not necessarily better. You should select carefully, with an eye to the functions you need most, ease of use, and short learning curves. No one likes reading thick instruction manuals. Throughout this book, you will see productivity tips in boxes—like the one on this page—that will help you improve your own productivity.



PRODUCTIVITY TIP

Time management experts advise that you process your email inbox to zero, flagging important messages, moving others to appropriate categories, and rerouting some using automated filtering tools. Your email system can do quite a bit of work for you if you take time to configure it.

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

2 The Nature of Information

Except for words like *the*, *a*, *and*, *if*, and *it*, the word *information* was once one of the most common words on the Internet. No wonder people called the net an “information” storehouse. The term *information* is critical to understanding how information systems work, but it can be very slippery.

Facts, data, intelligence, knowledge, and even tips are synonyms for information, and they all touch on characteristics of the “stuff” that information systems can manage. For our purposes, the term **data** refers to individual facts or pieces of information, and **information** refers to data or facts that are assembled and analyzed to add meaning and usefulness. A patient’s single high-temperature reading at a 24-hour walk-in clinic in Maryland is one piece of data.

FIGURE 1-6

Examples of the continuum from data to information to knowledge, as meaning and usefulness grow.

Data	Information	Knowledge
Patient’s temperature at walk-in clinic on Dec. 15 = 103.9° F.	Table showing flu diagnoses in region during month of December	Worldwide map of flu outbreaks suggesting pandemic
01010011 01001111 01010011	Binary code for SOS	HELP!!!
Microsoft (MSFT) closing stock price	Graph of Microsoft highs and lows for one year	Combined with analysis of other information, leads to broker’s recommendation to buy, hold, or sell stock
CWOT	Complete Waste of Time (text messaging abbreviation)	May be interpreted as an insult
GPS coordinates	Map showing location with push pin	Location of Taj Mahal in India
Invoice #259 Total Amount = \$139.23	Total Sales for Southern Region in First Quarter = \$2,156,232	Fastest growing sales region; consider broader marketing campaign

But entered into the clinic’s information system and combined with the patient’s other symptoms and previous medical records, it becomes far more valuable as a diagnostic tool.

We gain even more from this one temperature reading by combining it with data from other patients entering all clinics that week. The patterns may warn of a flu outbreak or even a major epidemic. The health staff at the Centers for Disease Control and Prevention in Atlanta, Georgia, draw on data like this to map the spread of diseases and take swift action to protect the public.

Refining, analyzing, and combining information make it more and more useful and meaningful, and the effort adds to our ability to use it to make decisions and take action. The path from data to information, and then to knowledge, is a continuum, and Figure 1-6 shows some examples. No clear dividing lines separate these categories; they blend together and form a continuum as more meaning and usefulness are created through skillful analysis and human insight.

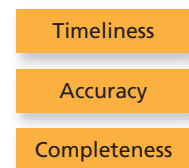
What Makes Information Valuable?

Separating useful information from the trivial is no easy task given the sheer volume of information on the planet. Three characteristics stand out, however, that contribute to making some information very valuable: (1) timeliness, (2) accuracy, and (3) completeness (Figure 1-7).

Timeliness matters a great deal in some settings, and near real-time information often costs more. For example, people pay monthly fees to financial services to get up-to-the minute stock prices rather than the delayed price reports shown on free stock tickers you can add to your own browser. Riswan Khalfan of TD Securities says his system can handle a breathtaking 5 million pieces of data per second, far more than most other banks. He points out that “if you fall behind, you’re dealing with stale data and that puts you at a disadvantage.” With timely, up-to-date trading data, Khalfan’s systems can make quicker decisions, which he argues are better (Figure 1-8).⁶

Accuracy may seem like an obvious feature of valuable information, but there actually are degrees of accuracy. The more accurate you want the information to be, the longer it may take to obtain, making extreme accuracy a trade-off to timeliness. A CEO who wants to know how much competitors charge for a rival product, for example, might wait too long for staff to scour all the distribution channels and assemble the data. An approximate but timely answer is more valuable.

FIGURE 1-7
What makes information valuable?



competitive advantage

Anything that gives a firm a lead over its rivals; it can be gained through the development and application of innovative information systems.

data

Individual facts or pieces of information.

information

Data or facts that are assembled and analyzed to add meaning and usefulness.