Brief Contents

PART I DECISION SUPPORT AND BUSINESS INTELLIGENCE 1

CHAPTER 1 Decision Support Systems and Business Intelligence 3

PART II COMPUTERIZED DECISION SUPPORT 43

CHAPTER 2 Decision Making, Systems, Modeling, and Support 45

CHAPTER 3 Decision Support Systems Concepts, Methodologies, and Technologies: An Overview 84

CHAPTER 4 Modeling and Analysis 131

PART III BUSINESS INTELLIGENCE 185

CHAPTER S **Special Introductory Section: The Essentials of Business Intelligence** 187

CHAPTER 5 Data Warehousing 206

CHAPTER 6 Business Analytics and Data Visualization 253

CHAPTER 7 Data, Text, and Web Mining 302

CHAPTER 8 Neural Networks for Data Mining 343

CHAPTER 9 Business Performance Management 383

PART IV COLLABORATION, COMMUNICATION, GROUP SUPPORT SYSTEMS, AND KNOWLEDGE MANAGEMENT 431

CHAPTER 10 Collaborative Computer-Supported Technologies and Group Support Systems 433

CHAPTER 11 Knowledge Management 478

PART V INTELLIGENT SYSTEMS 531

CHAPTER 12 Artificial Intelligence and Expert Systems 533

CHAPTER 13 Advanced Intelligent Systems 575

CHAPTER 14 Intelligent Systems over the Internet 614

PART VI IMPLEMENTING DECISION SUPPORT SYSTEMS 663

CHAPTER 15 System Development and Acquisition 665

CHAPTER 16 Integration, Impacts, and the Future of Management Support Systems 708

ONLINE MATERIAL

CHAPTER 17 Enterprise Systems 751

CHAPTER 18 Knowledge Acquisition, Representation, and Reasoning 752

Online Tutorials

Tutorial 1: Systems

Tutorial 2: Forecasting

Tutorial 3: Text Mining Project

Tutorial 4: Statistica Software Project

CONTENTS

Preface xxiii

PART I DECISION SUPPORT AND BUSINESS INTELLIGENCE 1

CHAPTER 1 Decision Support Systems and Business Intelligence 3

1.1 Opening Vignette: Toyota Uses Business Intelligence to Excel **4**

1.2 Changing Business Environments and Computerized Decision Support **6**

1.3 Managerial Decision Making **9**

1.4 Computerized Support for Decision Making **11**

1.5 An Early Framework for Computerized Decision Support **14**

Intelligent Price Setting Using an ADS 17
Decision Support at Hallmark for Better Strategy and Performance 19

1.6 The Concept of Decision Support Systems **20**

The Houston Minerals Case 21
Helping Atlantic Electric Survive in the Deregulated Marketplace 23

1.7 A Framework for Business Intelligence **24**

Predictive Analytics Helps Collect Taxes 29

1.8 A Work System View of Decision Support **30**

1.9 The Major Tools and Techniques of Managerial Decision Support **31**

United Sugars Corporation Optimizes Production, Distribution, and Inventory Capacity with Different Decision Support Tools 33

1.10 Implementing Computer-Based Managerial Decision Support Systems **34**

1.11 Plan of the Book **35**

1.12 Resources, Links, and the Teradata University Network Connection **37**

End of Chapter Application Case *Decision Support at a Digital Hospital* 41

References 42

PART II COMPUTERIZED DECISION SUPPORT 43

CHAPTER 2 Decision Making, Systems, Modeling, and Support 45

2.1 Opening Vignette: Decision Making at the U.S. Federal Reserve **46**

2.2 Decision Making: Introductory and Definitions **47**

2.3 Models **51**

2.4 Phases of the Decision-Making Process **53**

2.5 Decision Making: The Intelligence Phase **55**

2.6 Decision Making: The Design Phase **57**

Decision Making Between a Rock and a Hard Place; or What Can You Do When There Are No Good or Even Feasible Alternatives? 60

Decision Making From the Gut: When Intuition Can Fail 64

Too Many Alternatives Spoils the Broth 66

2.7 Decision Making: The Choice Phase **68**

2.8 Decision Making: The Implementation Phase **69**

2.9 How Decisions Are Supported **70**

Union Pacific Railroad: If You're Collecting Data, Use It Profitably! 72

Advanced Technology for Museums: RFID Makes Art Come Alive 75

2.10 Resources, Links, and the Teradata University Network Connection **76**

End of Chapter Application Case *Strategic Decision Making in the Pharmaceutical Industry: How Bayer Decides Whether or Not to Develop a New Drug* 80

References 81

CHAPTER 3 Decision Support Systems Concepts, Methodologies, and Technologies: An Overview 84

3.1 Opening Vignette: Decision Support System Cures For Health Care **85**

3.2 Decision Support Systems Configurations **87**

3.3 Decision Support Systems Description **88**

Web/GIS-Based DSS Aid in Disaster Relief and Identifying Food Stamp Fraud 89

3.4 Decision Support Systems Characteristics and Capabilities **90**

3.5 Components of DSS **92**

3.6 The Data Management Subsystem **97**

Roadway Drives Legacy Applications onto the Web 98

3.7 The Model Management Subsystem **104**

Web-Based Cluster Analysis DSS Matches Up Movies and Customers 107

3.8 The User Interface (Dialog) Subsystem **109**

Clarissa: A Hands-Free Helper for Astronauts 111

3.9 The Knowledge-Based Management Subsystem **115**

IAP Systems's Intelligent DSS Determines the Success of Overseas Assignments and Learns from the Experience 116

3.10 The Decision Support Systems User **116**

3.11 Decision Support Systems Hardware **117**

3.12 Decision Support Systems Classification **118**

Database-Oriented DSS: Glaxo Wellcome Accesses Life-Saving Data 119

3.13 Resources, Links, and the Teradata University Network Connection **124**

End of Chapter Application Case *FedEx Tracks Customers Along with Packages* 127

References 129

CHAPTER 4 Modeling and Analysis 131

4.1 Opening Vignette: Winning Isn't Everything . . . But Losing Isn't Anything: Professional Sports Modeling for Decision Making **132**

4.2 Management Support Systems Modeling **135**

United Airlines Model-Based DSS Flies the Friendly Skies 137

Forecasting/Predictive Analytics Boosts Sales for Cox Communications 139

4.3 Static and Dynamic Models **142**

4.4 Certainty, Uncertainty, and Risk **143**

4.5 Management Support Systems Modeling with Spreadsheets **145**

4.6 Decision Analysis with Decision Tables and Decision Trees **147**

Johnson & Johnson Decides About New Pharmaceuticals by Using Trees 150

4.7 The Structure of Mathematical Models for Decision Support **151**

4.8 Mathematical Programming Optimization **153**

Complex Teacher Selection Is a Breeze in Flanders 154

4.9 Multiple Goals, Sensitivity Analysis, What-If Analysis, and Goal Seeking **158**

4.10 Problem-Solving Search Methods **162**

Heuristic-Based DSS Moves Milk in New Zealand 164

4.11 Simulation **165**

Pratt & Whitney Canada Gets Real Savings Through Virtual Manufacturing 165
Simulation Applications 170

4.12 Visual Interactive Simulation **171**

4.13 Quantitative Software Packages and Model Base Management **173**

4.14 Resources, Links, and the Teradata University Network Connection **174**

End of Chapter Application Case *Major League Baseball Scheduling: Computerized Mathematical Models Take Us Out to the Ballgame* 180

References 181

PART III BUSINESS INTELLIGENCE 185

CHAPTER S Special Introductory Section: The Essentials of Business Intelligence 187

S.1 A Preview of the Content of Chapters 5 through 9 **187**
S.2 The Origins and Drivers of Business Intelligence (BI) **188**
S.3 The General Process of Intelligence Creation and Use **189**
S.4 The Major Characteristics of Business Intelligence **192**
S.5 Toward Competitive Intelligence and Advantage **195**
S.6 The Typical Data Warehouse and Business Intelligence User Community **197**
S.7 Successful Business Intelligence Implementation **198**

France Telecom Business Intelligence 199

S.8 Structure and Components of Business Intelligence **201**
S.9 Conclusion: Business Intelligence Today and Tomorrow **203**
S.10 Resources, Links and the Teradata University Network Connection **203**

References 205

CHAPTER 5 Data Warehousing 206

5.1 Opening Vignette: Continental Airlines Flies High With Its Real-Time Data Warehouse **206**
5.2 Data Warehousing Definitions and Concepts **209**
5.3 Data Warehousing Process Overview **212**

Data Warehousing Supports First American Corporation's Corporate Strategy 212

5.4 Data Warehousing Architectures **214**
5.5 Data Integration and the Extraction, Transformation, and Load (ETL) Processes **222**

Bank of America's Award-Winning Integrated Data Warehouse 223

5.6 Data Warehouse Development **226**

Things Go Better with Coke's Data Warehouse 227

HP Consolidates Hundreds of Data Marts into a Single EDW 231

5.7 Real-Time Data Warehousing **238**

Egg Plc Fries the Competition in Near-Real-Time 239

5.8 Data Warehouse Administration and Security Issues **243**
5.9 Resources, Links, and the Teradata University Network Connection **244**

End of Chapter Application Case *Real-Time Data Warehousing at Overstock.com* 249

References 250

CHAPTER 6 Business Analytics and Data Visualization 253

6.1 Opening Vignette: Lexmark International Improves Operations with Business Intelligence **254**

6.2 The Business Analytics (BA) Field: An Overview **256**

Ben & Jerry's Excels with BA 257

6.3 Online Analytical Processing (OLAP) **261**

TCF Financial Corp.: Conducting OLAP, Reporting, and Data Mining 266

6.4 Reports and Queries **266**

6.5 Multidimensionality **269**

6.6 Advanced Business Analytics **273**

Predictive Analysis Can Help You Avoid Traffic Jams 274

6.7 Data Visualization **276**

Financial Data Visualization at Merrill Lynch 279

6.8 Geographic Information Systems (GIS) **280**

GIS and GPS Track Where You Are and Help You with What You Do 282

6.9 Real-time Business Intelligence Automated Decision Support (ADS), and Competitive Intelligence **284**

6.10 Business Analytics and the Web: Web Intelligence and Web Analytics **289**

Web Analytics Improves Performance for Online Merchants 291

6.11 Usage, Benefits, and Success of Business Analytics **292**

Retailers Make Steady BI Progress 294

End of Chapter Application Case *State Governments Share Geospatial Information 298*

References 299

CHAPTER 7 Data, Text, and Web Mining 302

7.1 Opening Vignette: Highmark, Inc., Employs Data Mining to Manage Insurance Costs **302**

7.2 Data Mining Concepts and Applications **304**

Data Help Foretell Customer Needs 306

Motor Vehicle Accidents and Driver Distractions 309

Data Mining to Identify Customer Behavior 310

Customizing Medicine 311

A Mine on Terrorist Funding 312

7.3 Data Mining Techniques and Tools **313**

7.4 Data Mining Project Processes **325**

DHS Data Mining Spinoffs and Advances in Law Enforcement *328*

7.5 Text Mining **329**

Flying Through Text *330*

7.6 Web Mining **333**

Caught in a Web *334*

End of Chapter Application Case *Hewlett-Packard and Text Mining* *340*

References 341

CHAPTER 8 Neural Networks for Data Mining 343

8.1 Opening Vignette: Using Neural Networks To Predict Beer Flavors with Chemical Analysis **343**

8.2 Basic Concepts of Neural Networks **346**

Neural Networks Help Reduce Telecommunications Fraud *349*

8.3 Learning in Artificial Neural Networks (ANN) **355**

Neural Networks Help Deliver Microsoft's Mail to the Intended Audience *356*

8.4 Developing Neural Network-Based Systems **362**

8.5 A Sample Neural Network Project **367**

8.6 Other Neural Network Paradigms **370**

8.7 Applications of Artificial Neural Networks **372**

Neural Networks for Breast Cancer Diagnosis *373*

8.8 A Neural Network Software Demonstration **374**

End of Chapter Application Case *Sovereign Credit Ratings Using Neural Networks* *380*

References 381

CHAPTER 9 Business Performance Management 383

9.1 Opening Vignette: Cisco and the Virtual Close **384**

9.2 Business Performance Management (BPM) Overview **386**

9.3 Strategize: Where Do We Want To Go? **388**

9.4 Plan: How Do We Get There? **390**

9.5 Monitor: How are we Doing? **392**

Discovery-Driven Planning: The Case of Euro Disney *394*

9.6 Act and Adjust: What Do We Need To Do Differently **395**

9.7 Performance Measurement **398**

International Truck and Engine Corporation *400*

9.8 Business Performance Management Methodologies **402**

9.9 Business Performance Management Architecture and Applications **409**

9.10 Performance Dashboards **417**

Dashboards for Doctors 419

9.11 Business Activity Monitoring (BAM) **421**

City of Albuquerque Goes Real-time 422

End of Chapter Application Case *Vigilant Information Systems at Western Digital 428*

References 429

PART IV COLLABORATION, COMMUNICATION, GROUP SUPPORT SYSTEMS, AND KNOWLEDGE MANAGEMENT 431

CHAPTER 10 Collaborative Computer-Supported Technologies and Group Support Systems 433

10.1 Opening Vignette: Collaborative Design at Boeing-Rocketdyne **434**

10.2 Making Decisions in Groups: Characteristics, Process, Benefits, and Dysfunctions **436**

10.3 Supporting Groupwork with Computerized Systems **439**

How General Motors is Collaborating Online 440

10.4 Tools for Indirect Support of Decision Making **443**

Videoconferencing Is Ready for Prime Time 446

10.5 Integrated Groupware Suites **448**

NetMeeting Provides a Real-Time Advantage 449

10.6 Direct Computerized Support for Decision Making: From Group Decision Support Systems (GDSS) to Group Support Systems (GSS) **452**

Eastman Chemical Boosts Creative Processes and Saves $500,000 with Groupware 456

10.7 Products and Tools for GDSS/GSS and Successful Implementation **458**

10.8 Emerging Collaboration Tools: From VoIP to Wikis **462**

10.9 Collaborative in Planning, Design, and Project Management **465**

CPFR Initiatives at Ace Hardware and Sears 468

10.10 Creativity, Idea Generation, and Computerized Support **469**

End of Chapter Application Case *Dresdner Kleinwort Wasserstein Uses Wiki for Collaboration 475*

References 476

CHAPTER 11 Knowledge Management 478

11.1 Opening Vignette: Siemens Knows What It Knows Through Knowledge Management **479**

11.2 Introduction to Knowledge Management **481**

Cingular Calls on Knowledge 485

11.3 Organizational Learning and Transformation **486**

11.4 Knowledge Management Activities **488**
11.5 Approaches to Knowledge Management **490**
Texaco Drills for Knowledge *492*
11.6 Information Technology (IT) in Knowledge Management **495**
11.7 Knowledge Management System (KMS) Implementation **500**
Portal Opens the Door to Legal Knowledge *502*
Knowledge Management: You Can Bank on It at Commerce Bank *504*
11.8 Roles of People in Knowledge Management **507**
Online Knowledge Sharing at Xerox *510*
11.9 Ensuring the Success of Knowledge Management Efforts **513**
The British Broadcasting Corporation Knowledge Management Success *514*
How the U.S. Department of Commerce Uses an Expert Location System *515*
When KMS Fail, They Can Fail in a Big Way *518*
End of Chapter Application Case *DaimlerChrysler EBOKs with Knowledge Management* *524*
References 526

PART V INTELLIGENT SYSTEMS 531

CHAPTER 12 Artificial Intelligence and Expert Systems 533
12.1 Opening Vignette: Cigna Uses Business Rules to Support Treatment Request Approval **534**
12.2 Concepts and Definitions of Artificial Intelligence **535**
Intelligent Systems Beat Chess Grand Master *535*
12.3 The Artificial Intelligence Field **537**
Automatic Speech Recognition in Call Centers *542*
Agents for Travel Planning at USC *544*
12.4 Basic Concepts of Expert Systems (ES) **545**
12.5 Applications of Expert Systems **549**
Sample Applications of Expert Systems *549*
12.6 Structure of Expert Systems **552**
12.7 How Expert Systems Work: Inference Mechanisms **555**
12.8 Problem Areas Suitable for Expert Systems **558**
12.9 Development of Expert Systems **560**
12.10 Benefits, Limitations, and Success Factors of Expert Systems **563**
12.11 Expert Systems on the Web **566**
Banner with Brains: Web-Based ES for Restaurant Selection *567*
Rule-Based System for Online Student Consulation *567*

End of Chapter Application Case *Business Rule Automation at Farm Bureau Financial Services* 572

References 573

CHAPTER 13 Advanced Intelligent Systems 575

13.1 Opening Vignette: Improving Urban Infrastructure Management in the City of Verdun **576**

13.2 Machine-Learning Techniques **577**

13.3 Case-Based Reasoning (CBR) **580**

CBR Improves Jet Engine Maintenance, Reduces Costs 585

13.4 Genetic Algorithm Fundamentals **587**

13.5 Developing Genetic Algorithm Applications **592**

Genetic Algorithms Schedule Assembly Lines at Volvo Trucks North America 593

13.6 Fuzzy Logic Fundamentals **595**

13.7 Natural Language Processing (NLP) **598**

13.8 Voice Technologies **601**

13.9 Developing Integrated Advanced Systems **605**

Hybrid ES and Fuzzy Logic System Dispatches Trains 607

End of Chapter Application Case *Barclays Uses Voice Technology to Excel* 611

References 612

CHAPTER 14 Intelligent Systems over the Internet 614

14.1 Opening Vignette: Netflix Gains High Customer Satisfaction from DVD Recommendation **615**

14.2 Web-Based Intelligent Systems **617**

14.3 Intelligent Agents: An Overview **629**

14.4 Characteristics of Intelligent Agents **622**

14.5 Why Use Intelligent Agents? **624**

14.6 Classification and Types of Intelligent Agents **626**

14.7 Internet-Based Software Agents **629**

Fujitsu(Japan) Uses Agents for Targeted Advertising 635

Wyndham Uses Intelligent Agents in Its Call Center 637

14.8 Agents and Multiagents 637

14.9 The Semantic Web: Representing Knowledge for the Intelligent Agents 641

14.10 Web-Based Recommendation Systems **647**

Amazon.com Uses Collaborative Filtering to Recommend Products 648

Content-Based Filtering at EuroVacations.com 653

14.11 Managerial Issues of Intelligent Agents **654**

End of Chapter Application Case *Spartan Uses Intelligent Systems to Find the Right Person and Reduce Turnover* 659

References 660

PART VI IMPLEMENTING DECISION SUPPORT SYSTEMS 663

CHAPTER 15 System Development and Acquisition 665

15.1 Opening Vignette: Osram Sylvania Thinks Small, Strategizes Big to Develop the HR Infonet Portal System **666**

15.2 What Types of Support Systems Should You Build? **668**

15.3 The Landscape and Framework of Management Support Systems Application Development **670**

15.4 Development Options for Management Support System Applications **673**

15.5 Prototyping: A Practical Management Support System Development Methodology **681**

15.6 Criteria for Selecting an Management Support System Development Approach **687**

15.7 Third-Party Providers of Management Support System Software Packages and Suites **689**

Floriculture Partnership Streamlines Real-Time Ordering 692

15.8 Connecting to Databases and Other Enterprise Systems **693**

15.9 The Rise of Web Services, XML, and the Service-Oriented Architecture **695**

Lincoln Financial Excels by Using Web Services 696

15.10 User-Developed Management Support System **697**

End-User Development Using Wikis 697

15.11 Management Support System Vendor and Software Selection **700**

15.12 Putting Together an Management Support System **701**

End of Chapter Application Case *A Fully Integrated MSS for Sterngold: An Old Dental Manufacturer Adopts New IT Tricks* 705

References 706

CHAPTER 16 Integration, Impacts and the Future of Management Support Systems 708

16.1 Opening Vignette: Elite Care Supported by Intelligent Systems **709**

16.2 Systems Integration: An Overview **711**

16.3 Types of Management Support System Integration **715**

16.4 Integration with Enterprise Systems and Knowledge Management **720**

16.5 The Impacts of Management Support Systems: An Overview **725**

16.6 Management Support Systems Impacts on Organizations **726**

16.7 Management Support Systems Impacts on Individuals **730**

16.8 Automating Decision Making and the Manager's Job **731**

16.9 Issues of Legality, Privacy, and Ethics **733**

16.10 Intelligent and Automated Systems and Employment Levels **737**

Robots **738**

16.11 Other Societal Impacts of Management Support Systems and the Digital Divide **739**

16.12 The Future of Management Support Systems **742**

End of Chapter Application Case *An Intelligent Logistics Support System* *747*

References 748

ONLINE MATERIAL

CHAPTER 17 Enterprise Systems 751

CHAPTER 18 Knowledge Acquisition, Representation, and Reasoning 752

Chapter 1 Online Files

W1.1 Representative Decision Support Tools
W1.2 Decision Support Technologies and the Web
W1.3 Emerging Technologies That May Benefit Decision Support
W1.4 Additional References
W1.5 Teradata University Network

Chapter 2 Online Files

W2.1: The MMS Running Case
W2.2: Web Sources for Decision-Making Support Sampler
W2.3: Further Reading

Chapter 3 Online Files

W3.1: Databases
W3.2: Major Capabilities of the UIMS
W3.3: Ad Hoc Visual Basic DSS Example
W3.4: Further Reading on DSS

Chapter 4 Online Files

W4.1: Influence Diagrams
W4.2: Links to Spreadsheet-Based DSS Excel Files in Chapter 4
W4.3: Spreadsheet-Based Economic Order Quantity Simulation Model
W4.4: Waiting Line Modeling (Queueing) in a Spreadsheet
W4.5: Linear Programming Optimization: The Blending Problem
W4.6: Lindo Example: The Product-Mix Model
W4.7: Lingo Example: The Product-Mix Model
W4.8: The Goal Programming MBI Model
W4.9: Links to Excel Files of Section 4.9
W4.10: Table of Models and Web Impacts
W4.11: Model Base Management
W4.12: Additional References

BI Preview Chapter Online Files

WS.1: The General Process of Intelligence Creation and Use as Reflected in Continental Airline Case
WS.2: BI Governance
WS.3: The BI User Community
WS.4: An Action Plan for the Information Systems Organization

Chapter 6 Online Files

W6.1 Capabilities of EIS
W6.2 SAP Analytics
W6.3 Trends in Visualization Products for Decision Support
W6.4 Virtual Realty Visualization
W6.5 Competitive Intelligence on the Internet
W6.6 Cabela's

Chapter 7 Online Files

W7.1 Data Mining

Chapter 8 Online Files

W8.1 Heartdisease.sta
W8.2 Creditrisk.xls
W8.3 Movietrain.xls
W8.4 Movietest.xls
W8.5 Statistica Coupon

Chapter 9 Online Files

W9.1 Portfolio of Options
W9.2 Rolling Forecasts and Real-Time Data
W9.3 Effective Performance Measurement
W9.4 Six Sigma Roles
W9.5 Problems with Dashboard Displays

Chapter 10 Online Files

W10.1 Seven Sins of Deadly Meetings and Seven Steps to Salvation
W10.2 Whiteboards
W10.3 Internet Voting
W10.4 GroupSystems Tools for Support of Group Processes
W10.5 Collaboration in Designing Stores

Chapter 11 Online Files

W11.1 Leveraging Knowledge through Knowledge Management Systems

Chapter 12 Online Files

W12.1 Intelligent Systems
W12.2 Internet-Based Intelligent Tutoring Systems
W12.3 Automating the Help Desk
W12.4 Assignment ES

Chapter 13 Online Files

W13.1: Steps in the CBR Process
W13.2: Automating a Help Desk with Case-Based Reasoning
W13.3: Automatic Translation of Web Pages

Chapter 15 Online Files

W15.1 Guidelines for a "Think Small, Strategize Big" Implementation
W15.2 Project Management Software
W15.3 Utility Computing
W15.4 Agile Development and Extreme Programming (XP)
W15.5 A Prototyping Approach to DSS Development
W15.6 IBM's WebSphere Commerce Suite
W15.7 XML, Web Services and Service-Oriented Architecture
W15.8 The Process of Selecting a Software Vendor and an MSS Package

Chapter 16 Online Files

W16.1 An Active and Self-Evolving Model of Intelligent DSS
W16.2 Cookies and Spyware
W16.3 A Framework for Ethical Issues
W16.4 A Hybrid Intelligent System

Online Tutorials

Tutorial 1: Systems
Tutorial 2: Forecasting
Tutorial 3: Text Mining Project
Tutorial 4: Statistica Software Project

REFERENCES 748

GLOSSARY **751**

INDEX **763**