

MANAGEMENT INFORMATION SYSTEMS

MANAGING
THE
DIGITAL
FIRM

18E



KENNETH C. LAUDON | JANE P. LAUDON | CAROL G. TRAVER

Management Information Systems

Managing the Digital Firm

Eighteenth Edition

Kenneth C. Laudon

New York University

Jane P. Laudon

Azimuth Information Systems

Carol Guercio Traver

Azimuth Interactive, Inc.



Pearson

Commercial Product Manager: Jenifer Niles

Content Production: Priyaa Kaushik

Product Marketing: Wayne Stevens

Rights and Permissions: Dimple Bhorwal

Please contact www.AskPearsonSupport.com with any queries on this content.

Pearson puts care into the creation of our products. Our learning materials undergo content reviews to minimize bias and ensure the content is inclusive, accurate, and relevant. Please use this link to report instances of bias and inaccuracies: <https://www.pearson.com/report-bias.html>

You can learn more about Pearson's commitment to accessibility at <https://www.pearson.com/us/accessibility.html>

Cover Image by Metamorworks/Shutterstock

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® and Windows® 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 © 2026, 2024, 2021 by Pearson Education, Inc. or its affiliates, 221 River Street, Hoboken, NJ 07030.

All Rights Reserved. This digital 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 otherwise except as authorized for use under the product subscription through which this digital application is accessed. For information regarding permissions, request forms and the appropriate contacts within the Pearson Education Global Rights & Permissions department, please visit <https://www.pearson.com/global-permission-granting.html>.

Acknowledgments of third-party content appear on the appropriate page within the text, which constitutes an extension of this copyright page.

Pearson, Pearson+, and MyLab are exclusive trademarks owned by Pearson Education, Inc. or its affiliates in the U.S. and/or other countries.

Unless otherwise indicated herein, any third-party trademarks, logos, or icons that may appear in this work are the property of their respective owners, and any references to third-party trademarks, logos, icons, or other trade dress are for demonstrative or descriptive purposes only. Such references are not intended to imply any sponsorship, endorsement, authorization, or promotion of Pearson's products by the owners of such marks, or any relationship between the owner and Pearson Education, Inc., or its affiliates, authors, licensees, or distributors.

Library of Congress Cataloging-in-Publication Data

Names: Laudon, Kenneth C., author. | Laudon, Jane P. (Jane Price), author. | Traver, Carol Guercio, author.

Title: Management information systems : managing the digital firm / Kenneth C. Laudon, New York University, Jane P. Laudon, Azimuth Information Systems, Carol Guercio Traver, Azimuth Interactive, Inc.

Description: Eighteenth edition. | Hoboken, NJ : Education, Inc., [2026] | Includes bibliographical references and index.

Identifiers: LCCN 2024043847 | ISBN 9780138344245 (paperback) | ISBN 9780138344108 (ebook)

Subjects: LCSH: Management information systems.

Classification: LCC T58.6 .L376 2026 | DDC 658.4/038--dc23/eng/20241211

LC record available at <https://lcn.loc.gov/2024043847>

\$PrintCode



ISBN 10: 0-13-834424-8
ISBN 13: 978-0-13-834424-5

Brief Contents

Preface	xii	PART THREE Key System Applications for the Digital Age	293
About the authors	xxvii		
Acknowledgments	xxviii		
PART ONE Organizations, Management, and the Networked Enterprise	1	Chapter 9 Achieving Operational Excellence and Customer Intimacy: Enterprise Applications	294
Chapter 1 Information Systems in Global Business Today	2	Chapter 10 E-commerce: Digital Markets, Digital Goods	323
Chapter 2 Global E-business and Collaboration	35	Chapter 11 Artificial Intelligence	361
Chapter 3 Information Systems, Organizations, and Strategy	71	Chapter 12 Enhancing Decision Making with Data Analytics and Business Intelligence	394
Chapter 4 Ethical and Social Issues in Information Systems	108	PART FOUR Building and Managing Systems	423
PART TWO Information Technology Infrastructure	145	Chapter 13 Building Information Systems	424
Chapter 5 IT Infrastructure and Emerging Technologies	146	Chapter 14 Making the Business Case for Information Systems and Managing Projects	459
Chapter 6 Foundations of Business Intelligence: Databases and Information Management	183	Chapter 15 Managing Global Information Systems	487
Chapter 7 Telecommunications, the Internet, and Wireless Technology	218	Glossary	G-1
Chapter 8 Securing Information Systems	253	Index	I-1

Contents

Preface	xii	1.9 Describe Different Approaches Used to Study Information Systems	23
About the Authors	xxvii	Technical Approach	23
Acknowledgments	xxviii	Behavioral Approach	23
		Approach of This Text: Sociotechnical Systems	24
PART ONE Organizations, Management, and the Networked Enterprise	1	1.10 Understand How This Book Prepares You for the Future	25
1 Information Systems in Global Business Today	2	Understanding Business Applications of Technology	25
Opening Case Study ConocoPhillips Drills Down with Digital Technology	3	1.11 Understand How the Information in This Chapter Can Help Your Career	26
1.1 Understand How Information Systems Transform Business and Careers	5	Real-World Scenario Faciliteq Rebuilds Its Sales Team	27
How Information Systems Are Transforming Business	5	Chapter Case Study Capital One: A Digital Transformation in the Making	28
The Transformation of Jobs: What All This Means for You	5	Review Summary	30
1.2 Describe Key Challenges and Opportunities Created by New MIS Technologies	6	Key Terms	31
Key Challenges in Management Information Systems	6	Review Questions	31
Globalization Challenges and Opportunities	8	Discussion Questions	32
1.3 Describe Key Features of a Digital Firm	8	Using AI Project	32
1.4 Describe the Business Objectives of Information Systems	9	Hands-On MIS Projects	32
Operational Excellence	9	References	33
New Business Models, Products, and Services	10	2 Global E-business and Collaboration	35
Customer and Supplier Intimacy	10	Opening Case Study Microsoft Teams and AI Help Toyota Motor North America Do Even Better	36
Improved Decision Making	11	2.1 Understand How Business Processes Relate to Information Systems	38
Competitive Advantage	11	Business Processes	38
Survival	11	How Information Technology Enhances Business Processes	39
Environmental Impact, Sustainability, Governance, and Responsible AI	11	2.2 Explain How Information Systems Serve Different Management Groups	40
1.5 Explain What an Information System Is and How It Works	12	Transaction Processing Systems	40
What Is an Information System	12	Systems for Business Intelligence	41
It Isn't Simply Technology: The Role of Management and Organizations	14	2.3 Explain How Enterprise Applications Improve Firm Performance	45
1.6 Describe Organizational, Management, and Technology Dimensions of Information Systems	15	Enterprise Applications	45
Organizations	15	Enterprise Systems	45
Management	16	Supply Chain Management Systems	46
Technology	17	Intranets and Extranets	47
Spotlight on Technology Case Study UPS Competes Globally with Information Technology	18	2.4 Understand the Importance of Collaboration and Social Business Systems	47
1.7 Understand the Importance of IoT, Big Data, Cloud Computing, and AI	19	What Is Collaboration?	47
1.8 Understand Why Complementary Assets Are Essential	21	What Is Social Business?	48
Complementary Assets: Organizational Capital and the Right Business Model	21	Business Benefits of Collaboration and Social Business	49
		Building a Collaborative Culture and Business Processes	50
		2.5 Describe Collaboration Tools	51
		Email and Instant Messaging Platforms	51

Collaboration Platforms	51	The Internet's Impact on Competitive Advantage	88
Artificial Intelligence (AI) and Collaboration	52	3.5 Discuss the Value Chain Model	89
Spotlight on Technology Case Study AI Accelerates Drug Discovery and Development	53	Extending the Value Chain: The Value Web	91
2.6 Describe Social Business Tools	54	3.6 Discuss Synergies, Core Competencies, and Network Economics	91
Enterprise Social Networking Tools	54	Synergies	92
Virtual Worlds and the Metaverse	55	Enhancing Core Competencies	92
2.7 Understand How to Evaluate Collaboration and Social Business Tools	55	Network-Based Strategies	93
2.8 Describe Knowledge Management Systems	57	3.7 Understand How AI Can Be Used in Competitive Strategy	95
Types of Knowledge	57	AI and the Value Chain	95
Types of Knowledge Management Systems	57	AI and Porter's Competitive Forces Model	95
Enterprise-wide Knowledge Management Systems	58	3.8 Describe the Challenges Posed by Strategic Information Systems	96
Major Types of Knowledge Work Systems	59	Sustaining Competitive Advantage	97
2.9 Describe the Role of the Information Systems Function	61	Spotlight on Management Case Study Spotify's Podcasting Strategy Stumbles	97
The Information Systems Department	61	Aligning IT with Business Objectives	98
Organizing the Information Systems Function	62	Management Checklist: Performing a Strategic Systems Analysis	99
2.10 Understand How the Information in This Chapter Can Help Your Career	62	3.9 Understand How the Information in This Chapter Can Help Your Career	99
Real-World Scenario Customer Success Analysts Help Princess Cruises Maximize Revenue	63	Real-World Scenario Crayola Develops Its Business with Digital Technology	100
Additional Career Resources	63	Additional Career Resources	100
Chapter Case Study How Much Do Virtual Meetings Help Collaboration?	64	Chapter Case Study AI Redesigns the Fashion Industry	101
Review Summary	66	Review Summary	103
Key Terms	67	Key Terms	104
Review Questions	67	Review Questions	104
Discussion Questions	68	Discussion Questions	104
Using AI Project	68	Using AI Project	105
Hands-On MIS Projects	68	Hands-On MIS Projects	105
References	69	References	106
3 Information Systems, Organizations, and Strategy	71	4 Ethical and Social Issues in Information Systems	108
Opening Case Study PepsiCo Tames the Doritos Crunch	72	Opening Case Study Apps That Track: A Double-Edged Sword	109
3.1 Discuss Technical and Behavioral Views of Organizations	74	4.1 Describe IT/IS-related Ethical, Social, and Political Issues	111
What Is an Organization?	74	Ethical Challenges in Conducting Business	111
3.2 Discuss Features of Organizations that Affect Information Systems	76	A Model for Thinking about Ethical, Social, and Political Issues	112
Routines and Business Processes	76	Five Moral Dimensions of the Information Age	113
Organizational Politics	77	Key IT Trends That Raise Ethical Issues	113
Organizational Culture	77	4.2 Describe Principles for Ethical Conduct	116
Organizational Environments	78	Basic Concepts: Responsibility, Accountability, Liability, and Due Process	116
Organizational Structure	80	Ethical Analysis	116
Other Organizational Features	80	Ethical Principles	117
3.3 Describe the Impact of Information Systems on Organizations	80	Professional Codes of Conduct	118
Economic Impacts	81	Governance Codes	118
Organizational and Behavioral Impacts	82	Some Real-World Ethical Dilemmas	118
Implications for the Design and Understanding of Information Systems	83	4.3 Discuss Information Rights and Privacy Issues	119
3.4 Discuss Porter's Competitive Forces Model	84	Information Rights: Privacy and Freedom in the Internet Age	119
Porter's Competitive Forces Model	84	Legal Protections for Privacy in the United States	119
Information Systems Strategies for Dealing with Competitive Forces	85		

The European General Data Protection Regulation	120	5.2 Describe the Components of IT Infrastructure	153
Challenges Posed by the Internet	122	Computer Hardware Platforms	153
Challenges Posed by AI	124	Operating System Platforms	154
Technological Solutions	124	Enterprise Software Applications	154
4.4 Discuss Intellectual Property Issues	124	Data Management and Storage	154
Copyright	125	Networking/Telecommunications Platforms	155
Patents	126	Internet Platforms	155
Trademarks	126	Consulting and System Integration Services	155
Trade Secrets	126	5.3 Discuss the Mobile Platform, Apps, and BYOD	156
Challenges to Intellectual Property Rights		The Mobile Platform	156
Posed by Today's Information Technologies and Systems	126	Apps	156
Challenges Posed by AI	127	Consumerization of IT and BYOD	156
4.5 Discuss System Quality Issues	128	5.4 Discuss Quantum Computing and Green Computing	157
System Quality: Data Quality and System Errors	129	What Is Quantum Computing?	158
4.6 Discuss Accountability and Control Issues	129	Green Computing	158
Software and Internet Liability Issues	130	5.5 Discuss Virtualization and Cloud Computing	160
Spotlight on Organizations Case Study		Virtualization	160
Section 230 Under Fire	130	Cloud Computing and Virtualization	161
AI Liability Issues	132	Cloud AI Services	164
Computer Crime and Abuse	132	Edge Computing	164
4.7 Discuss Quality of Life Issues	133	5.6 Describe Contemporary Software Platforms	166
Big Tech: Concentrating Economic and Political Power	133	Open-Source Software	166
Digital Divide	134	Software for the Web: Java, HTML, and HTML5	166
Employment: Job Loss Due to Automation, Business Process Reengineering, and AI	134	Web Services	167
Rapidly of Change: Reduced Response Time to Competition	135	5.7 Discuss Alternative Ways of Obtaining Software	169
Maintaining Boundaries: Family, Work, and Leisure	135	Software Packages and Software Services	169
Physical, Mental, and Cognitive Health Risks	136	Software Outsourcing	169
4.8 Understand How the Information in This Chapter Can Help Your Career	137	5.8 Describe IT Infrastructure for AI	170
Real-World Scenario Cermentos Argos Uses Privacy Analysts to Cement Competitive Advantage	138	Spotlight on Technology Case Study AI Chips	171
Additional Career Resources	138	AI and Edge Computing	172
Chapter Case Study Meta's Many Ethical Challenges	139	5.9 Discuss IT Infrastructure Management	
Review Summary	141	Challenges	172
Key Terms	141	Dealing with Platform and Infrastructure Change	172
Review Questions	142	Management and Governance	173
Discussion Questions	142	Making Wise Infrastructure Investments	173
Using AI Project	143	5.10 Understand How the Information in This Chapter Can Help Your Career	175
Hands-On MIS Projects	143	Real-World Scenario CloudCall Calls on AWS Trainers	176
References	143	Additional Career Resources	176
PART TWO Information Technology Infrastructure	145	Chapter Case Study Are AI and Cloud Computing Sustainable?	177
5 IT Infrastructure and Emerging Technologies	146	Review Summary	178
Opening Case Study QRYde Rides High with the Cloud and AI	147	Key Terms	179
5.1 Discuss IT Infrastructure and Its Evolution	149	Review Questions	180
Defining IT Infrastructure	149	Discussion Questions	180
Evolution of IT Infrastructure	150	Using AI Project	180
		Hands-On MIS Projects	181
		References	181
		6 Foundations of Business Intelligence: Databases and Information Management	183
		Opening Case Study Australia's Royal Flying Doctor Service Flies with Oracle Autonomous Database	184

6.1 Describe Traditional File Environment Data Management Problems	186	TCP/IP and Connectivity	224
File Organization Terms and Concepts	186	Signals: Digital versus Analog	226
Problems with the Traditional File Environment	186	7.3 Describe the Different Types of Networks	227
6.2 Describe DBMS and Relational DBMS Capabilities	188	Local Area Networks	227
Database Management Systems	189	WANs, CANs, and MANs	227
Relational Databases and Relational DBMS	190	Transmission Media and Bandwidth	227
Capabilities of Database Management Systems	191	7.4 Understand What the Internet Is and How It Works	229
6.3 Discuss Relational Database Design Principles	194	What Is the Internet?	229
Normalization and Entity-Relationship Diagrams	194	Internet Addressing and Architecture	229
6.4 Describe Non-Relational Database, Cloud Database, and Blockchain Capabilities	196	7.5 Explain How Internet Services Support Business	231
Non-Relational Databases	196	Email	232
Cloud Databases and Distributed Databases	196	Instant Messaging	233
Blockchain	197	Voice over IP (VoIP)	233
6.5 Describe Tools Used to Analyze Data in Databases	198	Unified Communications	234
The Challenge of Big Data	199	Virtual Private Networks	234
Big Data and Artificial Intelligence (AI)	199	7.6 Discuss How the Web Works and How It Can Be Used in Business	235
Business Intelligence Infrastructure	200	Hypertext	235
Analytical Tools: Relationships, Patterns, Trends	202	Web Servers	235
Databases and the Web	205	Searching for Information on the Web	236
6.6 Discuss Data Governance, Data Quality Assurance, and Data Management	206	Sharing Information on the Web	238
Assuring Data Quality	206	The Future Internet/Web Ecosystem	239
Spotlight on Technology Case Study Facial Databases: Do You Know Who's Using Your Face?	208	7.7 Describe the Principal Wireless Technologies and Standards	240
How AI Improves Data Management	209	Cellular Systems	240
6.7 Understand How the Information in This Chapter Can Help Your Career	209	Spotlight on Technology Case Study Cleveland Clinic Turns to Private 5G Network for Its Newest Hospital	241
Real-World Scenario Keurig Green Mountain Embraces Data Governance	210	Wireless Computer Networks and Internet Access	242
Additional Career Resources	210	RFID and Wireless Sensor Networks	244
Chapter Case Study Pursuing Sustainability with Blockchain	211	7.8 Understand How the Information in This Chapter Can Help Your Career	246
Review Summary	213	Real-World Scenario Network Specialists Help Dundee Precious Metals Underground	247
Key Terms	214	Additional Career Resources	247
Review Questions	214	Chapter Case Study AI and the Future of Search	248
Discussion Questions	215	Review Summary	249
Using AI Project	215	Key Terms	250
Hands-On MIS Projects	215	Review Questions	250
References	216	Discussion Questions	251
7 Telecommunications, the Internet, and Wireless Technology	218	Using AI Project	251
Opening Case Study From the Football Field to the Cloud and Back Again: The NFL Partners with AWS	219	Hands-On MIS Projects	251
7.1 Describe Key Components of Telecommunications Networks	221	References	252
What Is a Computer Network?	221	8 Securing Information Systems	253
Networks in Large Companies	223	Opening Case Study Ransomware Attack Paralyzes U.S. Healthcare Payment Systems	254
7.2 Describe Key Digital Networking Technologies	224	8.1 Understand Why Information Systems Are Vulnerable	256
Client/Server Computing	224	Why Systems Are Vulnerable	256
Packet Switching	224	8.2 Describe the Most Prevalent and Dangerous Types of Malware	258
		8.3 Understand the Dangers Posted by Threat Actors	261
		Spoofing, Phishing, and Pharming	261
		Living off the Land and Advanced Persistent Threats	261

Denial-of-Service Attacks	262	PART THREE Key System Applications	293
Data Breaches and Identity Theft	262	for the Digital Age	
Global Threats: Cyberwarfare			
and Cyberterrorism	263		
Internal Threats: Employees	264		
Computer Crime	264		
8.4 Describe the Security Issues Raised		9 Achieving Operational Excellence	
by Software Vulnerabilities	265	and Customer Intimacy: Enterprise	
8.5 Describe the Security Issues Raised		Applications	294
by Artificial Intelligence	266	Opening Case Study TrueBlue Speeds	
Phishing with AI	266	Ahead with Enterprise Applications	295
Deepfakes	267	9.1 Understand ERP Systems	296
Subverting LLMs	267	What Is an ERP System?	297
8.6 Describe the Business Value of Security		ERP Software	298
and Control	267	The Business Value of ERP Systems	298
Legal and Regulatory Requirements		AI and ERP Systems	299
for Electronic Records Management	268	9.2 Understand SCM Systems	299
Electronic Evidence and Digital Forensics	269	The Supply Chain	299
8.7 Describe an Organizational Framework		Information Systems and Supply Chain	
for Security and Control	269	Management	301
Information Systems Controls	269	Supply Chain Management Software	302
Risk Assessment	270	Demand-Driven Supply Chains	303
Security Policy	271	The Business Value of SCM Systems	304
Disaster Recovery Planning and Business		9.3 Describe Global Supply Chain Management	
Continuity Planning	272	Challenges	304
The Role of Auditing	273	Global Supply Chain Issues	305
8.8 Discuss Technologies for Safeguarding		Spotlight on Organizations Case Study BYK	
Information Resources	274	Tames Its Supply Chains	305
Identity and Access Management		AI and Supply Chain Management	306
and Authentication	274	9.4 Understand CRM Systems	307
Firewalls, Intrusion Detection and Prevention		What Is Customer Relationship Management?	307
Systems, and Anti-Malware Software	275	CRM System Software Packages	309
Securing Wireless Networks	277	Operational and Analytical CRM	310
Encryption and Public Key Infrastructure	278	Business Value of CRM Systems	312
Securing Transactions with Blockchain	279	CRM and AI	312
Ensuring System Availability	280	9.5 Discuss Enterprise Application Challenges	313
Achieving Digital Resiliency	280	Enterprise Application Challenges	313
Spotlight on Organizations Case Study Uptime		Enterprise Application Trends	314
Institute: Understanding and Preventing System		9.6 Describe How Enterprise Applications	
Outages	281	Are Using AI	315
Addressing Internet of Things, Cloud Computing,		9.7 Understand How the Information in This	
and Mobile Platform Security Challenges	282	Chapter Can Help Your Career	315
Ensuring Software Quality	284	Real-World Scenario SAP Business ByDesign	
8.9 Understand How the Information in This		Helps Customer Relationship Managers	
Chapter Can Help Your Career	284	at Skullcandy	316
Real-World Scenario FBI Cybersecurity		Additional Career Resources	316
Specialists Help Turn the Tables on the Hive		Chapter Case Study MillerKnoll Uses Salesforce	
Ransomware Group	285	and AI to Transform Its Business Strategy	317
Additional Career Resources	285	Review Summary	318
Chapter Case Study Social Engineering Creates		Key Terms	319
Chaos for MGM Resorts	286	Review Questions	319
Review Summary	287	Discussion Questions	320
Key Terms	288	Using AI Project	320
Review Questions	289	Hands-On MIS Projects	320
Discussion Questions	289	References	321
Using AI Project	290		
Hands-On MIS Projects	290	10 E-commerce: Digital Markets, Digital Goods	323
References	291	Opening Case Study Chewy Blends B2C	
		and B2B E-commerce	324
		10.1 Discuss the Evolution of E-commerce	326
		The Evolution of E-commerce	326

E-commerce Today	327	Review Questions	358
AI and E-commerce: The Newest Frontier	328	Discussion Questions	358
10.2 Describe the Unique Features of E-commerce	329	Using AI Project	358
Ubiquity	329	Hands-On MIS Projects	359
Global Reach	329	References	360
Universal Standards	329	11 Artificial Intelligence	361
Richness	330	Opening Case Study Computer Vision AI	
Interactivity	330	Helps Reddit Become More Accessible	362
Information Density	330	11.1 Understand Artificial Intelligence	363
Personalization/Customization	330	Artificial Intelligence and Human	
Social Technology: User Content Generation,		Intelligence	364
Creators, and Social Networks	331	Evolution of AI	364
10.3 Describe Digital Markets and Digital Goods	332	Major Types of AI Technologies	364
Digital Markets	332	11.2 Describe Machine Learning	364
Digital Goods	333	What Is Machine Learning?	365
10.4 Describe Types of E-commerce and		Supervised and Unsupervised Learning	366
E-commerce Business Models	334	11.3 Describe Neural Networks and Deep	
Types of E-commerce	334	Learning	367
E-commerce Business Models	335	What Are Neural Networks	367
10.5 Describe E-commerce Revenue Models	337	Examples of Neural Networks and	
Advertising Revenue Model	338	Deep Learning Applications	369
Sales Revenue Model	338	11.4 Discuss Generative AI	369
Subscription Revenue Model	338	Foundation Models, Large Language Models,	
Free/Freemium Revenue Model	338	and Transformers	369
Transaction Fee Revenue Model	339	Examples of GenAI Tools	370
Affiliate Revenue Model	339	11.5 Discuss Intelligent Agents	370
10.6 Explain How E-commerce Has Transformed		Chatbots	371
Marketing	339	Virtual Assistants	372
Behavioral Targeting	339	Bots	372
10.7 Describe Social Networks, Social Marketing,		11.6 Understand Natural Language Processing	373
and Social E-commerce	343	Examples of NLP Applications	373
Social Networks	343	11.7 Understand Computer Vision Systems	373
Social Marketing and Advertising	344	Examples of Computer Vision Systems	374
Spotlight on Organizations Case Study Social		11.8 Describe Robotics	375
Listening with Sprout Social	344	Robotics Applications	375
Social E-commerce	345	Types of Robots	375
10.8 Understand How E-commerce Has Affected		11.9 Discuss Genetic Algorithms	376
Business-to-Business Transactions	346	Examples of Genetic Algorithm Applications	377
Electronic Data Interchange (EDI)	346	11.10 Discuss Expert Systems	378
New Ways of B2B Buying and Selling	347	How Expert Systems Work	378
10.9 Describe M-commerce and M-commerce		11.11 Describe Fuzzy Logic Systems	379
Applications	349	11.12 Understand the Challenges of AI	380
Location-based Services and Applications	350	Hallucination	380
Mobile App Payment Systems	351	Lack of Transparency	381
10.10 Discuss How to Build an E-commerce		AI Bias	381
Presence	352	Cybersecurity Problems	381
Develop an E-commerce Presence Map	352	Job Loss and Inequality	382
Develop a Timeline: Milestones	353	Environmental Impact	382
10.11 Understand How the Information in This		Misinformation and Disinformation	383
Chapter Can Help Your Career	353	Loss of Privacy	383
Real-World Scenario eHarmony's E-commerce		Copyright and Intellectual Property	
Analysts	354	Challenges	384
Additional Career Resources	354	Spotlight on Management Case Study Apple's	
Chapter Case Study Lemonade Seeks to Disrupt		AI Strategy: AI in Every Pocket	385
the Insurance Industry with AI	355	Responsible AI	386
Review Summary	356	11.13 Understand How the Information in This	
Key Terms	357	Chapter Can Help Your Career	386

Real-World Scenario ParentLab's Prompt Engineer	387	Real-World Scenario Data Analysts Help KPMG Offer New Services and Deeper Insights	416
Additional Career Resources	387	Additional Career Resources	416
Chapter Case Study Is AI Coming for Your Job?	388	Chapter Case Study Big Data Analytics and AI: A New Way of Combating Natural Disasters	417
Review Summary	389	Review Summary	418
Key Terms	390	Key Terms	419
Review Questions	390	Review Questions	419
Discussion Questions	391	Discussion Questions	420
Using AI Project	391	Using AI Project	420
Hands-On MIS Projects	391	Hands-On MIS Projects	420
References	392	References	421
12 Enhancing Decision Making with Data Analytics and Business Intelligence	394	PART FOUR Building and Managing Systems	423
Opening Case Study Fulton County Schools Power Up Data-Driven Decision Making with Power BI	395	13 Building Information Systems	424
12.1 Describe the Different Types of Business Decisions	396	Opening Case Study Signet Jewelers Sparkles with New Virtual Sales System	425
Types of Business Decisions	397	13.1 Explain How New Information Systems Can Promote Organizational Change	427
12.2 Describe the Decision-Making Process	398	Systems Development and Organizational Change	427
12.3 Describe the Different Roles Managers Play	399	13.2 Understand How IT Can Be Used to Manage and Redesign Business Processes	428
Managerial Roles	399	Tools for Business Process Management and Process Mining	431
Information Systems Supporting Various Managerial Roles	400	13.3 Describe the Core Activities in the Systems Development Process	431
12.4 Understand the Value of Improved Decision Making	400	Systems Analysis	431
12.5 Understand Why Information Systems Do Not Always Result in Better Decisions	401	Systems Design	432
Information Quality	401	Completing the Systems Development Process	433
Management Filters	402	13.4 Discuss Methods for Building and Acquiring Information Systems	436
Organizational Inertia and Politics	402	Traditional Systems Development Life Cycle	436
High-Velocity Automated Decision Making	402	Prototyping	437
Risks Introduced by Using AI in Decision Making	402	Application Software Packages, Software Services, and Outsourcing	438
12.6 Discuss How Data Analytics, BI, and AI Support Decision Making	402	13.5 Describe Methods That Enable Rapid Systems Development	440
Data Analytics, BI, and AI	403	Object-Oriented Design (OOD)	441
The Business Intelligence and Analytic Environment	403	Rapid Application Development (RAD)	442
12.7 Describe the Capabilities of BI Systems	406	Joint Application Development (JAD)	442
Analytic Functionalities of BI Systems	406	Agile Development	442
Predictive and Prescriptive Analytics	407	DevOps	443
Spotlight on Technology Case Study Land O'Lakes Seeks to Reshape the Future of Farming with Predictive Analytics and AI	408	13.6 Discuss the Increasing Democratization of Software Development	443
Big Data Analytics	409	What Is Open-Source Software?	443
Operational Intelligence and Analytics	410	Low-Code and No-Code Development	445
Location Analytics and Geographic Information Systems	410	Citizen Development	445
12.8 Understand the Different Types of BI Users	411	Spotlight on Management Case Study Meet the Citizen Developers	446
Decision Support for Operational and Middle Management	412	13.7 Understand the Impact of AI on Software Development	448
Support for Semistructured Decisions	412	Challenges of Developing AI Software	449
Decision Support for Senior Management: Balanced Scorecard and Business Performance Management Methods	414	13.8 Discuss Approaches for Building Mobile Applications	449
12.9 Understand How the Information in This Chapter Can Help Your Career	415	Designing for a Multiscreen World	450

13.9 Understand How the Information in This Chapter Can Help Your Career	450	Discussion Questions	484
Real-World Scenario Process Analysts Help Carter's Redesign Its Business Processes	451	Using AI Project	484
Additional Career Resources	451	Hands-On MIS Projects	484
Chapter Case Study Process Mining with Celonis	452	References	485
Review Summary	453	15 Managing Global Information Systems	487
Key Terms	455	Opening Case Study Hormel Foods Implements Oracle Cloud Applications to Unify Its Systems Worldwide	488
Review Questions	455	15.1 Discuss Factors Impacting Development of Global Information Systems	489
Discussion Questions	456	Global Business Drivers	490
Using AI Project	456	Global Business Challenges	491
Hands-On MIS Projects	456	15.2 Discuss How to Develop Global Information Systems Architecture	493
References	457	15.3 Discuss Strategies and Organizational Structures for Global Businesses and Information Systems	494
14 Making the Business Case for Information Systems and Managing Projects	459	Global Strategies and Business Organization	494
Opening Case Study BigCommerce Turns to Wrike for Better Project Management Tools	460	Global Systems Configurations to Fit the Strategy	495
14.1 Explain How to Build a Business Case The Information Systems Plan	462	Reorganizing the Business	496
14.2 Describe Methods for Evaluating IT Investments	463	15.4 Discuss Management Challenges in Developing Global Information Systems	497
Portfolio Analysis	463	A Typical Scenario: Disorganization on a Global Scale	497
Scoring Models	465	15.5 Discuss Management Solutions for Global Information Systems Development	498
Determining Solution Costs and Benefits	466	Challenges	498
14.3 Describe Project Management Methodologies and Variables	468	Devising Management Solutions for Global Information Systems Development	500
Project Management Methodologies	468	Challenges	501
Project Management Variables	469	Implementing Management Solutions	501
14.4 Understand the Importance of Effective Project Management	469	15.6 Discuss Technology Issues and Alternatives in Developing Global Information Systems	501
Runaway Projects and System Failure	470	Computing Platforms and Systems	501
14.5 Discuss Project Risk Factors	471	Integration	502
Dimensions of Project Risk	471	Connectivity	502
Change Management and the Concept of Implementation	471	Spotlight on Organizations Case Study	
Spotlight on Management Case Study Happy Feet International Overcomes Change Management and Implementation Issues	473	The Rise of Digital Nationalism	503
14.6 Understand How Project Risks Can Be Managed	474	Software Localization	504
Managing Technical Complexity	475	15.7 Understand How the Information in This Chapter Can Help Your Career	504
Formal Planning and Control Tools	475	Real-World Scenario Fiat Learns How to Coordinate Global Operations	505
Increasing User Involvement and Overcoming User Resistance	476	Additional Career Resources	505
Designing for the Organization	478	Chapter Case Study Wyndham Centralizes Its Information Systems to Better Serve Its Worldwide Hotels	506
Project Management Software Tools	479	Review Summary	507
14.7 Understand How the Information in This Chapter Can Help Your Career	479	Key Terms	508
Real-World Scenario Project Managers Help Intuit Launch New Cloud Platform	480	Review Questions	508
Additional Career Resources	480	Discussion Questions	509
Chapter Case Study Southwest Airlines Invests in Digital Transformation to Navigate Future Turbulence	481	Using AI Project	509
Review Summary	482	Hands-On MIS Projects	509
Key Terms	483	References	510
Review Questions	483	Glossay	G-1
		Index	I-1

Preface

Management Information Systems: Managing the Digital Firm is a leading textbook and courseware package with the most up-to-date and comprehensive overview of information systems used by businesses today. After using this learning package, students will be able to participate in, and even lead, management discussions of information systems, and understand how to use information technology in their future jobs to achieve bottom-line business results. Regardless of whether students are accounting, finance, management, operations management, marketing, or information systems majors, the knowledge and information in this book will be valuable throughout their business careers.

New to This Edition

Please note that all eText assessments, videos, and other interactive media items are only available in the Pearson+ eText, which is available both for standalone purchase as well as part of a MyLab subscription.

Management Information Systems: Managing the Digital Firm, 18th edition, has been thoroughly updated to cover the latest industry and technology changes that impact the course and to provide new interactive learning opportunities. In addition, chapter material is now organized around new, more sharply focused learning objectives. The major sections of each chapter are divided into shorter, more easily “digestible” chunks, each followed by a *Check Your Understanding* question (in the eText only), aiding student comprehension.

The Laudon texts are known for their outstanding real-world case studies, which describe how well-known businesses are using IT to solve problems and achieve objectives. Students are often asked to analyze a business problem and propose alternative solutions. The Laudon texts also provide hands-on MIS software and management decision-making problems that are based on real-world companies and business scenarios.

The text and learning package has a strong career focus, which incentivizes students to learn by showing exactly how each chapter will help them prepare for future jobs. In addition to the Careers section in each chapter, MyLab MIS features Career Resources, including how to incorporate MIS knowledge into resumes, cover letters, and job interviews.

New and Updated Topics

The 18th edition features three engaging Case Studies per chapter focusing on well-known companies and MyLab MIS includes an additional Video Case Study. There are also numerous new in-text examples of companies using IT applications. The text, figures, tables, and Case Studies are based on the latest-available sources from industry and MIS research.

There is new and/or updated content throughout the text on the following topics:

- **Artificial intelligence:** AI is the latest information technology that is in the process of transforming business. Public attention is riveted on AI because of its enormous potential for improving how companies conduct business, as well as many aspects of everyday life. The text has been extensively updated to cover developments in AI as follows.
 - AI is introduced in Chapter 1, as one of the major technology developments impacting MIS.
 - AI is covered throughout the text as it relates to topics in each chapter, including numerous case studies that feature how companies are using AI.
 - Chapter 11 has been rewritten to focus solely on AI, including new and expanded coverage of machine learning, neural networks and deep learning, generative AI, intelligent agents, natural language processing, computer vision systems, robotics, genetic algorithms, and fuzzy logic systems.

- **Cloud computing:** More coverage of cloud computing has been added throughout because of its importance in the MIS world.
 - Chapter 1 introduces cloud computing as one of the major technology developments students should be familiar with.
 - Chapter 5 has updated and expanded coverage with more detail on types of cloud services, private and public clouds, hybrid clouds, and managing cloud services.
 - Chapter 6 covers cloud databases.
 - Chapter 8 reviews issues related to cloud security.
 - Chapter 9 covers cloud-based CRM and ERP systems.
 - Chapter 10 discusses the use of the cloud in e-commerce.
 - Chapter 11 includes a discussion of cloud-based AI.
 - Chapter 13 discusses the use of cloud software services in creating information systems.
 - Case studies on cloud computing are included in Chapters 5, 6, 7, 9, 14, and 15.
- **The Internet of Things (IoT), big data, data analytics, and business intelligence:**
 - Chapter 1 introduces the importance of IoT, big data, and data analytics, and their relationship to cloud computing and AI.
 - Emphasis on data analytics has been expanded with the addition of Tableau projects in Chapters 2, 3, 6, and 12.
 - Case studies on data analytics and big data can be found in Chapters 1, 6, 7, 9, 10, and 12.
 - Case Studies on IoT are included in Chapters 1, 7, and 12.

The following are additional highlights of further new and/or updated coverage within the chapters:

Chapter 1

- How information systems are transforming business and careers
- Key challenges in MIS (new table)
- Environmental impact, sustainability, governance and Responsible AI as strategic business objectives

Chapter 2

- AI and collaboration; human-AI collaboration
- Knowledge management systems (updated/moved from Chapter 11)
- Knowledge work and knowledge worker (updated/moved from Chapter 11)

Chapter 3

- AI and competitive strategy
- AI and the value chain
- AI and Porter's Competitive Forces Model

Chapter 4

- Ethical risks of relying on AI
- Governance codes; Responsible AI
- Technological protections for privacy (new table)
- GDPR and AI
- AI challenges to privacy and intellectual property rights
- Liability issues: Software; AI; EU AI Act Big Tech and Digital Markets Act (EU)

- Quality of life: Bias in AI; impact of AI on jobs; social media mental health risks; metaverse mental health risks

Chapter 5

- Quantum computing
- Green computing
- Virtualization and cloud computing
- Cloud AI services
- IT infrastructure for AI
- Edge AI

Chapter 6

- Blockchain
- Big data and AI
- Data lakes
- Cloud-based data analytics platforms: Microsoft Power BI, Google Looker
- Sentiment analysis using AI
- AI and data management

Chapter 7

- AI functionality for UC systems
- Impact of AI on search
- Impact of generative AI on future of web
- Web3
- Metaverse
- 5G and private 5G networks (case study)
- 6G

Chapter 8

- Threat actors
- 5G security issues
- Metaverse security issues
- New types of attacks: LOTL and APT; credential stuffing; software supply chain
- AI security issues
- Security tools; IAM software; zero trust framework; multifactor and two-factor authentication; web application and next generation firewalls; intrusion prevention systems; SOCs
- Security protocols: WPA3; TLS; HTTPS; HSTS
- Impact of quantum computing on security
- IoT, cloud computing, and mobile platform security challenges

Chapter 9

- AI and ERP systems
- AI and supply chain management
- AI and CRM systems
- Composable ERP
- AI and enterprise applications

Chapter 10

- Impact of AI on e-commerce
- New e-commerce revenue models
- Rise of social e-commerce

Chapter 11

- AI and human intelligence
- Evolution of AI and major branches of AI
- Machine learning
- Supervised and unsupervised learning
- Neural networks and deep learning
- Generative AI
- Intelligent agents, chatbots, virtual assistants, and bots
- Natural language processing
- Computer vision systems

- Robotics: robotic applications, industrial robots, collaborative robots, service robots, humanoid robots, medical robots, drones and autonomous cars
- Genetic algorithms
- Fuzzy logic systems
- AI challenges: hallucinations, lack of transparency, bias, security, job loss, environmental impact, misinformation and disinformation, privacy, intellectual property
- Responsible AI

Chapter 12

- Data analytics, business intelligence, and AI
- Risks introduced by use of AI in decision making
- Tableau
- Predictive and prescriptive analytics AR, VR, and the metaverse as data visualization tools

Chapter 13

- Open-source development: examples, advantages, disadvantages, and security issues
- Democratization of software development: low code, no code, and citizen development
- Impact of AI on software development
- Hybrid mobile apps; adaptive web design

Chapter 14

- Software to help make technology decisions: Technology business management (TBM) framework and IT financial (ITFM) tools
- Project management methodologies: Waterfall method, agile project management; Kanban boards
- Technical debt
- AI and project management software tools

Chapter 15

- Use of AI to deal with global supply chain issues
- Use of AI for software localization



Content Features

The Core text provides an overview of fundamental MIS concepts using an integrated framework for describing and analyzing information systems. This framework shows information systems composed of management, organizations, and technology elements and is reinforced in student projects and case studies. The Core text consists of 15 chapters with hands-on projects covering the most essential topics in MIS.

Chapter Organization

Each chapter contains the following elements:

- List of Student Learning Objectives
- List of the Case Studies for each chapter
- Opening Case Study that describes a real-world organization to establish the theme and importance of the chapter
- Diagram analyzing the Opening Case Study in terms of the management, organization, and technology model used throughout the text

- “Spotlight on” Case Study focusing on a management, organization, or technology topic, with Case Study Questions
- Careers section showing students how to the chapter will help them in career preparation
- Chapter Case Study at the end of each chapter that enables students to apply chapter concepts
- Review Summary keyed to the Student Learning Objectives
- List of Key Terms that students can use to review concepts
- Review questions for students to test their comprehension of chapter material
- Discussion questions raised by the broader themes of the chapter
- Using AI Project that asks students to use a free generative AI tool to solve common business problems
- Series of Hands-On MIS Projects consisting of a Management Decision Problem, a hands-on application software project, and a project to develop Internet skills
- Collaboration and Teamwork Project to develop teamwork and presentation skills with options for using open-source collaboration tools

Student Learning-Focused

Student Learning Objectives are organized to focus student attention. Each major chapter section is based on a Learning Objective and each chapter concludes with a Review Summary and Review Questions organized around these Learning Objectives.

Key Features

We have enhanced the text to make it more interactive, leading edge, and appealing to both students and instructors.

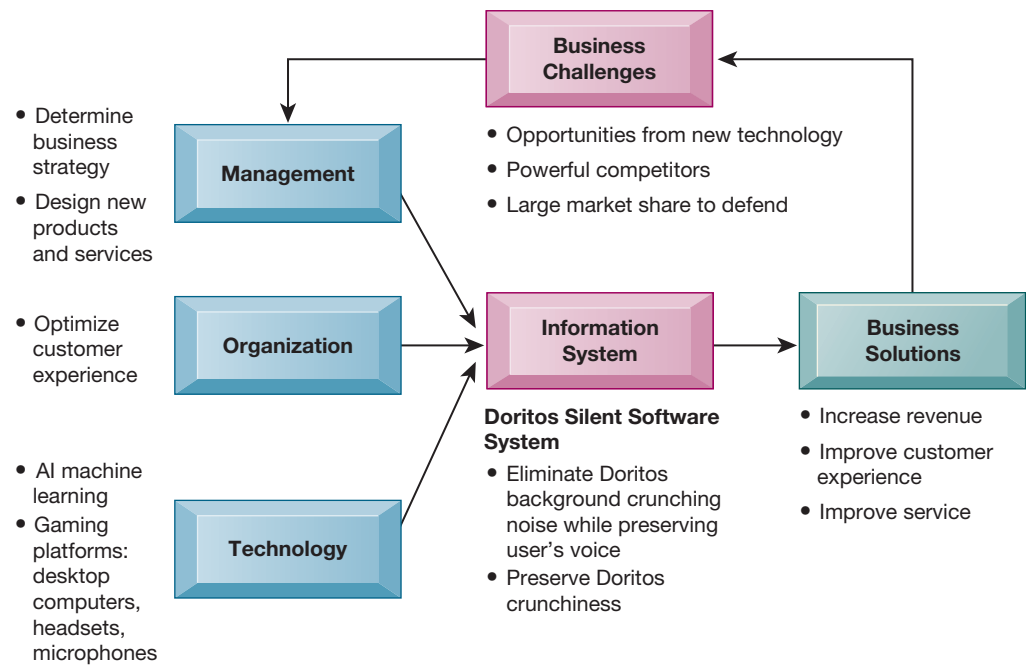
Business-Driven with Real-World Business Cases and Examples

Using real-world companies throughout helps students see the direct connection between information systems and business performance. The in-text examples and case studies describe the main business objectives driving the use of information systems and technologies in corporations all over the world: operational excellence, new products and services, customer and supplier intimacy, improved decision making, competitive advantage, survival, and promoting ESG leadership. In-text examples and case studies show students how specific companies use information systems to achieve these objectives.

Each chapter contains three major case studies focusing on real-world organizations that will be familiar to students, such as UPS, Capital One, PepsiCo, Spotify, Meta, the National Football League, Chewy, Lemonade, Reddit, Apple, Land O’Lakes, Signet Jewelers, Southwest Airlines, Hormel Foods, and Wyndham, among others.

The *Opening Case Study* sets the stage for the chapter. It describes a real-world organization facing a business challenge related to the themes and topics of the chapter, followed by a diagram that analyzes the case in terms of the management, organization, and technology model used throughout the text. It also includes a Career Benefit box which highlights how employees of the relevant company might benefit as a result.

The *Spotlight on Case Study* within each chapter highlights a management, organization, or technology topic related to the content of the chapter. The *Chapter Case Study* at the end of chapter is a more extensive case that pulls together chapter concepts and issues. Each case concludes with case study questions that encourage students to apply chapter concepts to real-world companies in class discussions, student presentations, or writing assignments.



A diagram accompanying each chapter-opening case graphically illustrates how management, organization, and technology elements work together to create an information system solution to the business challenges discussed in the case.

Spotlight on Technology Case Study

UPS Competes Globally with Information Technology



© Ground Picture/Shutterstock

End of Chapter Hands-On Text Activities

Real-world business scenarios and data help students to learn firsthand what MIS is all about. These projects heighten student involvement in this exciting subject.

- **NEW Using AI Projects:** An AI project in every chapter gives students experience using free generative AI tools such as ChatGPT, Google Gemini, and Microsoft Copilot to solve common business problems. These are also available as assignments in MyLab MIS.
- **Hands-On MIS Projects:** Every chapter includes a Hands-On MIS Projects section containing three types of projects: a Management Decision Problem; a hands-on application software exercise using Microsoft Excel, Access, or web page and blog creation tools; and a project that develops Internet business skills for accessing information, conducting research, and performing online calculations and analysis. Students practice solving real-world problems to learn how to achieve operational excellence and enhance decision making. The Dirt Bikes USA running case provides additional hands-on projects for each chapter.

- **NEW Tableau Projects:** Several chapters also include a Tableau project.
- **Collaboration and Teamwork Projects:** Each chapter features a collaborative project that encourages students working in teams to use Google Drive, Google Sites, Google Docs, or other open-source collaboration tools.

MyLab MIS

To improve student results, we recommend pairing this textbook with **MyLab MIS**, the teaching and learning platform that combines respected content with personalized engagement to help student see real results, while developing skills that future employers are seeking in their candidates. From **Video Case Studies** and **real-world decision simulations** to **Using AI Projects** and **Dynamic Study Modules**, MyLab MIS helps you channel your teaching style and develop confident learners. It's the power of MyLab.

What's Included

Pearson+ eText:

The course eText is accessed directly in your MyLab course. You and your students can use the eText to take notes, make highlights, and review flashcards—and even listen to your book at home or on the go with the Pearson+ mobile app.

- **NEW eText AI Study Tools** give students unlimited opportunity to achieve proficiency and master key course concepts—anytime, anywhere. Students engage with the study tools for **personalized support**, **simplified explanations**, and **productive guided practice** with an expert chatbot.
- **MIS Headlines** start each chapter with a monthly news article to keep you and your students up to date with the technology industry. Each article comes with two discussion questions you can use in class or assign through your LMS.
- **Check Your Understanding Questions** at the end of each learning objective enable students to check their understanding of the material in the section and provides feedback on answer choices.
- Figure animations walk students through important concepts in each chapter (40 in total) using a contemporary animation platform.

NEW Using AI Projects: Provide ready-to-assign activities to teach students how to use generative AI effectively. The projects demonstrate the power of free AI tools and teach the essential skills needed to use AI in school and work. The projects come with grading guidance and rubrics.

Pre-built Courses and Assignments: Ease your workload, save time, and increase efficiency with MyLab's pre-built courses and assignments. Each course has a foundation of interactive course-specific content—by authors who are experts in their field—to tailor and adapt as you see fit.

NEW Interactive Reading Assignments: Allow you to assign eText readings and gradable questions in a seamless experience with other video and low stakes-assessments. Increase student engagement with the eText and fundamental concepts of MIS.

NEW MyLab AI-powered Study Tool: Our AI-guided practice draws on Pearson content to turn questions during reading and homework mistakes into teachable moments. Improves independent learning.

Updated Scenario-Based Decision Simulations: Foster critical decision-making skills and engage students with the content. Students play various roles and make business decisions. The simulations adapt to student's choices and take them on a path based on their decisions with feedback along the way and grading details at the end.

NEW Forage Job Simulations: These immersive simulations help students gain valuable job experience with some of the world's top employers. Each simulation showcases a day in the life of a particular role. Students complete a series of task-based scenarios designed to simulate the actual work the company does. Instructors choose which job simulations to assign from the library of offerings.

NEW Video Case Study Assignments: A brand new collection of Video Case Studies (one per chapter) available in MyLab MIS focus on popular companies to cover key concepts and experiences in the MIS world, illustrating how real-world businesses and managers are using information technology and systems. Each Video Case Study is accompanied by three auto-graded true/false or multiple-choice questions and two or three manually graded essay questions.

NEW Prompt Writing Module to teach students the essential skills they need to use AI efficiently.

Chapter Warm Ups, Chapter Quizzes: These objective-based quizzes evaluate comprehension and provide a variety of assignments to prepare and assess students.

Dynamic Study Modules: Help your students stay on track and achieve a higher level of subject-matter mastery. Each module poses a series of questions about a course topic that adapts to each student's performance and offers personalized, targeted feedback to help reinforce their mastery.

Classroom Response Tool (Learning Catalytics): Help to increase student engagement and enhance their learning in the classroom. This interactive student response tool allows you to deploy questions and surveys, and assess student comprehension. It also equips you with real-time data to help adjust your instructional strategy on the fly.

MyLab MIS + Exploring 365

If you also teach Excel, Access, Word, or PPT in your MIS course—we offer a full solution in one combined MyLab MIS + Exploring 365. With this combined course, you and your students have full access to the eTexts, videos, auto-graded application projects, and training simulations from the Exploring 365 series. You select what you want to assign based on your course requirements.



Developing Career Skills

For students to succeed in a rapidly changing job market, they should be aware of their career options and how to go about developing a variety of skills. With MyLab MIS and *Management Information Systems 18e*, we focus on these skills in the following ways.

Career Resources

Every student who reads this text wants to know: How will this book help my career? The Careers section at the end of each chapter shows students how they can use the information in the chapter and in MyLab MIS as tools for career-building. There students will find a real-world scenario featuring a job related to the topics covered in that chapter. A table further describes the roles and responsibilities of the job, the IT knowledge and skills required, as well as a potential career path, including salary information. We also include a Career Benefit box after each Opening Case Study to show the career benefit obtained by the people who worked on the solution to the business problem described in the case.

The following are the careers featured in the Careers section of each chapter.

Additional Career Resources can be found in MyLab MIS including job-hunting guides and instructions on how to build a Digital Portfolio. The portfolio can be included in a resume or job application or used as a learning assessment tool for instructors.

Chapter	Job
1. Information Systems in Global Business Today	Sales Representative
2. Global E-business and Collaboration	Customer Success Analyst
3. Information Systems, Organizations, and Strategy	Business Development Representative
4. Ethical and Social Issues in Information Systems	Privacy Analyst
5. IT Infrastructure and Emerging Technologies	AWS Trainer
6. Foundations of Business Intelligence: Databases and Information Management	Data Quality Analyst
7. Telecommunications, the Internet, and Wireless Technology	Network Specialist
8. Securing Information Systems	Cybersecurity/IT Security Specialist
9. Achieving Operational Excellence and Customer Intimacy: Enterprise Applications	Customer Relationship Manager
10. E-commerce: Digital Markets, Digital Goods	E-Commerce Analyst
11. Managing Knowledge and Artificial Intelligence	AI Prompt Engineer
12. Enhancing Decision Making with Data Analytics and Business Intelligence	Data Analyst
13. Building Information Systems	Process Analyst
14. Making the Business Case for Information Systems and Managing Projects	IT Project Manager
15. Managing Global Systems	Global Supply Chain Analyst

Case Studies

The following companies and topics are covered in the book's Case Studies:

Case Study	Companies	Topics
1. Information Systems in Global Business Today		
Opening Case Study: ConocoPhillips Drills Down with Digital Technology	ConocoPhillips	Digital technologies; 3D printing; IoT; big data; data analytics; data visualization; automation; AI; machine learning
Spotlight on Technology Case Study: UPS Competes Globally with Information Technology	UPS; FedEx	Information technologies; information systems; AI
Chapter Case Study: Capital One: A Digital Transformation in the Making	Capital One; Amazon Web Services	Digital transformation; big data; data analytics; cloud computing; agile software development; sustainability; mobile apps; AI; machine learning; chatbots
2. Global E-business and Collaboration		
Opening Case Study: Microsoft Teams and AI Helps Toyota Motor North America Do Even Better	Toyota Motor North America; Microsoft	Teamwork and collaboration tools; Microsoft Teams; generative AI; chatbots
Spotlight on Technology Case Study: AI Accelerates Drug Discovery and Development	Johnson & Johnson; Merck	Human-AI collaboration
Chapter Case Study: How Much Do Virtual Meetings Help Collaboration	Zoom; Microsoft	Impact of virtual collaboration technologies; Microsoft Teams; Zoom
3. Information Systems, Organizations, and Strategy		
Opening Case Study: PepsiCo Tames the Doritos Crunch	PepsiCo	AI; machine learning; business strategy
Spotlight on Management Case Study: Spotify's Podcasting Strategy Stumbles	Spotify	Streaming music services; podcasting; business strategy
Chapter Case Study: AI Redesigns the Fashion Industry	H&M; Zara; Lenzing Group; Thread.com; StitchFix; Shopify; Nike	AI; machine learning; sustainability; personalization; generative AI

Case Study	Companies	Topics
4. Ethical and Social Issues in Information Systems		
Opening Case Study: Apps That Track: A Double-Edged Sword	Apple; Google; AccuWeather; Kochava; Outlogic; Verizon; T-Mobile	Mobile devices; privacy; ethics
Spotlight on Organizations Case Study: Section 230 Under Fire	Big Tech companies	Social media; liability; ethics
Chapter Case Study: Meta's Many Ethical Challenges	Meta	Ethics; privacy; social media; AI
5. IT Infrastructure and Emerging Technologies		
Opening Case Study: QRYde Rides High with the Cloud and AI	QRYde; Oracle	IT infrastructure; legacy systems; cloud computing; AI; mobile apps
Spotlight on Technology Case Study: AI Chips	Nvidia; OpenAI; Google; Microsoft; Amazon	IT infrastructure; AI
Chapter Case Study: Are AI and Cloud Computing Sustainable?	Microsoft; Amazon Web Services; Google; Meta	IT infrastructure; AI; cloud computing; data centers; sustainability
6. Foundations of Business Intelligence: Databases and Information Management		
Opening Case Study: Australia's Royal Flying Doctor Service Files with Oracle Autonomous Database	Royal Flying Doctor Service; Oracle	Cloud computing; databases; data management; mobile devices
Spotlight on Technology Case Study: Facial Databases: Do You Know Who's Using Your Face?	Clearview AI	AI; databases; privacy; ethics
Chapter Case Study: Pursuing Sustainability with Blockchain	Unilever; Green Token; Newlight Technologies; IBM	Blockchain; sustainability; software as a service; ethics
7. Telecommunications, the Internet, and Wireless Technology		
Opening Case Study: From the Football Field to the Cloud and Back Again: The NFL Partners with AWS	NFL; Amazon Web Services	IoT; cloud computing; data analytics; AI; machine learning; 3D visualization
Spotlight on Technology Case Study: Cleveland Clinic Turns to Private 5G Networks for Its Newest Hospital	Cleveland Clinic; Verizon; Ericsson	Wireless networks; 5G
Chapter Case Study: AI and the Future of Search	Google; OpenAI; Microsoft; Perplexity AI	Search technology; AI; GenAI; chatbots; ethics
8. Securing Information Systems		
Opening Case Study: Ransomware Attack Paralyzes U.S. Healthcare Payment Systems	Change Healthcare; UnitedHealth Group	Ransomware; threat actors; information systems security infrastructure; privacy; ethics
Spotlight on Organizations Case Study: Uptime Institute: Understanding and Preventing System Outages	Uptime Institute	Digital resiliency; data centers
Chapter Case Study: Social Engineering Creates Chaos for MGM Resorts	MGM Resorts	Social engineering; threat actors; information systems security
9. Achieving Operational Excellence and Customer Intimacy: Enterprise Applications		
Opening Case Study: TrueBlue Speeds Ahead with Enterprise Applications	TrueBlue; Oracle	Enterprise applications; cloud computing; legacy systems
Spotlight on Organizations Case Study: BYK Tames Its Supply Chains	BYK; SAP	Enterprise applications; supply chain management systems; cloud computing
Chapter Case Study: MillerKnoll Uses Salesforce and AI to Transform Its Business Strategy	MillerKnoll; Salesforce	Enterprise applications; CRM systems; cloud computing; AI; data analytics; sustainability

Case Study	Companies	Topics
10. E-commerce: Digital Markets, Digital Goods		
Opening Case Study: Chewy Blends B2C and B2B E-commerce	Chewy	E-commerce business models; business strategy
Spotlight on Organizations Case Study: Social Listening with Sprout Social	Sprout Social; Goally; TikTok	Social networks; social listening
Chapter Case Study: Lemonade Seeks to Disrupt the Insurance Industry with AI	Lemonade	Insurtech; AI; chatbots; big data; data analytics; mobile apps; digital infrastructure
11. Artificial Intelligence		
Opening Case Study: Computer Vision AI Helps Reddit Become More Accessible	Reddit; Microsoft	AI: computer vision systems;
Spotlight on Management Case Study: Apple's AI Strategy: AI in Every Pocket	Apple	AI; mobile devices; business strategy
Chapter Case Study: Is AI Coming for Your Job?		AI; ethics
12. Enhancing Decision Making with Data Analytics and Business Intelligence		
Opening Case Study: Fulton County Schools Power Up Data-Driven Decision Making with Power BI	Fulton County Schools; Microsoft	Data analytics; data visualization tools; decision making
Spotlight on Technology Case Study: Land O'Lakes Seeks to Reshape the Future of Farming with Predictive Analytics and AI	Land O'Lakes; Microsoft	Data analytics; IoT; big data; predictive analytics; AI
Chapter Case Study: Big Data Analytics and AI: A New Way of Combating Natural Disasters	NASA; California Wildlife Threat and Intelligence Integration Center; NOAA; USGS	Data analytics; IoT; big data; AI
13. Building Information Systems		
Opening Case Study: Signet Jewelers Sparkles with New Virtual Sales Systems	Signet Jewelers	Systems development; business strategy; AI; virtual collaboration tools; e-commerce
Spotlight on Management Case Study: Meet the Citizen Developers	Chevron; ING bank; AT&T; Shell	Citizen software development; AI; machine learning
Chapter Case Study: Process Mining with Celonis	Celonis; Deutsche Telekom Services Europe; Avnet; Kraft Heinz	Business process redesign; business process mining; execution management systems; AI; machine learning; digital twins
14. Making the Business Case for Information Systems and Managing Projects		
Opening Case Study: BigCommerce Turns to Wrike for Better Project Management Tools	BigCommerce; Wrike	Project management tools; cloud computing; software as a service
Spotlight on Management Case Study: Happy Feet International Overcomes Change Management and Implementation Issues	Happy Feet International; Kuebix; Oracle NetSuite	Legacy systems; implementation; change management; enterprise applications
Chapter Case Study: Southwest Airlines Invests in Digital Transformation to Navigate Future Turbulence	Southwest Airlines	Digital transformation; legacy systems; technical debt; project management; cloud computing
15. Managing Global Systems		
Opening Case Study: Hormel Foods Implements Oracle Cloud Applications to Unify Its Systems Worldwide	Hormel Foods; Oracle	Global information systems; enterprise applications; legacy systems
Spotlight on Organizations Case Study: The Rise of Digital Nationalism		Internet; data localization policies; social and political issues
Chapter Case Study: Wyndham Centralizes Its Information Systems to Better Serve Its Worldwide Hotels	Wyndham Hotel & Resorts; Salesforce; Oracle; Okta	Global information systems; enterprise applications; legacy systems; cloud computing; AI

New Video Case Studies

In addition to the case studies that appear within the text, there is one Video Case Study Assignment per chapter in MyLab MIS. The Video Case Study Assignments are all new to this edition and based on Pearson’s collection of business and technology video clips, as well as videos available on official company YouTube channels. These Video Case Study Assignments require students to view the video, read the case study, and answer multiple choice and essay questions to confirm their comprehension.

Chapter	Video Case Study
1. Information Systems in Global Business Today	Twilio Drives Customer Engagement with AI
2. Global E-business and Collaboration	What’s Up with WhatsApp
3. Information Systems, Organizations, and Strategy	Delivery Drones: Walmart’s New Competitive Weapon
4. Ethical and Social Issues in Information Systems	Trustworthy AI
5. IT Infrastructure and Emerging Technologies	D-Wave Makes Waves with Quantum Computing
6. Foundations of Business Intelligence: Databases and Information Management	Alation Helps Companies Develop AI That Can Be Trusted
7. Telecommunications, the Internet, and Wireless Technology	Low Earth Orbit (LEO) Satellite Internet Systems: The Competition Heats Up
8. Securing Information Systems	Akamai Helps Companies Stay Secure
9. Achieving Operational Excellence and Customer Intimacy: Enterprise Applications	Forethought: AI-Driven Customer Support
10. E-commerce: Digital Markets, Digital Goods	Shopify AI
11. Artificial Intelligence	Boston Dynamics’ Spot Robot: “Athletic Intelligence”
12. Enhancing Decision Making with Data Analytics and Business Intelligence	Using Snowflake for Data Analysis
13. Building Information Systems	Will GitHub Copilot Make Every Company a Software Company?
14. Making the Business Case for Information Systems and Managing Projects	Smartsheet Helps ADP to Manage Projects
15. Managing Global Systems	Reslinc Helps Companies Develop Global Supply Chain Resilience



Integrating Business with Technology

By completing the projects in this text, students will be able to demonstrate generative AI skills, business knowledge, application software proficiency, and Internet skills, as well as analytical, writing, presentation, and teamwork and collaboration skills. These projects can be used by instructors as learning assessment tools and by students as demonstrations of their business, software, and problem-solving skills to future employers. Here are some of the skills and competencies students using this text will be able to demonstrate:

- **Generative AI skills:** The ability to use generative AI tools to answer common business questions and solve common business problems.
- **Business Application skills:** The ability to use business and software skills in real-world business applications and demonstrate business knowledge and proficiency in spreadsheet, database, Tableau, and web page/blog creation tools.

- **Internet skills:** The ability to use online tools to access information, conduct research, and perform online calculations and analysis.
- **Analytical, writing, presentation, and teamwork and collaboration skills:** The ability to research a specific topic, analyze a problem, think creatively, suggest a solution, and prepare a clear written or oral presentation of the solution, working either individually or with others in a group.

Generative AI Skills

Select a business name	Chapter 1
Create brand images	Chapter 2
Analyze geographic and demographic factors	Chapter 3
Consider social, ethical, and legal issues in establishing an online presence	Chapter 4
Select an information system	Chapter 5
Perform sentiment analysis	Chapter 6
Identify and compare Internet Service Providers	Chapter 7
Devise an information systems security plan	Chapter 8
Identify customer touchpoints and improve customer experience	Chapter 9
Create an e-commerce presence	Chapter 10
Write a press release	Chapter 11
Identify business decisions	Chapter 12
Identify business processes and process efficiencies	Chapter 13
Identify change management problems	Chapter 14
Understand global supply chain issues	Chapter 15

Business Application Skills

Business Skills	Software Skills	Chapter
Finance and Accounting		
Payroll accounting	Worksheet formatting Spreadsheet formulas SUM, AVERAGE functions Absolute and relative addressing	Chapter 1
Financial statement analysis	Spreadsheet formulas Spreadsheet charts	Chapter 2*
Budgeting	Spreadsheet formulas Spreadsheet charts Spreadsheet assumptions	Chapter 2
Total Cost of Ownership (TCO) analysis	Spreadsheet formulas SUM	Chapter 5
Technology Rent vs. Buy Decision	Spreadsheet formulas	Chapter 5*
Analyze wireless services and costs	Spreadsheet formulas	Chapter 7
Financial statement analysis	Spreadsheet formulas Spreadsheet downloading and formatting	Chapter 10
Capital budgeting	Spreadsheet formulas and functions	Chapter 14*
Data analytics and visualization	Tableau	Chapter 2 Chapter 3 Chapter 6 Chapter 12

Human Resources

Analyzing security events	Spreadsheet sorting, data filtering	Chapter 8
Employee training and skills tracking	Database design Database querying and reporting	Chapter 13*
Internal job postings	Database and web page design	Chapter 15

Manufacturing and Production

Inventory management	Database design, querying, and reporting	Chapter 6
Analyzing supplier performance and pricing	Spreadsheet date functions Data filtering, AVERAGE function	Chapter 9
Bill of materials cost sensitivity analysis	Spreadsheet data tables Spreadsheet formulas	Chapter 12*

Sales and Marketing

Sales trend analysis	Data analytics Database querying and reporting Database design	Chapter 3
Blog creation and design	Blog creation tools	Chapter 4
Customer profiling	Database design Database querying and reporting	Chapter 6*
Customer reservation system	Database querying and reporting	Chapter 13

* Indicates skill in Dirt Bikes Running Case in MyLab MIS

Internet Skills**Internet Skills**

Research jobs and career development	Chapter 1
Plan efficient transportation routes	Chapter 2
Research and evaluate websites	Chapter 3
Analyze web browser privacy protection	Chapter 4
Research travel costs	Chapter 5
Search online databases for products and services	Chapter 6
Conduct business research using online search tools and generative AI	Chapter 7*
Research and evaluate security outsourcing services	Chapter 8
Research and evaluate supply chain management services	Chapter 9*
Research and evaluate e-commerce hosting services	Chapter 10
Improve web searches with generative AI	Chapter 11
Compare product price, features, and availability using shopping bots	Chapter 11
Using an online DSS for financial planning	Chapter 12
Analyze website design	Chapter 13
Research buying and financing a home	Chapter 14
Research international marketing and product pricing	Chapter 15*

* Indicates skill in Dirt Bikes Running Case in MyLab MIS

Analytical, Writing, Presentation, and Teamwork and Collaboration Skills*

Business Problem	Chapter
Select team collaboration tools	Chapter 1
Management analysis and information systems recommendations	Chapter 1*
Identify management decisions and systems	Chapter 2
Conduct a strategic business analysis	Chapter 3*
Formulate a corporate code of ethics	Chapter 4
Develop a privacy policy	Chapter 4*
Research and evaluate server and mobile operating systems	Chapter 5
Identify entities and attributes in an online database	Chapter 6
Research and evaluate smartphones	Chapter 7
Research and evaluate security software tools	Chapter 8
Disaster recovery planning	Chapter 8*
Research and evaluate enterprise application vendors	Chapter 9
Perform a competitive analysis	Chapter 10
Develop an e-commerce strategy	Chapter 10*
Investigate the use of AI	Chapter 11
Investigate the use of data-driven analytics	Chapter 12
Prepare website design specifications	Chapter 13
Identify implementation problems	Chapter 14
Identify technologies for global business strategies	Chapter 15

* Indicates skill in Dirt Bikes Running Case in MyLab MIS



Instructor Teaching Resources

Supplements Available to Instructors at www.pearson.com/laudon

Features of the Supplements

Instructor's Manual

Includes:

- Teaching suggestions
- Sample answers to Case Study, Review, Discussion, and Video Case Questions
- Solutions/solution descriptions for projects

Test Bank

Pearson has engaged skilled test item writers to ensure higher-level cognitive skills are tested. Test bank multiple-choice questions include questions on content but also include many questions that require analysis, synthesis, and evaluation skills.

AACSB Assessment Guidelines

As a part of its accreditation activities, the AACSB has developed an Assurance of Learning Program designed to ensure that schools do in fact teach students what they promise. Schools are required to state a clear mission, develop a coherent business program, identify student learning objectives, and then prove that students do in fact achieve the objectives.

To support AACSB efforts to encourage assessment-based education, student learning objectives and anticipated outcomes for Hands-On MIS projects are identified in this preface. The authors are also happy to provide advice on how to use this text in colleges with different missions and assessment needs. Please email the authors or contact your local Pearson representative for contact information.

Computerized TestGen	TestGen allows instructors to: • Customize, save, and generate classroom tests • Edit, add, or delete questions from the Test Item Files • Analyze test results • Organize a database of tests and student results
PowerPoints	A comprehensive collection of PowerPoints is available for each chapter. Slides are annotated with teaching suggestions. The annotations are like an Instructor's Manual built into the slides and make it easier to teach the course effectively. PowerPoints meet accessibility standards for students with disabilities. Features include but are not limited to: • Keyboard and Screen Reader access • Alternative text for images • High color contrast between background and foreground colors

About the Authors

Kenneth C. Laudon (B.A., Stanford University; Ph.D., Columbia University) was a Professor of Information Systems at New York University's Stern School of Business, where he taught courses on Managing the Digital Firm, Information Technology and Corporate Strategy, Professional Responsibility (Ethics), and Electronic Commerce and Digital Markets for more than 30 years. He also authored numerous books dealing with e-commerce, information technology, information systems, organizations, and society, as well as more than forty articles concerned with the social, organizational, and management impacts of information systems, privacy, ethics, and digital technology. Ken's work has had a lasting influence on the MIS field and although he has passed away, his ideas continue to infuse the content of this text.

Jane Price Laudon (B.A., Barnard College; M.A., Harvard University; Ph.D., Columbia University) is a management consultant in the information systems area and the author of seven books. She has taught at Columbia University and New York University's Stern School of Business. Her special interests include systems analysis, data management, MIS auditing, software evaluation, and teaching business professionals how to design and use information systems.

Carol Guercio Traver (B.A., Vassar College; J.D., Yale Law School) has been researching, writing, and educating students about information technology topics since the mid-1990s. In addition to being an author of *E-commerce: business. technology. society* (Pearson), as well as a number of other texts on information technology topics, she is also an attorney with expertise in technology law, Internet law, privacy law, intellectual property law, and general corporate law. Carol is also co-founder of Azimuth Interactive, a digital media company.

Acknowledgments

The production of any book involves valued contributions from a number of persons. We would like to thank all our editors for encouragement, insight, and strong support for many years. We thank our editors, Jenifer Niles, and Content Producer, Rudrani Mukherjee, for their roles in managing the project. Thanks also to Anu Sivakolundu and her team at Integra for their production work.

We want to thank our supplement authors for their work, including the following MyLab MIS content contributors: Reagan R. Siggard, Utah State University; Gipsi Sera, Indiana University (Retired), and John Hupp, Columbus State University; and Roberta Roth, University of Northern Iowa. We are indebted to Todd Traver for his help with security topics, to Erica Laudon for her contributions to the Careers section and Christopher Traver for his help with software-related topics and projects.

Special thanks to Professor Mark Gillenson, Fogelman College of Business and Economics, University of Memphis for his contributions to the discussion of agile development and testing.

We also want to especially thank all our reviewers, whose suggestions helped improve our texts. Reviewers for recent editions include :

- Abdullah Albizri, *Montclair State University*
- Robert M. Benavides, *Collin College*
- Gordon Bloom, *Virginia Commonwealth University*
- Brett Cabradillia, *Coastal Carolina Community College*
- Qiyang Chen, *Montclair State University*
- Amita Chin, *Virginia Commonwealth University*
- Lynn Collen, *St. Cloud State University*
- Reet Cronk, *Harding University*
- Uldarico Rex Dumdum, *Marywood University*
- Mahmoud Elhussini, *Montclair State University*
- Anne Formalarie, *Plymouth State University*
- Sue Furnas, *Collin College*
- Scott Hamerink, *Oakland University*
- Terry Howard, *University of Detroit Mercy*
- Dae Youp Kang, *University of Memphis*
- Rajkumar Kempaiah, *College of Mount Saint Vincent*
- Channa J. Kumarage, *Saint Cloud State University*
- Weiqi Li, *University of Michigan-Flint*
- Liu Liu, *Old Dominion University*
- Susan Mahon, *Collin College*
- Robert Morphew, *Texas Woman's University*
- John Newman, *Coppin State University*
- Jose Ng, *Montclair State University*
- Richard Peterson, *Montclair State University*
- Robin Poston, *University of Memphis*
- Dr. Michael Raisinghani, *Texas Woman's University*
- Patricia Ryan, *Southeast Missouri State University*
- Ethné Swartz, *Montclair State University*
- Amir Talaei-Khoei, *University of Nevada, Reno*
- Paulus Van Vliet, *University of Nebraska at Omaha*

Part One

Organizations, Management, and the Networked Enterprise



© Blackboard/Shutterstock

Chapter 1: Information Systems in Global Business Today

Chapter 2: Global E-business and Collaboration

Chapter 3: Information Systems, Organizations, and Strategy

Chapter 4: Ethical and Social Issues in Information Systems

PART ONE introduces the major themes of this book, raising a series of important questions: What is an information system, and what are its management, organization, and technology dimensions? Why are information systems so essential in businesses today? Why are systems for collaboration and social business so important? How can information systems help businesses become more competitive? What broader ethical and social issues do widespread use of information systems raise?

Information Systems in Global Business Today



© Sdecoret/Shutterstock

Learning Objectives

After completing this chapter, you will be able to:

- | | |
|---|--|
| 1.1 Understand how information systems transform business and careers. | 1.7 Understand the importance of IoT, big data, cloud computing, and AI. |
| 1.2 Describe key challenges and opportunities created by new MIS technologies. | 1.8 Understand why complementary assets are essential. |
| 1.3 Describe key features of a digital firm. | 1.9 Describe different approaches used to study information systems. |
| 1.4 Describe the business objectives of information systems. | 1.10 Understand how this book prepares you for the future. |
| 1.5 Explain what an information system is and how it works. | 1.11 Understand how the information in this chapter can help your career. |
| 1.6 Describe organizational, management, and technology dimensions of information systems. | |

Chapter Case Studies

- **Opening Case Study:** ConocoPhillips Drills Down with Digital Technology
- **Spotlight on Technology Case Study:** UPS Competes Globally with Information Technology
- **Chapter Case Study:** Capital One: A Digital Transformation in the Making

Opening Case Study

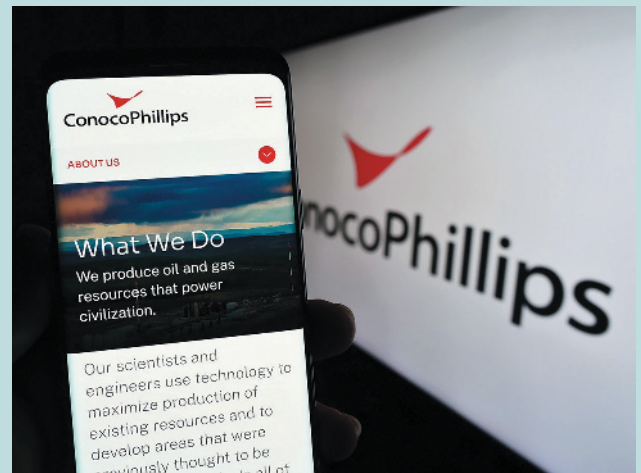
ConocoPhillips Drills Down with Digital Technology

ConocoPhillips is one of the world's largest independent oil and gas exploration and production companies. Its Kuparuk River oil field, located on Alaska's remote North Slope, has been in operation since 1981 and has produced more than 2.5 billion barrels of oil thus far. The ability to continue to recover oil from existing oil fields such as Kuparuk using existing infrastructure in a cost-effective manner is an important factor in minimizing the oil industry's environmental footprint, while continuing to support energy needs as alternative energy sources are being developed. ConocoPhillips is pursuing a variety of innovations in digital technology to do so.

For instance, in addition to issues arising from extremely cold weather, working on the Kuparuk oil field creates high costs and major supply chain challenges because it is so far from most sources of essential parts, such as for gas turbines. Gas turbines compress the natural gas that comes out of oil wells. A key component is a burner plug that enables fuel to be mixed with compressed air. The burner plugs in the gas turbines used in Kuparuk aren't commercially available anymore. When the plugs wear out, they must be made by local machine shops employing traditional manufacturing processes, which can take at least 30 weeks (and even longer for other critical parts, such as choke valves). Keeping extra parts in inventory "just in case" drives up warehousing costs.

ConocoPhillips was able to solve this problem using 3D printing, sometimes also referred to as additive manufacturing. 3D printing creates a physical object from a digital design, laying down thin layers of liquid or powdered plastic, metal, or cement, and then fusing the layers together. It enables companies to simulate many designs for various parts and identify the best configuration before manufacturing a part. These configurations are converted into a print file, which can be shared with additive manufacturing partners and then "printed" into three-dimensional objects.

With 3D printing, ConocoPhillips can replace burner plugs in two to three weeks instead of 30, and reduce the time to produce choke valves from 45 weeks to 5 or less. The 3D parts perform just as well, if not better, than those manufactured by traditional means. For instance, 3D printing technology makes it possible to print choke valves with complex geometries that reduce the amount of fuel consumed

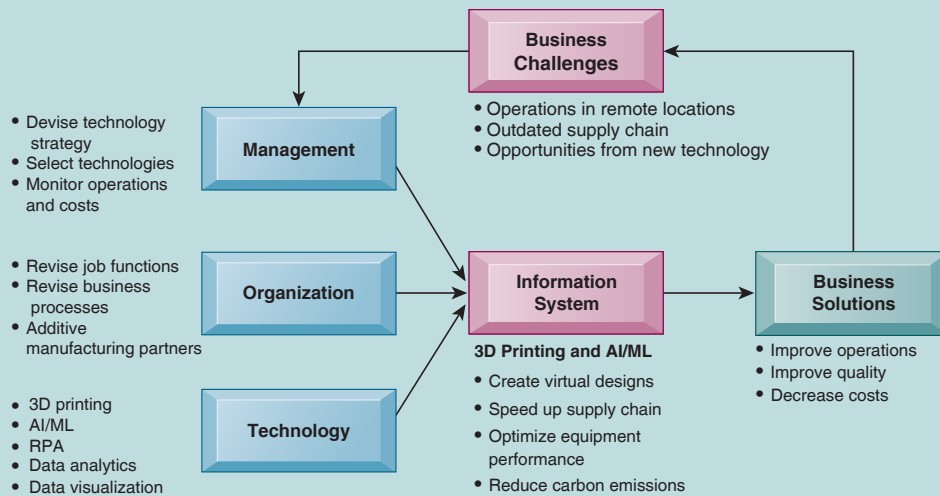


© T. Schneider/Shutterstock

and accompanying carbon emissions. And because 3D printing enables ConocoPhillips to create parts on demand and takes place closer to the point of use, it improves inventory management and reduces transportation costs associated with those parts as well as warehousing costs. As 3D printing continues to advance, ConocoPhillips expects to use it in other areas around the world, enabling it to replace physical inventory with digital inventory, advance environmental and sustainability metrics, and improve efficiency.

ConocoPhillips is also using a host of other innovative digital technologies, such as data analytics, data visualization, automation, and artificial intelligence/machine learning (AI/ML) to improve operational performance. It uses data analytics to harness the vast amounts of data (known as big data) generated from its business, including from Internet of Things (IoT) devices such as sensors. Data visualization tools, such as digital twin technology, enable ConocoPhillips to create a virtual representation of physical objects, allowing it to test various scenarios virtually. It employs software bot-driven robotic process automation (RPA) to automate specific repetitive tasks to free humans for more complex work. And increasingly, it is using AI/ML algorithms to optimize equipment performance and extend machine life. Other ConocoPhillips ML applications include optimizing seismic imaging, reservoir simulations, and well operations.

Going forward, ConocoPhillips's digital mission is to improve the efficiency of its operations, lower its



supply costs, reduce carbon emissions, and improve its safety performance. Innovation is a core value. The company believes that when combined with the skills of its workforce, digital technologies are critical to making its assets and processes more intelligent and automated.

SOURCES: "Digitizing Our Business," Conocophillips.com, accessed November 18, 2024. Michael Bertha, "ConocoPhillips Enlists 3D Printing for Supply Efficiencies on Alaska's North Slope," Cio.com, December 14, 2023; "Kuparak 1981—2021," ConocoPhillips Alaska and Petroleum News, March 2022.

ConocoPhillips' experience dealing with parts shortages, antiquated business processes, and supply chain issues shows how essential information systems are today. Forward-looking multinational firms such as ConocoPhillips are struggling to keep costs down, improve decision making, protect the environment, and find better ways of doing business, even in remote locations with harsh climates. ConocoPhillips addressed this problem by deploying leading-edge information technology, including 3D printing and AI/ML.

The Opening Case Study diagram above calls attention to important points raised by this case and this chapter. ConocoPhillips needs to extract oil and natural gas from numerous locations around the world, including remote locations with harsh climates such

as Alaska's North Slope. The company's supply chain was not very resilient and hampered by the inability to obtain critical parts on short notice. 3D printing enabled ConocoPhillips to obtain parts more quickly, reducing transportation and warehouse costs, and to also improve their design. AI/ML and other innovative digital technologies have helped the company improve operational efficiency, optimize machine performance, extend equipment life, as well as reduce carbon emissions.

It is important to note that deploying new information technology has changed the way ConocoPhillips runs its business. To effectively use new digital tools, the company had to redesign jobs and business processes for manufacturing and obtaining parts. These changes had to be carefully planned to make sure they enhanced efficiency, service, and profitability.

Case Study Questions

1. Identify the problem described in this case. What areas of the business did it affect?
2. How did ConocoPhillips benefit from using 3D printing and AI/ML?
3. How did these new technologies change the way ConocoPhillips ran its business?

CAREER BENEFIT

Employees, managers, and IT specialists who worked on this problem gained recognition for selecting, testing, and implementing 3D printing and AI/ML systems, and for finding innovative uses for these technologies that can further improve business performance. ConocoPhillips employees and managers obtained career benefits by assisting with the adoption of new technologies and using them in their jobs to improve productivity and quality.

1.1 Understand How Information Systems Transform Business and Careers

The way businesses operate is changing at an increasingly rapid pace due to new technologies, particularly AI. According to research firm Gartner, firms spent more than \$20 trillion on information technology (IT) and IT services worldwide between 2019 and 2023, and are expected to spend an additional \$5 trillion in 2024 (Gartner, 2024). You can see the results of this spending around you every day.

How Information Systems Are Transforming Business

Today, information systems that incorporate the Internet and mobile devices have become essential tools of business. In 2024, around 2.9 billion people worldwide are expected to purchase something online, and more than two-thirds of all retail e-commerce revenues will be generated by people using a mobile device. What this means is that if a business isn't using information systems connected to the Internet and mobile apps, chances are it isn't being as effective as it could be.

Information systems that use sophisticated data analytics to analyze massive amounts of data are enabling businesses to track and respond to rapidly changing customer demand, reduce inventories to the lowest possible levels, and achieve higher levels of operational efficiency. As a result, supply chains have become faster-paced, with companies of all sizes depending on the delivery of just-in-time inventory to stay competitive. If a company is not employing these kinds of supply chain information systems, chances are it is not as efficient as it could be. The importance of supply chains and supply chain management has been highlighted even further by supply chain disruptions introduced by the Covid-19 pandemic.

Information systems have driven the development of both social networks and social media. In 2024, there are expected to be almost 4 billion people around the world who use social networks, representing about 50 percent of the total global population. Customers are using Facebook, Instagram, TikTok, and other forms of social media to talk to each other about a company's products and services. This means that companies need a solid online customer relationship program in place, and they need to keep track of what customers are saying about them.

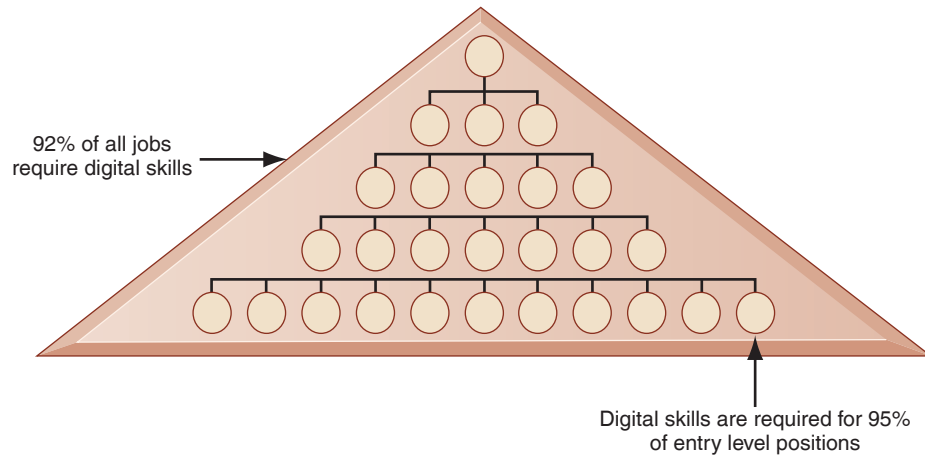
Advertising is another business that has been transformed by the development of information systems. Digital advertising spending worldwide is projected to reach more than \$900 billion by 2027, representing more than 75 percent of total media ad spending. More than three-quarters of this spending will be for mobile advertising. Companies need to make sure that their advertising is reaching web and mobile customers.

The data generated by billions of Internet-linked devices, e-commerce, and social media is driving the explosive growth of digital information. According to some estimates, almost 330 million terabytes of data are created every day. Retention of all the data created by businesses as well as consumers on social media and the Internet has raised privacy concerns and has led to the passage of laws about how such data must be safeguarded. Various U.S. laws require companies to meet certain requirements for storing financial, health, and occupational information. If they don't, the entire business may be at risk.

Artificial intelligence (AI) is the latest information technology that is in the process of transforming business. Public attention is riveted on AI because of its enormous potential for improving how companies conduct business, as well as many aspects of everyday life. If used properly, AI-driven information systems can lower costs, reduce risks, speed time to market, and create superior products and services, providing a competitive advantage (Emarketer, 2024, 2023; Duarte, 2023).

The Transformation of Jobs: What All This Means for You

These technology-driven changes are transforming jobs and careers—how you work, where you work, and how well you will be compensated. Many millions of new jobs have been created, not only for IT specialists but also for business professionals who now use IT tools to

Figure 1.1 High Demand for Digital Skills

accomplish their work. Employees across all industries are seeing more and more technology tools incorporated into their workflows.

A 2023 study by the National Skills Coalition investigated the demand for digital skills in the U.S. labor market. The report analyzed 43 million jobs from 2021 job postings and found strong demand for digital skills across every industry and in almost every occupation, even those that only required limited education or for entry-level positions. The report further found that workers who qualify for jobs that require even *one* digital skill can earn an average of 23 percent more than in a job that does not require any digital skills. Moving from a job that does not require any digital skills to one requiring at least three can increase pay by an average of 45 percent. Figure 1.1 illustrates these findings (National Skills Coalition, 2023). The conclusion is obvious: People who can understand and work with technology are at a great advantage. Do you have the career skills to thrive and succeed in this fast-paced, digital-first world of business?

Knowing how to use technology tools to perform your current job may be sufficient right now for today's workplace, but gaining a deeper understanding of how technology works and is evolving is also essential for getting ahead. For instance, the increasing use of AI tools will be transforming many jobs over the next five to ten years. The last section of each chapter in this book will help you understand how what you have learned in the chapter can translate into a higher paying job and career advancement. These recommendations are not limited to IT careers—they also apply to most career paths in this tech-driven world. Additional career resources are available in MyLab MIS.

1.2 Describe Key Challenges and Opportunities Created by New MIS Technologies

In this book, we focus primarily on management information systems (MIS), which can be broadly defined as information systems used to help optimize firm performance. The technologies behind management information systems are changing and evolving every day. This creates both challenges and opportunities, which are what make management information systems one of the most exciting areas in business today. Globalization, which in large part has been driven by changes in technology, brings with it its own set of challenges and opportunities.

Key Challenges in Management Information Systems

Table 1.1 summarizes the major challenges that technology changes have created in using management information systems. No matter what your role is in a business, you are likely to encounter some, if not all, of these challenges at some point in your career.

Table 1.1 Key Challenges in Management Information Systems

Change	Business Challenge
Technology	
Cloud computing: Companies are increasingly turning to cloud computing, a system for storing, managing, and processing data using an Internet-connected network of remote computing centers, to perform tasks traditionally performed at corporate data centers. Major business applications can be delivered online as an Internet service (software as a service [SaaS]).	What are the costs and benefits of cloud computing and how much of the firm's IT infrastructure should be moved to cloud providers?
Big data and the Internet of Things (IoT): Businesses are looking for insights in huge volumes of data from web traffic, email messages, social media content, and Internet-connected devices (sensors). More powerful data analytics and interactive dashboards can provide real-time performance information to managers to enhance decision making.	Does your firm have the ability to analyze and use big data?
Artificial intelligence (AI): Computer systems can perform tasks normally requiring human intelligence, such as speech recognition, visual perception, recognizing patterns, making predictions, and learning from experience, with the potential for dramatically improving operations and decision making.	Where can your company use AI, and where can you find the expertise to implement it? What benefits can you expect? How much will it cost?
The mobile platform: Business and personal computing is increasingly moving to smartphones, tablet computers, car infotainment systems, and wearable devices. Thousands of applications are now available to support collaboration, coordination of work, communication with colleagues and customers, and online purchases on mobile devices. Almost 90 percent of Internet users use a mobile device to access the Internet at least some of the time.	Is your firm making the best use of mobile capabilities for its employees and customers? How could your firm improve? What are the costs and benefits?
Management	
Return on investment (ROI): Although firms spend millions on information systems and services, they typically have little understanding of how much benefit they receive.	How can your firm measure and understand the benefit it is receiving from IT expenditures? Are there alternative sources of these services that would cost less?
Online collaboration and social networks: Millions of business professionals use Google Apps, Microsoft 365, Slack, and Zoom to support online meetings, project management, blogs, personal profiles, and online communities.	Is your firm making a coordinated effort to use new technologies to improve coordination, collaboration, and knowledge sharing? Which of the many alternatives should it be using?
Organizations	
Security and privacy: Security lapses and protecting customer privacy are major public issues that affect all businesses.	How does your company know its data are secure? How much does it spend on security now? What privacy policies does your firm have in place? How should the firm expand its privacy protections as new laws emerge?

Change	Business Challenge
Social business: Businesses use social network platforms, including Facebook, X (formerly Twitter), TikTok, Instagram, and internal corporate social tools, to deepen interactions with employees, customers, and suppliers.	How is your company using social business tools? Is your company getting real value from these platforms?
Remote and hybrid work: The Internet, cloud computing, smartphones, and tablet computers make it possible for growing numbers of people to work away from the traditional office. This capability proved critical during the height of the Covid-19 pandemic, when more than 70 percent of workers worked from home.	Going forward, what will your firm’s policies and technologies be for remote work, and what are the challenges and opportunities?

Globalization

The flow of goods, services, capital, people, and ideas across international boundaries.

Globalization Challenges and Opportunities

Globalization is defined as the flow of goods, services, capital, people, and ideas across international boundaries. A growing percentage of the economies of the United States and other countries depend on imports and exports. According to the World Trade Organization, world trade of goods and services constitutes almost 60 percent of overall global economic activity (World Trade Organization, 2023). More than 35 percent of the revenue of U.S. Fortune 500 companies is generated outside of the United States.

The level of globalization in the world today has been made possible by advances in information technology. The emergence of the Internet into a full-blown international communications system has drastically reduced the costs of operating and transacting on a global scale. Communication between a factory floor in Mumbai, India and a distribution center in Rapid City, South Dakota, is now instant and virtually free. Customers can now shop in a worldwide marketplace, obtaining price and quality information reliably 24 hours a day. Firms producing goods and services on a global scale can achieve extraordinary cost reductions by finding low-cost suppliers and managing production facilities in other countries.

Globalization gives businesses the opportunity to expand into new markets, reach international buyers, and increase revenue. However, it also presents challenges for businesses. The challenge for businesses is to understand the potential impact that globalization can have on markets for goods and services. For instance, businesses can learn how to profit from the lower costs available in world markets and the chance to serve a marketplace with billions of customers. Globalization can provide opportunities to develop more profitable products and services. On the other hand, globalization can create increased competition from other companies who may be more successful in leveraging the benefits of globalization.

What does globalization mean for you and your career? It’s not just goods that move across borders, but jobs as well. Some of these jobs are high-level positions that pay well and require a college degree. Between 1998 and 2021, the United States lost 5 million manufacturing jobs to offshore producers. U.S. multinational companies employ more than 14 million people outside the United States, many of them in service jobs in information technology, customer call centers, human resources, financial services, consulting, engineering, architecture, and even medical services, such as radiology. On the plus side, the U.S. economy continues to create millions of new jobs, and some of those can be attributed to globalization. The challenge for you as a student and in your future career is to develop high-level skills through education and on-the-job experience that cannot be replicated at a lower cost abroad (Scot et al., 2022).

Digital firm

Organization where nearly all significant business processes and relationships with customers, suppliers, and employees are digitally enabled, and key corporate assets are managed through digital means.

1.3 Describe Key Features of a Digital Firm

The changes we have just described have created the conditions for the emergence of “digital firms.” A **digital firm** is one in which the organization’s significant business relationships with customers, suppliers, and employees are digitally enabled and corporate assets

are managed through digital means. *Core business processes* are accomplished through digital networks spanning the entire organization or linking multiple organizations.

Business processes refer to the set of logically related tasks and behaviors that organizations develop over time to produce specific business results and the unique manner in which these activities are organized and coordinated. Developing a new product, generating and fulfilling an order, creating a marketing plan, and hiring an employee are examples of business processes, and the ways organizations accomplish their business processes can be a source of competitive strength. More detail about business processes can be found in Chapters 2 and 3.

Key corporate assets—intellectual property, core competencies, and financial and human assets—are managed through digital means. In a digital firm, the information required to support key business decisions is available at all times and anywhere in the firm.

A digital firm can sense and respond to its environment far more rapidly than a traditional firm, giving it more flexibility to survive in turbulent times. Digital firms offer extraordinary opportunities for more flexible global organization and management. In digital firms, both time shifting and space shifting are the norm. *Time shifting* refers to business being conducted continuously, 24/7, rather than in narrow “workday” time bands of 9 a.m. to 5 p.m. *Space shifting* means that work takes place in a global workshop as well as within national boundaries. Work is accomplished physically wherever in the world it is best accomplished using digital tools and networks to link information and people.

Firms often undertake digital transformation initiatives in an effort to become a digital firm. **Digital transformation** refers to large-scale change efforts to capture the benefits of digital technology, driving fundamental changes in how businesses operate and how they deliver value to customers. Digital transformation is an ongoing process. Firms engaging in digital transformation move progressively closer to becoming digital firms. Cisco Systems, Caterpillar, and 3M are examples of businesses that are taking an aggressive “digital first” approach, using the Internet and information technology to drive nearly every aspect of their business. Most companies are not fully digital, but they are moving toward closer digital ties to suppliers, customers, and employees.

Digital transformation is a complex endeavor requiring enterprises to rethink their business models, change their organizational structures and practices, become more data-driven, and embrace a culture of continuous change.

Business processes

The unique ways in which organizations coordinate and organize work activities, information, and knowledge to produce a product or service.

Digital transformation

Large-scale change efforts to capture the benefits of digital technology, driving fundamental changes in how businesses operate and how they deliver value to customers.

1.4 Describe the Business Objectives of Information Systems

There is a growing interdependence between a firm’s ability to use information technology and its ability to implement corporate strategies and achieve corporate goals. What a business would like to do in five years often depends on what its systems will be able to do. Examine Figure 1.2, which illustrates this relationship. Changes in strategy, rules, and business processes increasingly require changes in hardware, software, data management, and networking and telecommunications technologies. Increasing market share, becoming the high-quality or low-cost producer, developing new products, and increasing employee productivity depend more and more on the kinds and quality of information systems in the organization. The more you understand about this relationship, the more valuable you will be in the business world.

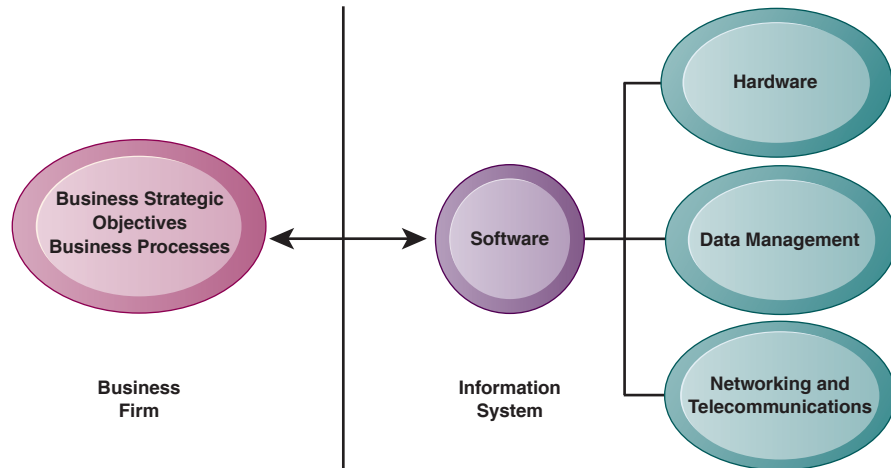
Business firms invest heavily in information systems to achieve six strategic business objectives: operational excellence, new products, services, and business models, customer and supplier intimacy, improved decision making, competitive advantage, and survival. In addition, companies today are increasingly concerned about the environmental impact of their operations and sustainability, as well as proper governance of the organization and the responsible use of AI. Such concerns are becoming a strategic business imperative, and information systems are central in enabling companies to meet their goals.

Operational Excellence

Businesses continuously seek to improve the efficiency of their operations to achieve higher profitability. Information systems and technologies are some of the most important tools available to managers for achieving higher levels of efficiency and productivity in business operations, especially when coupled with changes in business practices and management behavior.

Figure 1.2 The Interdependence of Organizations and Information Systems

Today, a firm's information systems and its business capabilities have become interdependent. Often, what the organization would like to do depends on what its systems will permit it to do.



Walmart, the largest retailer on Earth, exemplifies the power of information systems coupled with sophisticated business practices and supportive management to achieve world-class operational efficiency. In fiscal 2024, Walmart generated \$648 billion in sales—largely because of its Retail Link and Global Replenishment System, which digitally links its suppliers to every one of Walmart's stores worldwide. As soon as a customer purchases an item, the supplier monitoring the item knows to ship a replacement to the shelf. Walmart is the most efficient retail store in its industry.

New Business Models, Products, and Services

Business model

Describes how a company produces, delivers, and sells a product or service in order to create value.

Information systems and technologies are a major enabling tool for firms to create new business models, as well as new products and services. A **business model** describes how a company produces, delivers, and sells a product or service to generate revenue. For instance, Apple transformed a music distribution business model based at the time on the sale of physical products such as vinyl records, tapes, and CDs into a legal Internet-based digital download distribution model based on its own iTunes store.

Customer and Supplier Intimacy

When a business really knows its customers and serves them well, the way they want to be served, its customers generally respond by returning and purchasing more. This raises revenues and profits. Likewise, with suppliers, the more a business engages its suppliers, the better the suppliers can provide vital inputs. This lowers the business's costs. How to really know your customers or suppliers is a central problem for businesses.

High-end hotel chains such as Ritz-Carlton exemplify the use of information systems and technologies to achieve customer intimacy. Every time new prospects share their information or a guest checks in to a Ritz hotel, their information is stored in a cloud-based relationship management system. When that guest returns to the hotel or logs into their online account, the system cross-references their data profile and tailors that customer's guest experience to their exact preferences (such as room temperature, check-in and checkout times, and room location) and history. This highly personalized experience makes the customer feel valued, included, and part of the Ritz brand. The hotels also analyze their customer data to identify their best customers and develop individualized marketing campaigns based on customers' preferences.

Hong Kong-headquartered TAL Apparel, one of the world's largest contract apparel manufacturers, exemplifies the use of information systems to enable supplier intimacy. TAL Apparel produces shirts, blouses, knits, pants, outerwear, and suits for many leading garment brands, including Bono-bos and L.L.Bean. TAL manufactures one out of every six dress shirts sold in the United States. The company also helps its clients manage their supply chains. Every time its clients sell a dress shirt, for example, the record of the sale appears immediately on TAL's computers in Hong Kong. TAL runs

the numbers through a computer model it developed and decides how many replacement shirts to make and in what styles, colors, and sizes. TAL then sends the shirts to the retailer. TAL's systems reduce inventory costs and ensure that what customers want is actually on retailers' shelves.

Improved Decision Making

Many business managers operate in an information fog, never really having the right information at the right time to make an informed decision. Instead, managers rely on forecasts, best guesses, and luck. The result is over or underproduction of goods and services, misallocation of resources, and poor response times. These poor outcomes raise costs and lose customers. Information systems and technologies have now made it possible for managers to use real-time data from the marketplace when making decisions.

For instance, Coca-Cola Bottling Company Consolidated uses a series of business intelligence dashboards that display metrics like delivery operations, budget, and profitability, consolidating data from hundreds of disparate sources. Leadership dashboards focus on strategy, business growth, and profitability. Sales teams can now access mobile dashboards on iPads in the field, increasing timeliness to sell more products. Field sales dashboards allow sales teams to see a full overview of customer portfolios and track sales quotas.

Competitive Advantage

When firms achieve one or more of these business objectives—operational excellence, new products, services, and business models, customer/supplier intimacy, and improved decision making—chances are they have already achieved a competitive advantage. Doing things better than competitors, charging less for superior products, and responding to customers and suppliers in real time all add up to higher sales and profits that competitors cannot match. Apple, Walmart, and UPS are industry leaders because they know how to use information systems for this purpose.

Survival

Business firms also invest in information systems and technologies because they are necessities of doing business. Sometimes these necessities are driven by industry-level changes. For instance, after Citibank introduced the first automated teller machines (ATMs) in the New York region to attract customers through higher service levels, its competitors rushed to provide ATMs to their customers to keep up with Citibank. Today, virtually all banks in the United States have regional ATMs and link to national and international ATM networks, such as Cirrus. Providing ATM services to retail banking customers is simply a requirement of being in and surviving in the retail banking business.

Many federal and state statutes and regulations create a legal duty for companies and their employees to retain records, including digital records. For instance, the Toxic Substances Control Act, which regulates the exposure of U.S. workers to more than 75,000 toxic chemicals, requires firms to retain records on employee exposure for 30 years. The Sarbanes–Oxley Act, which was intended to improve the accountability of public firms and their auditors, requires public companies to retain audit working papers and records, including all email messages, for five years. The Dodd–Frank Act requires financial service firms to expand their public reporting greatly on derivatives and other financial instruments. Firms turn to information systems and technologies to provide the capability to respond to information retention and reporting requirements.

Environmental Impact, Sustainability, Governance, and Responsible AI

Over the past decade, there has been a growing awareness of the important role that businesses play and the impact that they have on society. With that growing awareness, there has come pressure from employees, customers, investors, and governmental authorities with respect to business conduct in three primary areas: sustainability and environmental impact, corporate governance, and increasingly, the responsible use of AI.

Sustainability and environmental concerns encompass aspects such as energy use, carbon footprint, recycling practices, pollution, and natural resource conservation. Governance criteria primarily relate to the actions of the company's leadership, executive pay, internal controls, and shareholder rights. Responsible AI initiatives aim to provide guidelines to ensure companies use AI technologies in an ethical manner. Many aspects of these concerns are intertwined with one another.

Showing leadership in these areas can add business value by facilitating growth, reducing costs, minimizing regulatory and legal issues, increasing employee productivity, and optimizing assets and investments. For instance, many consumers are no longer willing to support companies that don't prioritize sustainability.

Information systems are essential for enabling companies to achieve these sorts of goals. For instance, Crowley, a global logistics, marine, and energy solutions company, worked with consulting firm PwC and Salesforce to implement Salesforce Net Zero Cloud. Salesforce Net Zero Cloud quickly analyzes and reports reliable environmental data from a variety of disparate sources. Salesforce Net Zero Cloud helps Crowley measure and analyze its carbon emissions and those of its suppliers. Crowley expects to reduce overall emissions by 4.2 million metric tons of greenhouse gases per year, the equivalent of removing more than 900,000 cars from the road annually (PWC, 2022). We discuss other examples of information systems being used for these purposes throughout the text.

1.5 Explain What an Information System Is and How It Works

So far, we've used the terms *information systems* and *information technologies* informally without defining them. **Information technology (IT)** consists of all the hardware and software that a firm needs to use to achieve its business objectives. This includes not only computers, storage technology, and mobile devices, but also software such as the Windows and iOS operating systems, the Microsoft 365 productivity suite, and the many thousands of computer programs that can be found in a typical large firm. Information systems are more complex and can be understood best by looking at them from both a technology perspective and a business perspective.

What Is an Information System

An **information system (IS)** can be defined technically as a set of interrelated components that collect (or retrieve), process, store, and distribute information to support decision-making, coordinating, and control in an organization. In addition, information systems may also help managers and workers analyze problems, visualize complex subjects, and create new products.

Information systems contain information about significant people, places, and things within the organization or in the environment surrounding it. By **information**, we mean data that have been shaped into a form that is meaningful and useful to humans. **Data**, in contrast, are streams of raw facts representing events occurring in organizations or the physical environment before they have been organized and arranged into a form that people can understand and use.

A brief example contrasting information and data may prove useful. Examine Figure 1.3, which provides an example of an information system used by a supermarket. Supermarket checkout counters scan barcodes on products. The barcodes contain data about the product, such as a numerical identifier, name, and price ("331 Brite Dish Soap, 1.29"), shown in the left portion of the diagram. An information system enables these pieces of data to be totaled and analyzed to provide meaningful information, displayed in the right portion of the diagram, such as the total number of bottles of dish detergent sold at a particular store, which brands of dish detergent were selling the most rapidly at that store or sales territory, or the total amount spent on that brand of dish detergent at that store or sales region.

Three activities in an information system produce the information that organizations need to make decisions, control operations, analyze problems, and create new products or services. These activities are input, processing, and output. Examine Figure 1.4, which illustrates how these activities work together within an information system. **Input** captures or collects raw data from within the organization or from its external environment. **Processing** converts this raw

Information technology (IT)

All the hardware and software technologies a firm needs to achieve its business objectives.

Information system (IS)

Interrelated components working together to collect, process, store, and distribute information to support decision making, coordination, control, analysis, and visualization in an organization.

Information

Data that have been shaped into a form that is meaningful and useful to humans.

Data

Streams of raw facts representing events occurring in organizations or the physical environment before they have been organized and arranged into a form that people can understand and use.

Input

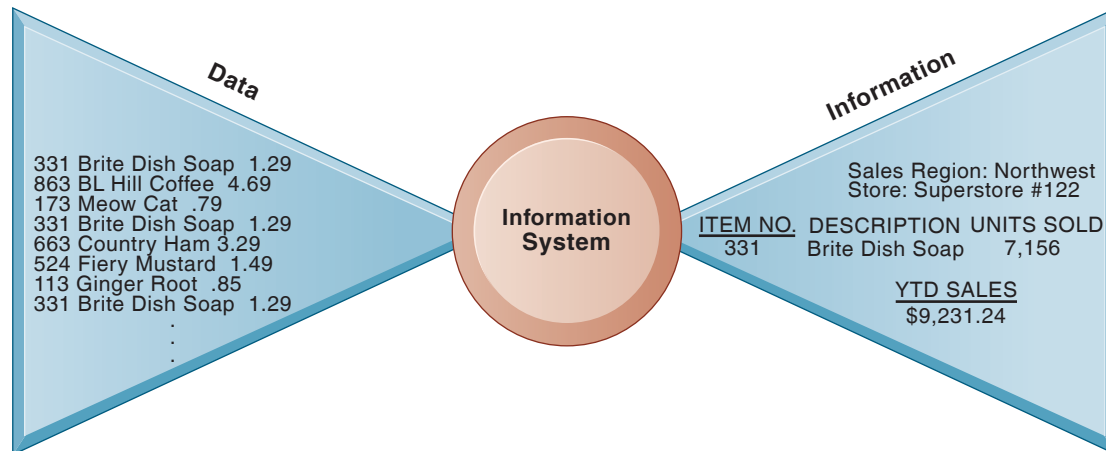
The capture or collection of raw data from within the organization or from its external environment for processing in an information system.

Processing

The conversion, manipulation, and analysis of raw input into a form that is more meaningful to humans.

Figure 1.3 Data and Information

Raw data from a supermarket checkout counter can be processed and organized to produce meaningful information, such as the total unit sales of dish detergent or the total sales revenue from dish detergent for a specific store or sales territory.



input into a meaningful form by classifying, arranging, and performing calculations on it.

Output transfers the processed information to the people who will use it or to the activities for which it will be used. Information systems also provide **feedback**, which is output that is returned to appropriate members of the organization to help them evaluate or correct the input stage. Figure 1.4 also illustrates that an organization's information systems do not operate within a vacuum: they are impacted by various elements in the environment that surround them, such as the organization's suppliers, customers, competitors, and stockholders as well as governmental agencies that regulate the organization.

Output

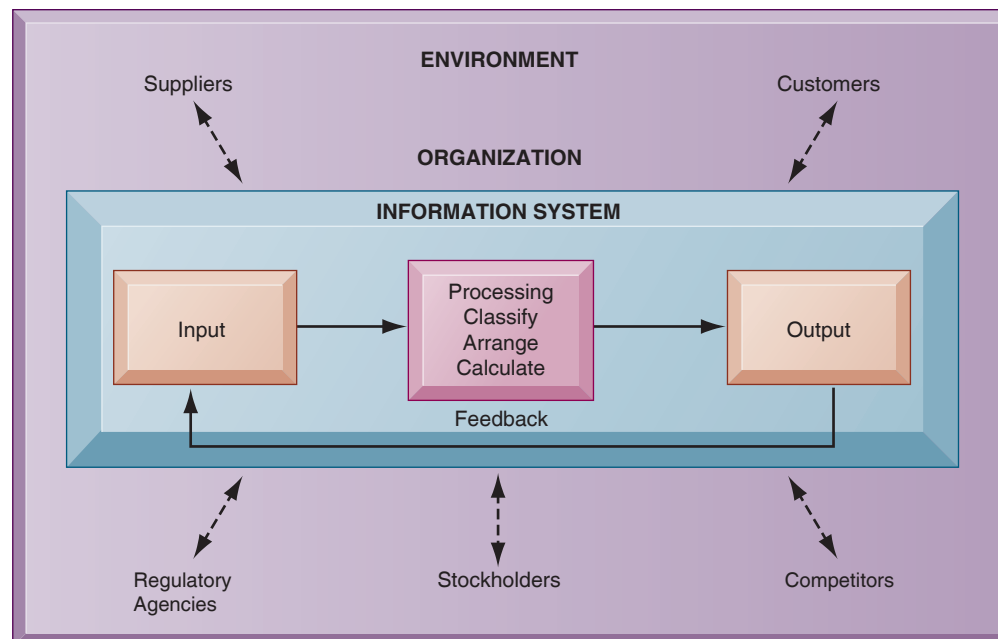
The distribution of processed information to the people who will use it or to the activities for which it will be used.

Feedback

Output that is returned to the appropriate members of the organization to help them evaluate or correct input.

Figure 1.4 Functions of an Information System

An information system contains information about an organization and its surrounding environment. Three basic activities—input, processing, and output—produce the information organizations need. Feedback is output returned to appropriate people or activities in the organization to evaluate and refine the input. Actors in the external environment, such as customers, suppliers, competitors, stockholders, and regulatory agencies, interact with the organization and its information systems.



Although computer-based information systems use computer technology to process raw data into meaningful information, there is a sharp distinction between a computer and a computer program, and an information system. Computers and related software programs are the technical foundation, the tools and materials of modern information systems. Computers provide the equipment for storing and processing information. Computer programs, or software, are sets of operating instructions that direct and control computer processing. Knowing how computers and computer programs work is important in designing solutions to organizational problems, but computers are only part of an information system.

A house is an appropriate analogy. Houses are built with hammers, nails, and wood, but these alone do not make a house. The architecture, design, setting, landscaping, and all of the decisions that lead to the creation of these features are part of the house and are crucial for solving the problem of putting a roof over one's head. Computers and programs are the hammer, nails, and lumber of computer-based information systems, but alone they cannot produce the information a particular organization needs. To understand information systems, you must understand the problems they are designed to solve, their architectural and design elements, and the organizational processes that lead to these solutions.

Information systems literacy

Broad-based understanding of information systems that includes behavioral knowledge about organizations and individuals using information systems as well as technical knowledge about computers.

Computer literacy

Knowledge about information technology and understanding how computer-based technologies work.

Management information systems (MIS)

The study of information systems, focusing on their use in business and management. Also refers to specific category of information system serving middle management.

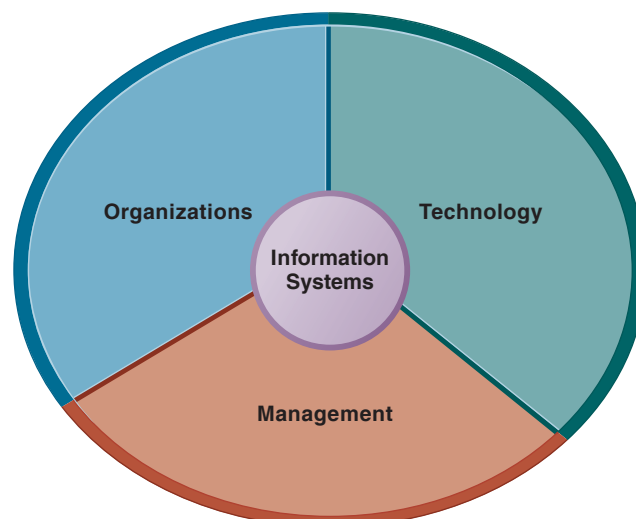
It Isn't Simply Technology: The Role of Management and Organizations

To understand information systems fully, you need to be aware of the broader organizational, managerial, and information technology dimensions of systems and their power to provide solutions to challenges and problems in the business environment. Examine Figure 1.5, which highlights the interconnected nature of these dimensions, showing that organizations, technology, and management are all interrelated components underlying the effective use of information systems. We refer to this broader understanding of information systems, which encompasses an understanding of the managerial and organizational dimensions of systems as well as the technical dimensions of systems, as **information systems literacy**. Information systems literacy includes a behavioral as well as a technical approach to studying information systems. **Computer literacy**, in contrast, focuses primarily on knowledge about information technology and understanding how computer-based technologies work.

The field of **management information systems (MIS)** tries to achieve this broader information systems literacy. MIS deals with behavioral issues as well as technical issues surrounding the development, use, and impact of information systems that managers and employees in the firm use. (Note that the term *management information systems* also refers to a specific category of information systems, as previously noted in Section 1.2 and further described in later chapters.)

Figure 1.5 Information Systems Are More Than Computers

Using information systems effectively requires an understanding of the organization, management and information technology shaping the systems. An information system provides a solution to important business problems or challenges facing the firm.



1.6 Describe Organizational, Management, and Technology Dimensions of Information Systems

Let's now further examine each of the organizational, management, and technology dimensions of information systems.

Organizations

Information systems are an integral part of organizations. Although we tend to think about information technology changing organizations and business firms, it is, in fact, a two-way street. The history and culture of business firms also affect how the technology is used and how it should be used. To understand how a specific business firm uses information systems, you need to know something about the structure, history, and culture of the company.

Organizations have a structure that is composed of different levels and specialties. Their structures reveal a clear-cut division of labor. A business firm is organized as a hierarchy, or a pyramid structure, of rising authority and responsibility. The upper levels of the hierarchy consist of managerial, professional, and technical employees, whereas the lower levels consist of operational personnel.

Examine Figure 1.6, which illustrates this hierarchy in the form of a pyramid. **Senior management**, which makes long-range strategic decisions about products and services as well as ensures financial performance of the firm, is at the top of the pyramid. **Middle management**, which carries out the programs and plans of senior management, forms the middle layer, and **operational management** at the base of the pyramid is responsible for monitoring the daily activities of the business. **Knowledge workers**, such as engineers, scientists, or architects, design products or services and create new knowledge for the firm,

Senior management

People occupying the topmost position in an organization's hierarchy and who are responsible for making long-range decisions.

Middle management

People in the middle of an organization's hierarchy and who are responsible for carrying out the plans and goals of senior management.

Operational management

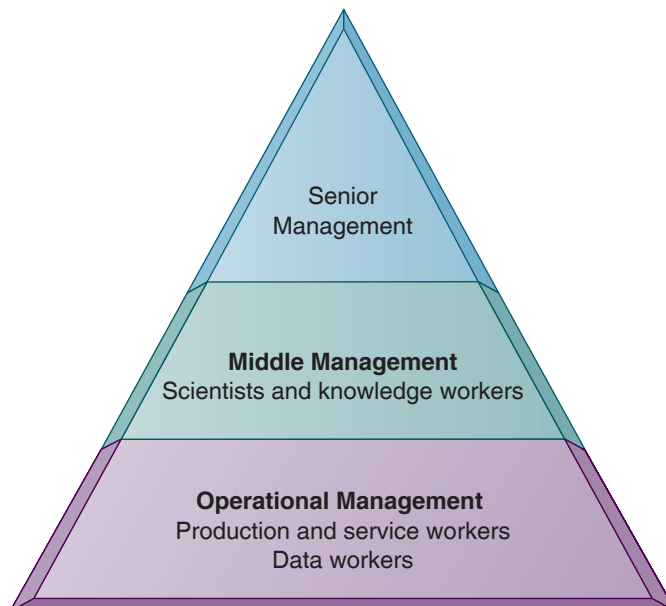
People who are responsible for monitoring the day-to-day activities of an organization.

Knowledge workers

People such as engineers, scientists, or architects who design products or services and create knowledge for the organization.

Figure 1.6 Levels in a Firm

Business organizations are hierarchies consisting of three principal levels: senior management, middle management, and operational management. Information systems serve each of these levels. Scientists and knowledge workers often work with middle management.



Data workers

People such as clerks or bookkeepers who assist with administrative work at all levels of a firm.

Production and service workers

People who actually produce the products or services of the organization.

Business functions

Specialized tasks performed in a business organization, such as manufacturing and production, sales and marketing, finance and accounting, and human resources.

Culture

Fundamental set of assumptions, values, and ways of doing things that has been accepted by most members of an organization.

Table 1.2 Major Business Functions

Function	Purpose
Sales and marketing	Selling the organization’s products and services
Manufacturing and production	Producing and delivering products and services
Finance and accounting	Managing the organization’s financial assets and maintaining the organization’s financial records
Human resources	Attracting, developing, and maintaining the organization’s labor force; maintaining employee records

frequently working with middle management. Operational management typically oversees **data workers**, such as bookkeepers or clerks, who assist with administrative work at all levels of the firm, along with **production and service workers** who actually produce the product and deliver the service.

Experts are employed and trained for different **business functions**, specialized tasks performed by business organizations, such as sales and marketing, manufacturing and production, finance and accounting, and human resources (see Table 1.2). The firm builds information systems to serve these different specialties and levels of the firm. Chapters 2 and 3 provide more detail on these business functions and organizational levels and the ways in which information systems support them.

An organization accomplishes and coordinates work through this structured hierarchy and through its business processes, which are logically related tasks and behaviors for accomplishing work. Developing a new product, fulfilling an order, and hiring a new employee are examples of business processes.

Most organizations’ business processes include formal rules that have been developed over a long time for accomplishing tasks. These rules guide employees in a variety of procedures, from writing an invoice to responding to customer complaints. Some of these business processes have been written down, but others are informal work practices, such as a requirement to return telephone calls from co-workers or customers that are not formally documented. Information systems automate many business processes. For instance, how a customer receives credit or how a customer is billed is often determined by an information system that incorporates a set of formal business processes.

Each organization has a unique **culture**, or fundamental set of assumptions, values, and ways of doing things, that has been accepted by most of its members. Parts of an organization’s culture can usually be found embedded in its information systems. For instance, customer service is a top priority for UPS (United Parcel Service), and this aspect of its organizational culture is reflected in the company’s package tracking systems. We discuss UPS’s information systems further in the Spotlight on Technology Case Study, *UPS Completes Globally with Information Technology*, later in the chapter.

Different levels and specialties in an organization create different interests and points of view. These views often conflict, which can lead to organizational politics. Information systems come out of this cauldron of differing perspectives, conflicts, compromises, and agreements that are a natural part of all organizations.

Management

Business firms require many kinds of skills and people, including managers as well as rank-and-file employees. The job of managers is to make sense of the many situations organizations face, make decisions, and formulate action plans to solve organizational problems. Managers perceive business challenges in the environment. They set the organizational strategy for responding to those challenges, and they allocate the human and financial resources to coordinate the work and achieve success. Throughout, they must exercise responsible leadership.

However, managers must do more than manage what already exists. They must also create new products and services, and even recreate the organization from time to time. A substantial part of management responsibility is creative work driven by new knowledge and information. Information systems can play a powerful role in helping managers develop novel solutions to a broad range of problems. Chapter 12 covers management decision-making in detail.

Technology

Information technology is one of many tools managers use to cope with change and complexity. Information technology includes many different components. **Computer hardware** consists of the physical equipment used for input, processing, and output activities in an information system. It includes the following: computers of various sizes and shapes (including mobile devices); various input, output, and storage devices; and networking devices that link computers.

Computer software consists of the detailed preprogrammed instructions that control and coordinate the computer hardware components in an information system. Chapter 5 describes the software and hardware platforms firms use today in greater detail.

Data management technology consists of the software governing the organization of data on physical storage media. More detail on data organization and access methods can be found in Chapter 6.

Networking and telecommunications technology, consisting of both physical devices and software, links the various pieces of hardware and transfers data from one physical location to another. Computers and communications equipment can be connected in networks for sharing voice, data, images, sound, and video. A **network** links two or more computers to share data or resources, such as a printer.

The world's largest and most widely used network is the **Internet**, a global network of networks that uses universal standards (described further in Chapter 7) to connect millions of networks in more than 230 countries and territories around the world. As of 2024, there were 4.8 billion Internet users worldwide, almost 60 percent of the global population (Emarketer, 2023c).

The Internet provides a universal technology platform on which to build new products, services, strategies, and business models. This same technology platform has internal uses, providing connectivity to link different systems and networks within the firm. An internal corporate network based on Internet technology and standards is called an **intranet**. A private intranet extended to authorized users outside the organization is called an **extranet**. Firms use extranets to coordinate their activities with other firms for making purchases, collaborating on design, and performing other interorganizational work. For most firms today, using Internet technology is a business necessity and a competitive advantage.

The **World Wide Web** (today, normally referred to as just the “web”) is an Internet service that uses universally accepted standards for storing, retrieving, formatting, and displaying information in a page format on the Internet. Web pages contain text, graphics, animations, sound, and video, and are linked to other web pages. By clicking highlighted words or buttons on a web page, you can link to related pages to find additional information and links to other locations on the web. The web now serves as the foundation for many information systems.

All of these technologies, along with the people required to run and manage them, represent resources that can be shared throughout the organization and constitute the firm's **information technology infrastructure (IT infrastructure)**. The IT infrastructure provides the foundation, or *platform*, on which the firm can build its specific information systems. Each organization must carefully design and manage its IT infrastructure so that it has the set of technology services it needs for the work it wants to accomplish with information systems. Part II of this text examines each major technology component of information technology infrastructure and shows how they all work together to create the technology platform for the organization.

The Spotlight on Technology Case Study, *UPS Competes Globally with Information Technology*, describes some of the typical technologies used in information systems today. UPS invests heavily in information systems technology to make its business more efficient and customer-oriented. It uses an array of information technologies, including barcode scanning systems, wireless networks, large mainframe computers, handheld computers, the Internet, and many pieces of software for tracking packages, calculating fees, maintaining customer accounts, and managing logistics. As you read this case, try to identify the problem this company was facing, what alternative solutions were available to management, and how well the chosen solution worked.

Computer hardware

Physical equipment used for input, processing, and output activities in an information system.

Computer software

Detailed, preprogrammed instructions that control and coordinate the work of computer hardware components in an information system.

Data management technology

Software governing the organization of data on physical storage media.

Networking and telecommunications technology

Physical devices and software that link various computer hardware components and transfer data from one physical location to another.

Network

The linking of two or more computers to share data or resources, such as a printer.

Internet

Global network of networks using universal standards to connect millions of different networks.

Intranet

An internal network based on Internet technology and standards.

Extranet

Private intranet that is accessible to authorized outsiders.

World Wide Web

A Internet service that uses universally accepted standards for storing, retrieving, formatting, and displaying information in a page format on the Internet; usually referred to as just the “web”.

Information technology infrastructure (IT infrastructure)

Computer hardware, software, data, storage technology, and networks providing a portfolio of shared IT resources for the organization.

Spotlight on Technology Case Study

UPS Competes Globally with Information Technology

United Parcel Service (UPS) started out in 1907 in a closet-sized basement office. Jim Casey and Claude Ryan—two teenagers from Seattle with two bicycles and one phone—promised the “best service and lowest rates.” UPS has used this formula successfully for more than a century to become the world’s largest ground and air package-delivery company. It’s a global enterprise with more than 500,000 employees, more than 125,000 delivery vehicles, and 557 aircraft.

Today, UPS delivers close to 25 million packages each day in more than 220 countries and territories. The firm has been able to maintain leadership in small-package delivery services despite stiff competition from FedEx, the US Postal Service, and Amazon by investing heavily in advanced information technology. UPS spends \$1 billion annually on IT to maintain a high level of customer service while keeping costs low and streamlining its overall operations.

It all starts with the scannable bar-coded label attached to a package, which contains detailed information about the sender, the destination, and when the package should arrive. Customers can download and print their own labels using special software provided by UPS or by accessing the UPS website or mobile app. Before the package is even picked up, information from the “smart” label is transmitted to one of UPS’s computer centers in Mahwah, New Jersey, or Alpharetta, Georgia, and sent to the distribution center nearest its final destination.

The first thing a UPS driver picks up each day is a handheld computer called a Delivery Information Acquisition Device (DIAD), which can access a cell phone network. As soon as drivers log on, their route is downloaded onto the DIAD. The DIAD also automatically captures customers’ signatures along with pickup and delivery information. Package tracking information is then transmitted to UPS’s computer network for storage and processing. From there, the information can be accessed worldwide to provide proof of delivery to customers or to respond to customer queries. UPS processes an average of 743.5 million tracking requests each day.

Through its automated package tracking system, UPS can monitor and even reroute packages throughout the delivery process. At various points along the route from sender to receiver, barcode devices scan shipping information on the package label and feed data about the progress of the package into the central computer. Customer service representatives are able to check the status of any package from desktop computers. UPS customers can also access this information from the



© Ground Picture/Shutterstock

company’s website using their own computers or mobile devices.

UPS created an AI application called DeliveryDefense designed to tackle the growing problem of shipment loss. The application examines characteristics such as location, loss frequency, returns volume, and delivery attempts, grouping them based on similarities. The application predicts the likelihood of a successful delivery, enabling shippers and their customers to reroute at-risk shipments to The UPS Store or a UPS Access Point. The solution can also be built into a customer’s ordering platform to improve their delivery outcomes and also helps UPS customers deter package theft. For example, DeliveryDefense helps gold and silver dealer Texas Precious Metals identify addresses that are likely targets for “porch pirates.”

An AI-powered app called Network Planning Tools (NPT) helps UPS reroute packages away from bad storms and other trouble spots in its global network. NPT also helps the company to move unusually large shipments efficiently. AI machine learning algorithms handle the massive amounts of data required to move packages around the world and on time, regardless of the weather.

UPS’s On-Road Integrated Optimization and Navigation (ORION) is an AI platform for planning and optimizing the routes taken by UPS drivers, based on advanced algorithms, AI machine learning, and deep learning (which is largely self-taught and can recognize patterns and make predictions from very large datasets). UPS vehicles are equipped with systems that capture logistical data. Dispatchers at UPS distribution centers use ORION routing software to create the most efficient delivery route for each driver, taking into account traffic, weather conditions, and the location

of each stop. In a network with 66,000 routes in the United States alone, shaving even one mile off each driver's daily route translates into big savings in time, fuel consumption, miles driven, and carbon emissions. Since ORION's initial deployment, it has saved UPS about 100 million miles and 10 million gallons of fuel per year.

SOURCES: UPS, "Company Facts," About.ups.com, accessed November 18, 2024; Anastasia Morozova, "Chatbots in Logistics and Supply Chain: How Do Companies Like UPS Benefit from Chatbots," Jasoren.com, accessed November 18, 2024; Zach Williamson, "UPS Saving Millions at the Pump, Emphasizes Importance of Planning Ahead," 3newsnow.com, July 18, 2022.

Case Study Questions

1. What are the inputs, processing, and outputs of UPS's package tracking system?
2. What technologies are used by UPS? How are these technologies related to UPS's business strategy? What role is played by AI?
3. What strategic business objectives do UPS's information systems address?
4. What would happen if UPS's information systems were not available?

Let's identify the organization, management, and technology elements in the UPS package tracking system we have just described. The organization element anchors the package tracking system in UPS's sales and production functions (the main product of UPS is a service—package delivery). It specifies the required procedures for identifying packages with both sender and recipient information, taking inventory, tracking the packages en route, and providing package status reports for UPS customers and customer service representatives.

The system must also provide information to satisfy the needs of managers and workers. UPS drivers need to be trained in both package pickup and delivery procedures, as well as how to use the package tracking system so that they can work efficiently and effectively. UPS customers may need some training to use UPS in-house package tracking software, the UPS website, or mobile apps.

UPS's management is responsible for monitoring service levels and costs, and for promoting the company's strategy of combining low cost and superior service. Management decided to use automation to increase the ease of sending a package via UPS and checking its delivery status, thereby reducing delivery costs and increasing sales revenues.

The technology supporting this system consists of handheld computers, bar code scanners, wired and wireless communications networks, desktop computers, UPS's central computer, storage technology for the package delivery data, UPS in-house package tracking software (and other software driving operations such as ORION), and software to access the web. The result is an information system solution to the business challenge of providing a high level of service with low prices in the face of mounting competition.

1.7 Understand the Importance of IoT, Big Data, Cloud Computing, and AI

Among all of these technologies, four developments are especially important today. They are the Internet of Things (IoT), big data, cloud computing, and artificial intelligence (AI). We will take a more detailed look at these in the following section.

The **Internet of Things (IoT)** describes a network of physical objects—"things"—that are embedded with sensors, software, and other technologies enabling them to connect and exchange data with other devices and systems via the Internet. These devices range from ordinary household objects to sophisticated industrial tools. The number of connected IoT devices is projected to reach nearly 22 billion by 2025 (Vailshery, 2023). Digitally linking these devices gives them enough intelligence to make simple decisions and remember particular patterns and routines to be carried out without any human involvement. IoT data is also a major source of data for systems with more sophisticated functionality such as forecasts, predictions, and optimizations.

These connected IoT devices, as well as data from websites and other sources, generate **big data**: large quantities of data (typically characterized by their volume, variety, and the velocity at which they are collected) that can provide useful information but that are often too vast and complex to capture, store, and process using traditional methods.

Internet of Things (IoT)

Network of physical objects (things) embedded with sensors, software, and other technologies enabling them to connect and exchange data with other devices and systems via the Internet.

Big data

Data sets typically characterized by the 3Vs (the extreme volume of data, the wide variety of data, and the velocity at which data must be processed) and which are beyond the ability of a typical DBMS to capture, store, and analyze.

Cloud computing

Model of computing in which processing, storage, software, and other services are provided as a shared pool of resources that can be accessed via the Internet.

Artificial intelligence (AI)

Effort to develop computer systems that are able to perform tasks normally requiring human intelligence.

Machine learning (ML)

Type of AI focused on building computer systems that can learn and improve on their own by using mathematical models (algorithms) to identify patterns and relationships in very large amounts of data.

Generative AI (GenAI)

Tools such as ChatGPT, Google's Gemini, and Microsoft Copilot that are able to identify patterns and structures within existing data to generate new and original content.

Cloud computing is a model of computing in which processing, storage, software, and other services are provided as a shared pool of resources that can be accessed via the Internet. Organizations and individuals can access these resources any time and at any place using an Internet-connected device such as a desktop, laptop, or mobile device. Cloud computing makes it possible for organizations to acquire much more analytical and processing power to expand the reach of their systems. It provides a more robust IT infrastructure than what is typically available on-site for artificial intelligence applications and the management and analysis of big data.

Artificial intelligence (AI) refers to computer systems that are able to perform tasks normally requiring human intelligence, such as speech recognition, visual perception, recognizing patterns, making predictions, writing essays, and learning from past experience.

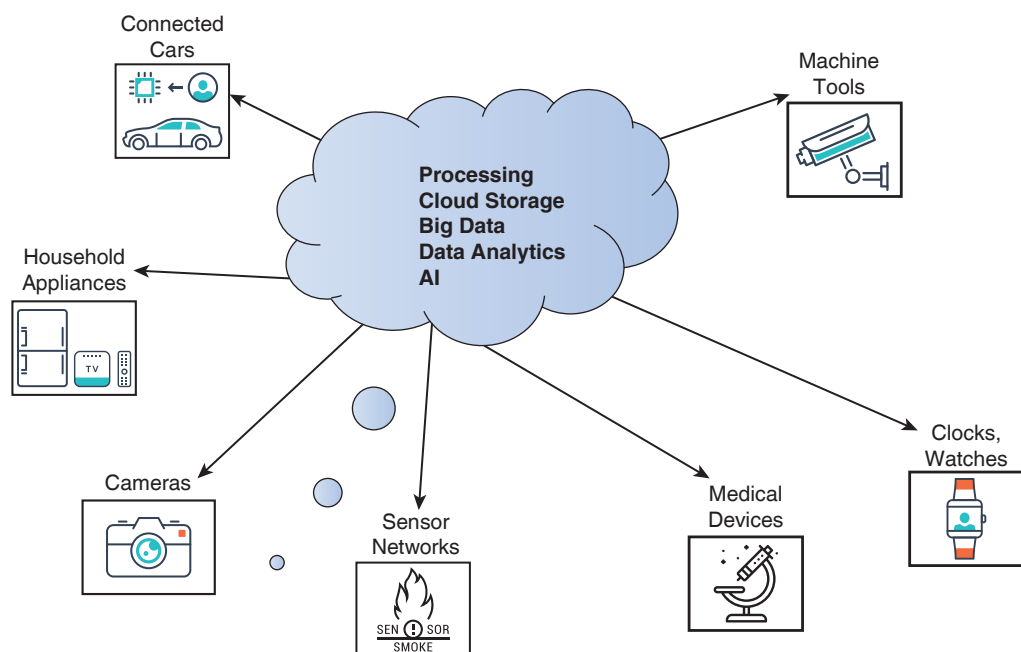
Machine learning (ML) is a type of AI that is focused on building computer systems that can learn and improve on their own. Machine learning uses mathematical models (algorithms) to identify patterns and relationships in very large amounts of data.

Although AI today cannot replicate everything humans do, it is still having a transformative impact. AI is revolutionizing everyday operations and decision-making in industries such as manufacturing, transportation, healthcare, retail, financial services, and education. Search engines, self-driving cars, industrial robots, personalized recommendation systems for products and services, fraud detection systems, and smart homes and cities are just some of the applications where AI can substitute for and even extend the power of humans. Decisions which used to take months because of manual processing and data inputs are now carried out in a few seconds with machines that measure, identify patterns, make predictions, understand and communicate in natural language, categorize requirements, and indicate risks with phenomenal speed, accuracy, and precision.

Generative AI (GenAI) tools such as ChatGPT, Google's Gemini (formerly called Bard), and Microsoft's Copilot are able to identify patterns and structures within existing data to generate new and original content, including textual responses to questions, articles, essays, fiction, and poetry, new software programs, musical compositions, and successful answers to test questions. AI has become such an important topic that we have an entire chapter devoted to AI and AI applications. We will also provide many examples of how organizations are using all of these technologies throughout the text.

Examine Figure 1.7, which illustrates the relationship between cloud computing, big data, AI, and IoT. It shows different kinds of IoT devices, including consumer appliances, sensors, medical devices, and connected cars, which generate millions and trillions of data points: big data.

Figure 1.7 Cloud Computing, Big Data, Artificial Intelligence, and the Internet of Things (IoT) Using remote cloud computing centers has made it possible to link large numbers of many different kinds of devices via the Internet so that they can exchange data. Cloud computing has also enabled organizations to create more robust IT infrastructures for managing and analyzing big data and AI applications.



The devices transmit data via the Internet to a remote cloud computing center for storage, processing, and analysis. The results might include analysis of X-ray images for signs of cancer, directions for a connected car to turn right, or predictions of when a part in a computer-controlled machine tool might fail before the event occurs. Cloud computing centers have the affordable high-performance computing power to process big data and AI applications efficiently and make big data available to AI systems.

1.8 Understand Why Complementary Assets Are Essential

Managers and business firms invest in information technology and systems because they provide real economic value to the business. The decision to build or maintain an information system assumes that the returns on this investment will be superior to other investments in buildings, machines, or other assets. These superior returns will be expressed as increases in productivity, increases in revenues (which will increase the firm's stock market value), or perhaps as superior long-term strategic positioning of the firm in certain markets (which will produce superior revenues in the future).

We can see that from a business perspective, an information system is an important instrument for creating value for the firm. Information systems enable the firm to increase its revenue or decrease its costs by providing information that helps managers make better decisions or that improves the execution of business processes. For example, the information system for analyzing supermarket checkout data illustrated in Figure 1.3 can increase firm profitability by helping managers make better decisions as to which products to stock and promote in retail supermarkets.

The business perspective calls attention to the organizational and managerial nature of information systems. An information system represents an organizational and management solution, based on information technology, to a challenge or problem posed by the environment. Every chapter in this book begins with a short case study that illustrates this concept. The Opening Case Study diagram illustrates the relationship between a business challenge and resulting management and organizational decisions to use IT as a solution to challenges generated by the business environment. You can use this diagram as a starting point for analyzing any information system or information system problem you encounter.

Review the Opening Case Study diagram. The diagram shows how ConocoPhillips tackled business challenges created by operations in remote locations and outdated equipment. The diagram also illustrates the management, organization, and technology elements that together helped ConocoPhillips create an information system solution using 3D printing and AI/ML for those challenges.

Complementary Assets: Organizational Capital and the Right Business Model

Awareness of the organizational and managerial dimensions of information systems can help us understand why some firms achieve better results from their information systems than others. Studies of returns from information technology investments show that there is considerable variation in the returns firms receive. Some firms invest a great deal and receive a great deal; others invest an equal amount and receive few returns. Still, other firms invest little and receive much, whereas others invest little and receive little. This suggests that investing in information technology does not by itself guarantee good returns. What accounts for this variation among firms?

The answer lies in the concept of complementary assets. Information technology investments alone cannot make organizations and managers more effective unless they are accompanied by supportive values, structures, and behavior patterns in the organization and other complementary assets. Business firms need to change how they do business before they can really reap the advantages of new information technologies.