Thirteenth Edition

OPERATIONS MANAGEMENT

Sustainability and Supply Chain Management

Jay Heizer Barry Render Chuck Munson

To Kay Heizer, always at my side

J.H.

To Horace Dawson and David Greenberg

B.R.

To Kim, Christopher, and Mark Munson for their unwavering support, and to Bentonville High School teachers Velma Reed and Cheryl Gregory, who instilled in me the importance of detail and a love of learning

C.M.

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ONLINE TUTORIALS (located at MyLab Operations Management)

Preface

New to This Edition

Operations is an exciting area of management that has a profound effect on productivity. The goal of this text and MyLab Operations Management is to present students a broad introduction to the field of operations in a realistic, practical, and applied manner. We want students to understand how operations work within an organization by seeing first-hand what goes on behind the scenes at a concert or major sports event; place an order through Amazon.com; board a flight on Alaska Airlines; or take a cruse with Celebrity Cruises. This text and MyLab Operations Management offer behind the scenes views that no other product on the market provides and one that students tell us they value because they gain a true understanding of operations.

With each edition, we work to gather feedback from instructors and students to enhance our text and MyLab. Based on that feedback, we have added the following new features and improvements.

Video Cases – Celebrity Cruise Line

With each edition, we offer in MyLab Operations Management integrated Video Cases as a valuable teaching tool for students. These short videos help readers see and understand operations in action within a variety of industries. With this edition, we are pleased to take you behind the scenes of Celebrity Cruises, one of the world's premier cruise lines. This fascinating organization opened its doors—and ships—for us to examine and share with you leading-edge OM in the cruise line industry.

The videos provide an inside look at:

- the 10 operations decisions at Celebrity Cruises (Chapter 1);
- how Celebrity Cruises designs a new product (Chapter 5);
- Celebrity's "Save-the-Waves" sustainability program (Supplement 5);
- how Celebrity Cruises treats quality as the heartbeat of the company (Chapter 6); and
- inventory management at Celebrity Cruises (Chapter 12).

Celebrity Cruises: Operations Management at Sea — Video Case

On any given day, Celebrity Cruises, Inc. has tens of thousands of passengers at sea on more than a dozen spectacular ships, spanning 7 continents and 75 countries. With this level of capital investment along with the responsibility for the happiness and safety of so many passengers, excellence in operations is required. To make it all work, the 10 operations management decisions must be executed flawlessly. From product design (which encompasses the ship's layout, the food, and 300 destinations), to scheduling, supply chain, inventory, personnel, maintenance, and the processes that hold them together, OM is critical.

Cruise lines require precise scheduling of ships, with down-to-the-minute docking and departure times. In addition to ship and port scheduling, some 2,000 plus crew members must be scheduled. And there are many schedule variations. Entertainers may arrive and leave at each port, while officers may have a schedule of 10 weeks on and 10 weeks off. Other crew members have onboard commitments varying from 4 to 9 months.

With $400 million invested in a ship and more than 5,000 lives involved in a cruise, detailed processes to ensure maintenance and reliability are vital. The modern ship is a technological marvel with hundreds of electronic monitors operating 24/7 to track everything from ship speed and location, to sea depth, to shipboard power demand and cabin temperature.

Celebrity's ship layout, destinations, and routing are adjusted to meet seasonal demands and the expectations of its premium market segment. With destinations from Alaska to Europe to Asia, crews are recruited worldwide, with as many as 70 nationalities represented. Instilling a quality culture requires an aggressive quality service orientation and, of course, meticulous cleanliness and attention to detail. Processes for food preparation, laundry, quality, and maintenance are complete and detailed.

A cruise ship, as a moving city, requires a comprehensive and precise supply chain that replenishes everything from food to fuel to soap and water. Land-based buyers support Celebrity's annual food and beverage purchases that exceed $110 million. Included in these expenditures are weekly shipments of 6 to 10 containers from the Miami headquarters destined for ships in European ports. An onboard staff organizes inventories to support this massive operation. The logistics effort includes hedging the weekly use of 24,000 gallons of fuel per ship with purchases 6 years into the future. Reliable global supply chains have been developed that deliver the required inventory on a tight time frame.

These crucial shipboard systems typically represent the best of operations management. Such is the case at Celebrity Cruises.

Discussion Questions*

1. Describe how the 10 OM decisions are implemented at Celebrity Cruises, Inc.
2. Identify how the 10 OM decisions at Celebrity Cruises differ from those decisions at a manufacturing firm.
3. Identify how the 10 OM decisions at Celebrity Cruises differ from those decisions at a retail store.
4. How are hotel operations on a ship different from those at a land-based hotel?

*You may wish to view the video that accompanies this case before addressing these questions.

In addition, we continue to offer our previous Video Cases that cover: Alaska Airlines, Orlando Magic basketball team, Frito-Lay, Darden/Red Lobster Restaurants, Hard Rock Cafe, Arnold Palmer Hospital, Wheeled Coach Ambulances, and Regal Marine.

We take the integration of our video case studies seriously, and for this reason, all of our videos are **created by the authors**, with the outstanding coauthorship of Beverly Amer at Northern Arizona University, to explicitly match text content and terminology.

46 Video Cases Listed by Chapter (new videos in bold)

- Frito-Lay: Operations Management in Manufacturing (Chapter 1)
- **Celebrity Cruises: Operations Management at Sea (Chapter 1)**
- Hard Rock Cafe: Operations Management in Services (Chapter 1)
- Strategy at Regal Marine (Chapter 2)
- Hard Rock Cafe's Global Strategy (Chapter 2)
- Outsourcing Offshore at Darden (Chapter 2)
- Project Management at Arnold Palmer Hospital (Chapter 3)
- Managing Hard Rock's Rockfest (Chapter 3)
- Forecasting Ticket Revenue for Orlando Magic Basketball Games (Chapter 4)
- Forecasting at Hard Rock Cafe (Chapter 4)
- **Celebrity Cruises Designs a New Ship (Chapter 5)**
- Product Design at Regal Marine (Chapter 5)
- Building Sustainability at the Orlando Magic's Amway Center (Supplement 5)
- **"Saving the Waves" at Celebrity Cruises (Supplement 5)**
- Green Manufacturing and Sustainability at Frito-Lay (Supplement 5)
- Quality Counts at Alaska Airlines (Chapter 6)
- The Culture of Quality at Arnold Palmer Hospital (Chapter 6)
- **Celebrity Cruises: A Premium Experience (Chapter 6)**
- Quality at the Ritz-Carlton Hotel Company (Chapter 6)
- Frito-Lay's Quality-Controlled Potato Chips (Supplement 6)
- Farm to Fork: Quality at Darden Restaurants (Supplement 6)
- Alaska Airlines: 20-Minute Baggage Process—Guaranteed! (Chapter 7)
- Process Strategy at Wheeled Coach (Chapter 7)
- Process Analysis at Arnold Palmer Hospital (Chapter 7)
- Capacity Planning at Arnold Palmer Hospital (Supplement 7)
- Locating the Next Red Lobster Restaurant (Chapter 8)
- Where to Place the Hard Rock Cafe (Chapter 8)
- Facility Layout at Wheeled Coach (Chapter 9)
- Laying Out Arnold Palmer Hospital's New Facility (Chapter 9)
- The "People" Focus: Human Resources at Alaska Airlines (Chapter 10)
- Hard Rock's Human Resource Strategy (Chapter 10)
- Darden's Global Supply Chains (Chapter 11)
- Supply Chain Management at Regal Marine (Chapter 11)
- Arnold Palmer Hospital's Supply Chain (Chapter 11)
- **Inventory Management at Celebrity Cruises (Chapter 12)**
- Managing Inventory at Frito-Lay (Chapter 12)
- Inventory Control at Wheeled Coach (Chapter 12)
- Using Revenue Management to Set Orlando Magic Ticket Prices (Chapter 13)
- When 18,500 Orlando Magic Fans Come to Dinner (Chapter 14)
- MRP at Wheeled Coach (Chapter 14)
- From the Eagles to the Magic: Converting the Amway Center (Chapter 15)
- Scheduling at Hard Rock Cafe (Chapter 15)
- Lean Operations at Alaska Airlines (Chapter 16)
- JIT at Arnold Palmer Hospital (Chapter 16)
- Maintenance Drives Profits at Frito-Lay (Chapter 17)
- Scheduling Challenges at Alaska Airlines (Module B)

Videos from Recent Graduates for Students

Located in MyLab Operations Management are brief videos of many recent grads who now work in some aspect of operations management. These 2- to 4-minute video clips feature young professionals talking about their jobs in the gamut of OM functions—each tied to a specific chapter and accompanied by multiple-choice quizzes that may be assigned. Each recent grad also talks about tips for success in the job market. This is sure to be a popular feature to engage students!

Kimberly Gersh, Project Manager, Little Green River Software

More Homework Problems—Quantity, Algorithmic, and Conceptual

We know that a vast selection of quality homework problems, ranging from easy to challenging (denoted by one to four dots), is critical for both instructors and students. Instructors need a broad selection of problems to choose from for homework, quizzes, and exams—without reusing the same set from semester to semester. We take pride in having more problems—by far, with 818—than any other OM text.

For this edition, we have added several **HUNDRED new algorithmic problems and concept questions in MyLab Operations Management!**

New Module Called "Applying Analytics to Big Data in Operations Management"

The marriage of business analytics, big data, and operations/supply chain management is a revolutionary change in our field. We are the first text to include a chapter (Module G) on this subject, which includes sections on data management, data visualization, and predictive and prescriptive business analytics tools. The topics include heat maps, conditional formatting for cleaning data, and pivot tables. The module includes numerous exercises that will use students' Excel skills and show them the power of Excel in Big Data.

Detailed Chapter-by-Chapter Changes

Chapter 1: Operations and Productivity

We introduced two new learning objectives for the chapter: "*Identify* the 10 strategic decisions of operations management" and "*Identify* career opportunities in operations management." Our first new video case study is called "Celebrity Cruises: Operations Management at Sea." We updated several entries for the Globalization Era in Figure 1.4. We updated Table 1.4 to reflect employment in various sectors. Finally, we added a new discussion question.

Chapter 2: Operations Strategy in a Global Environment

We updated Figure 2.1 on the growth of world trade and added several key historical events to the graph. We added the new key term *operational hedging*. There are two new OM in Action boxes in this chapter: "Amazon Updates Sears' Strategy" and "China Outsources Too—to Ethiopia." Finally, we updated Figure 2.5 to reflect product life cycle changes.

Chapter 3: Project Management

The Bechtel Global Profile has been rewritten and we have added four new homework problems.

Chapter 4: Forecasting

There are eight new homework problems in this chapter.

Chapter 5: Design of Goods and Services

We modified Figure 5.2 to present the cash flows more clearly. We introduced a discussion of *additive manufacturing* as a new key term to subsume 3-D printing. We added a new discussion of *augmented reality*. There are two new OM in Action boxes: "Product Design at McDonald's" and "Amazon Pushes Product Design." Our second new video case study is called "Celebrity

Cruises Designs a New Ship." We replaced the section on PCN Analysis with a new discussion on service design. We added two discussion questions and have seven new homework problems in this chapter.

Supplement 5: Sustainability in the Supply Chain

There is a new video case study called "Saving the Waves at Celebrity Cruises." We've also added new material on the circular economy and on ISO 50001. There is also a new OM in Action box called "Designing for the End of Life."

Chapter 6: Managing Quality

Our new video case study is called "Celebrity Cruises: A Premium Experience." There is also a new OM in Action box called "Inspecting the Boeing 787," new material on testing Samsung smart phones, and four new homework problems.

Supplement 6: Statistical Process Control

We have added 14 new homework problems and updated the OM in Action box called "Landing a Seat with Frequent Flyer Miles."

Chapter 7: Process Strategies

We updated Figure 7.8 to simplify the presentation of degree of customization and labor for services. We added an OM in Action box called "500,000 Tons of Steel; 14 Jobs." Finally, we updated Table 7.4 to provide more examples of technology's impact on services.

Supplement 7: Capacity and Constraint Management

We modified the numbers used to compute actual output in Table S7.1. We modified Figure S7.6 to improve the exposition for the four approaches to capacity expansion. We added 10 new homework problems for this supplement. Finally, we updated the birth rates in Table S7.4 for the Arnold Palmer Hospital case.

Chapter 8: Location Strategies

We have added seven new homework problems to this chapter.

Chapter 9: Layout Strategies

There is a new OM in Action box called "Amazon Warehouses are Full of Robots," and we have made major revisions to our coverage of Work Cells, Focused Facilities, Focused Work Centers, and Focused Factories. There are also four new homework problems.

Chapter 10: Human Resources, Job Design, and Work Measurement

We have added five new homework problems to this chapter.

Chapter 11: Supply Chain Management

We begin the chapter with a new Global Company Profile featuring Red Lobster. We've added a new section on blockchain, a new OM in Action box called "Samsung and Apple's Complex Supply Chain," and updated our treatment of SCOR. We also added three new homework problems.

Supplement 11: Supply Chain Management Analytics

There is a new discussion question and three new homework problems.

Chapter 12: Inventory Management

There is a new video case study called "Inventory Management at Celebrity Cruises." We have also revised the Amazon Global Company Profile and expanded coverage of the single period model. In addition, there are 13 new homework problems.

Chapter 13: Aggregate Planning and S&OP

We've added three new homework problems to this chapter.

Chapter 14: Material Requirements Planning (MRP) and ERP

We deleted Figure 14.6 and moved the presentation of *allocated items* into Example 3. Under *MRP Management*, we introduced a new section and key term for *demand-driven MRP*, along with a new associated Figure 14.6. A discussion of *blockchains* is introduced in the *Enterprise Resource Planning (ERP)* section. Finally, five new homework problems were added for this chapter.

Chapter 15: Short-Term Scheduling

There are six new homework problems to this chapter.

Chapter 16: Lean Operations

There is a new OM in Action box, "Dr. Pepper's Move to Kaizen," and two new homework problems.

Chapter 17: Maintenance and Reliability

There is new coverage of predictive maintenance, and there are three new homework problems.

Module A: Decision Making Tools

There is a new case study, "Tom Thompson's Liver Transplant," and seven new homework problems.

Module B: Linear Programming

We have added seven new homework problems to this module.

Module C: Transportation Models

We have added one new homework problem to this module.

Module D: Waiting-Line Models

There are five new homework problems in this module.

Module E: Learning Curves

We have revised Figure E.1, which deals with exponential and log-log learning graphs.

Module F: Simulation

There are three new homework problems in this module.

Module G: Applying Analytics to Big Data in Operations Management

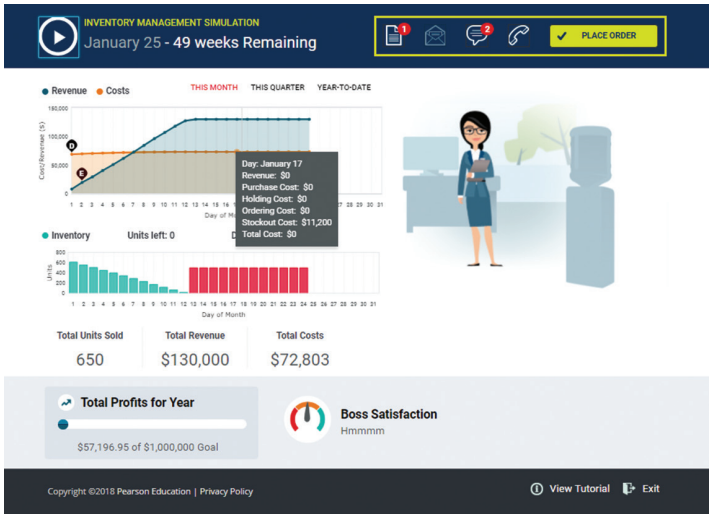
This new module includes sections on big data and business analytics, data management, data visualization, and predictive and prescriptive business analytics tools. There are 10 homework problems, two solved problems, and eight discussion questions.

Solving Teaching and Learning Challenges

Now in its 13th edition, the text and **MyLab Operations Management** provide an extremely comprehensive learning package. This robust program addresses teaching and learning challenges and affords the student with opportunities to learn and practice employable skills. Here are just a few of the key elements offered with this textbook and **MyLab Operations Management**.

MyLab Operations Management

MyLab Operations Management is the teaching and learning platform that empowers *every* student. When combined with educational content written by the authors, **MyLab Operations Management** helps deliver the learning outcomes to which students and instructors aspire.



Operations Management Simulations

Five operations management simulations give students hands-on experience in real-world roles, helping them make decisions, think critically, and link course concepts to on-the-job application.

By receiving real-time, dynamic feedback from stakeholders, students see the impact of their choices and can gauge their performance against individual, peer, and system metrics. Results of these simulations are recorded in the MyLab Gradebook.

The five simulations are:

- Project Management (Chapter 3)
- Forecasting (Chapter 4)
- Quality Management (Chapter 6)
- Supply Chain Management (Chapter 11)
- Inventory Management (Chapter 12)

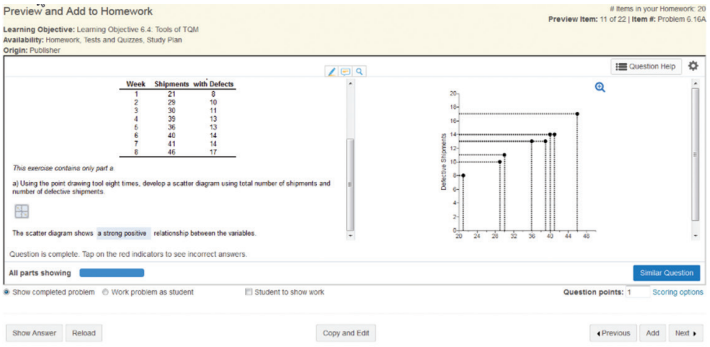
Students tell us that they enjoy learning OM through these simulations!

A Powerful Homework and Test Manager

Problems from the textbook can be assigned to students via a robust platform. This allows instructors to manage, create, and import online homework assignments, quizzes, and tests that are automatically graded. Instructors can choose from a wide range of assignment options, including time limits, proctoring, and maximum number of attempts allowed. The bottom line: **MyLab Operations Management** means more learning and less time grading.

Learning Aids

Right at the time of learning, students can access Learning Aids like Help Me Solve This, Videos from the authors of similar problems being solved, Ask My Instructor, and eText Pages. All of which provides the student feedback and assistance when they need it most.



Working with Excel Software

Excel use in the Operations Management course is becoming more important, and instructors often ask their students to develop their own Excel spreadsheet models. For this reason, we provide "Creating Your Own Excel Spreadsheets," examples toward the end of numerous chapters.

Decision Support Software

We also provide two decision support software programs, Excel OM for Windows and Mac, and POM for Windows, to help solve homework problems and case studies. More information on these packages can be found in **MyLab Operations Management** in the Download Center.

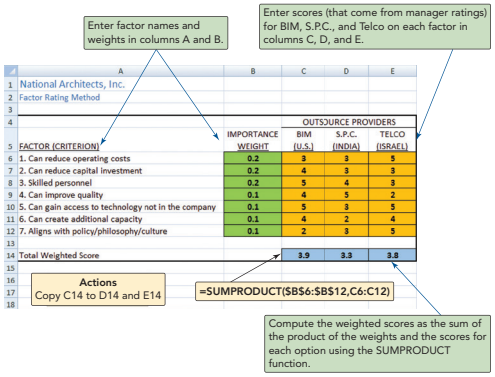
Using Software to Solve Outsourcing Problems

Excel, Excel OM, and POM for Windows may be used to solve many of the problems in this chapter.

CREATING YOUR OWN EXCEL SPREADSHEETS

Program 2.1 illustrates how to build an Excel spreadsheet for the data in Example 1. In this example the factor rating method is used to compare National Architects' three potential outsourcing providers.

This program provides the data inputs for seven important factors, including their weights (0.0–1.0) and ratings (1–5 scale where 5 is the highest rating) for each country. As we see, BIM is most highly rated, with a 3.9 score, versus 3.3 for S.P.C. and 3.8 for Telco.



Program 2.1

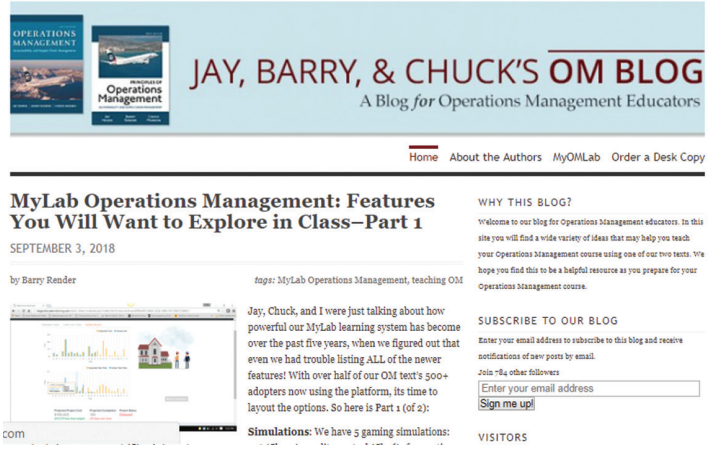
Using Excel to Develop a Factor Rating Analysis, With Data from Example 1

USING EXCEL OM

Excel OM (free with your text and also found in MyLab Operations Management) may be used to solve Example 1 (with the Factor Rating module).

USING POM FOR WINDOWS

POM for Windows also includes a factor rating module. For details, refer to Appendix II. POM for Windows is also found in MyLab Operations Management and can solve all problems labeled with a P.



Jay, Barry, & Chuck's OM Blog

As a complement to this text, we have created a companion blog, with coordinated features to help teach the OM course. There are teaching tips, highlights of OM items in the news (along with class discussion questions and links), video tips, guest posts by instructors using our text, and much more—all arranged by chapter. To learn more about any chapter topics, visit *www.heizerrenderOM.wordpress.com*. As instructors prepare their lectures and syllabus, they can scan our blog for discussion ideas, teaching tips, and classroom exercises.

ABOUT THE AUTHORS

JAY HEIZER

The Jesse H. Jones Professor Emeritus of Business Administration, Texas Lutheran University, Seguin, Texas. He received his B.B.A. and M.B.A. from the University of North Texas and his Ph.D. in Management and Statistics from Arizona State University. He was previously a member of the faculty at the University of Memphis, the University of Oklahoma, Virginia Commonwealth University, where he was department chair, and the University of Richmond. He has also held visiting positions at Boston University, George Mason University, the Czech Management Center, and the Otto-Von-Guericke University, Magdeburg.

Dr. Heizer's industrial experience is extensive. He learned the practical side of operations management as a machinist apprentice at Foringer and Company, as a production planner for Westinghouse Airbrake, and at General Dynamics, where he worked in engineering administration. In addition, he has been actively involved in consulting in the OM and MIS areas for a variety of organizations, including Philip Morris, Firestone, Dixie Container Corporation, Columbia Industries, and Tenneco. He holds the CPIM certification from APICS—the Association for Operations Management.

Professor Heizer has co-authored five books and has published more than 30 articles on a variety of management topics. His papers have appeared in the *Academy of Management Journal, Journal of Purchasing, Personnel Psychology, Production & Inventory Control Management, APICS—The Performance Advantage, Journal of Management History, IIE Solutions,* and *Engineering Management,* among others. He has taught operations management courses in undergraduate, graduate, and executive programs.

BARRY RENDER

The Charles Harwood Professor Emeritus of Operations Management, Crummer Graduate School of Business, Rollins College, Winter Park, Florida. He received his B.S. in Mathematics and Physics at Roosevelt University, and his M.S. in Operations Research and Ph.D. in Quantitative Analysis at the University of Cincinnati. He previously taught at George Washington University, University of New Orleans, Boston University, and George Mason University, where he held the Mason Foundation Professorship in Decision Sciences and was Chair of the Decision Sciences Department. Dr. Render has also worked in the aerospace industry for General Electric, McDonnell Douglas, and NASA.

Professor Render has co-authored 10 textbooks for Pearson, including *Managerial Decision Modeling with Spreadsheets, Quantitative Analysis for Management, Service Management, Introduction to Management Science,* and *Cases and Readings in Management Science. Quantitative Analysis for Management,* now in its 14th edition, is a leading text in that discipline in the United States and globally. Dr. Render's more than 100 articles on a variety of management topics have appeared in *Decision Sciences, Production and Operations Management, Interfaces, Information and Management, Journal of Management Information Systems, Socio-Economic Planning Sciences, IIE Solutions,* and *Operations Management Review,* among others. Dr. Render has been honored as an AACSB Fellow and was twice named a Senior Fulbright Scholar. He was Vice President of the Decision Science Institute Southeast Region and served as Software Review Editor for *Decision Line* for six years and as Editor of the *New York Times* Operations Management special issues for five years. For nine years, Dr. Render was President of Management Service Associates of Virginia, Inc., whose technology clients included the FBI, NASA, the U.S. Navy, Fairfax County, Virginia, and C&P Telephone. Dr. Render has received Rollins College's Welsh Award as leading Professor and was selected by Roosevelt University as the recipient of the St. Claire Drake Award for Outstanding Scholarship. Dr. Render also received the Rollins College MBA Student Award for Best Overall Course and was named Professor of the Year by full-time MBA students.

CHUCK MUNSON

Professor of Operations Management and Carson College of Business Ph.D. Program Director, Washington State University, Pullman, Washington. He received his BSBA *summa cum laude* in finance, along with his MSBA and Ph.D. in operations management, from Washington University in St. Louis. For three years, he worked as a financial analyst for Contel Telephone Corporation.

Professor Munson serves as a senior editor for *Production and Operations Management,* and he serves on the editorial review board of four other journals. He has published more than 25 articles in such journals as *Production and Operations Management, IIE Transactions, Decision Sciences, Naval Research Logistics, European Journal of Operational Research, Journal of the Operational Research Society,* and *Annals of Operations Research.* He is editor of the book *The Supply Chain Management Casebook: Comprehensive Coverage and Best Practices in SCM,* and he has co-authored the research monograph *Quantity Discounts: An Overview and Practical Guide for Buyers and Sellers*. He is also coauthor of *Managerial Decision Modeling: Business Analytics with Spreadsheets* (4th edition), published by deGruyter.

Dr. Munson has taught operations management core and elective courses at the undergraduate, MBA, and Ph.D. levels at Washington State University. He has also conducted several teaching workshops at international conferences and for Ph.D. students at Washington State University. His major awards include winning the Sahlin Faculty Excellence Award for Instruction (Washington State University's top teaching award, 2016); being a Founding Board Member of the Washington State University President's Teaching Academy (2004); winning the WSU College of Business Outstanding Teaching Award (2001 and 2015), Research Award (2004), and Service Award (2009 and 2013); and being named the WSU MBA Professor of the Year (2000 and 2008).

Instructor Teaching Resources

This teaching package comes with the following teaching resources.

Supplements available to instructors at www.pearsonhighered.com	Features of the Supplement
Instructor's Resource Manual authored by Chuck Munson	• Chapter summary • Class Discussion Ideas • Active Classroom Learning Exercises • Company Videos discussion • Cinematic Ticklers • Jay, Barry, and Chuck's OM Blog • Presentation Slides discussion • Additional Assignment Ideas • Internet Resources and Other Supplementary Materials
Instructor's Solutions Manual	The Instructor's Solutions Manual, written by the authors, contains the answers to all of the discussion questions, Ethical Dilemmas, Active Models, and cases in the text, as well as worked-out solutions to all the end-of-chapter problems, additional homework problems, and additional case studies.
Test Bank authored by Jianli Hu, Cerritos College	• More than 1,500 multiple-choice, true-or-false, and essay questions • Keyed by learning objective • Classified according to difficulty level • AACSB learning standard identified (Ethical Understanding and Reasoning; Analytical Thinking Skills; Information Technology; Diverse and Multicultural Work; Reflective Thinking; Application of Knowledge)
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 authored by Jeff Heyl, Lincoln University	An extensive set of PowerPoint presentations is available for each chapter. With well over 2,000 slides, this set has excellent color and clarity. A set of PowerPoints is also available as an ADA-compliant version that meet accessibility standards for students with disabilities. Features include: • Keyboard and screen reader access • Alternative text for images • High contrast between background and foreground colors
Excel Data Files, Excel OM, POM for Windows, and Active Models developed by Howard Weiss, Temple University	• The data files are prepared for specific examples and allow users to solve all the marked text examples without reentering any data. • POM for Windows is a powerful tool for easily solving OM problems. • Excel OM is our exclusive user-friendly Excel add-in. Excel OM automatically creates worksheets to model and solve problems. This software is great for student homework, what-if analysis, and classroom demonstrations. • Active Models are Excel-based OM simulations, designed to help students understand the quantitative methods shown in the textbook examples. Students may change the data to see how the changes affect the answers.

Acknowledgments

We thank the many individuals who were kind enough to assist us in this endeavor. The following professors provided insights that guided us in this edition (their names are in bold) and in prior editions:

ALABAMA

John Mittenthal
University of Alabama

Philip F. Musa
University of Alabama at Birmingham

William Petty
University of Alabama

Doug Turner
Auburn University

ALASKA

Paul Jordan
University of Alaska

ARIZONA

Susan K. Norman
Northern Arizona University

Scott Roberts
Northern Arizona University

Vicki L. Smith-Daniels
Arizona State University

Susan K. Williams
Northern Arizona University

CALIFORNIA

Jean-Pierre Amor
University of San Diego

Moshen Attaran
California State University–Bakersfield

Ali Behnezhad
California State University–Northridge

Joe Biggs
California Polytechnic State University

Lesley Buehler
Ohlone College

Manny Fernandez
Bakersfield College

Rick Hesse
Pepperdine

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Cerritos College

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V. Udayabhanu
San Francisco State University

Rick Wing
San Francisco State University

COLORADO

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Colorado State University–Pueblo

Gregory Stock
University of Colorado at Colorado Springs

CONNECTICUT

David Cadden
Quinnipiac University

Larry A. Flick
Norwalk Community Technical College

FLORIDA

Joseph P. Geunes
University of Florida

Rita Gibson
Embry-Riddle Aeronautical University

Donald Hammond
University of South Florida

Wende Huehn–Brown
St. Petersburg College

Andrew Johnson
University of Central Florida

Adam Munson
University of Florida

Ronald K. Satterfield
University of South Florida

Theresa A. Shotwell
Florida A&M University

Jeff Smith
Florida State University

GEORGIA

John H. Blackstone
University of Georgia

Johnny Ho
Columbus State University

John Hoft
Columbus State University

John Miller
Mercer University

Nikolay Osadchiy
Emory University

Spyros Reveliotis
Georgia Institute of Technology

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Suad Alwan
Chicago State University

Lori Cook
DePaul University

Matt Liontine
University of Illinois–Chicago

Zafar Malik
Governors State University

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Frank Pianki
Anderson University

Stan Stockton
Indiana University

Jerry Wei
University of Notre Dame

Jianghua Wu
Purdue University

Xin Zhai
Purdue University

IOWA

Debra Bishop
Drake University

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Iowa State University

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George Heinrich
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Sue Helms
Wichita State University

Hugh Leach
Washburn University

M.J. Riley
Kansas State University

Teresita S. Salinas
Washburn University

Avanti P. Sethi
Wichita State University

KENTUCKY

Wade Ferguson
Western Kentucky University

Kambiz Tabibzadeh
Eastern Kentucky University

LOUISIANA

Roy Clinton
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L. Wayne Shell (retired)
Nicholls State University

MARYLAND

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MASSACHUSETTS

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Peter Rourke
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In addition, we appreciate the wonderful people at Pearson Education who provided both help and advice: Stephanie Wall, our superb editor-in-chief; Thomas Hayward, our dynamo field marketing manager; Kaylee Carlson, our awesome product marketer; Linda Albelli, our editorial assistant; Courtney Kamauf and Mary Kate Murray for their fantastic and dedicated work on MyLab Operations Management; Melissa Feimer, our managing producer; Yasmita Hota, our content producer, and Kristin Jobe, our project manager at Integra. We are truly blessed to have such a fantastic team of experts directing, guiding, and assisting us.

In this edition, we were thrilled to be able to include one of the country's premier cruise lines, Celebrity Cruises, in our ongoing Video Case Study series. This was possible because of the wonderful efforts of President and CEO Lisa Lutoff-Perlo, and her superb management team. This included Patrik Dahlgren (Senior V.P. Global Marine Operations), Cornelius Gallagher (Associate V.P., Food and Beverage Operations), Brian Abel (V.P., Hotel Operations), and Paul Litvinov (Associate V.P., Strategic Sourcing and Supply Chain Management). We are grateful to all of these fine people, as well as the many others that participated in the development of the videos and cases during our trips to the Miami headquarters. In addition, we owe a deep gratitude to Rod McLeod, former Executive V.P., Royal Caribbean International, for introducing us to and tutoring us in the intricacies of the cruise industry.

We also appreciate the efforts of colleagues who have helped to shape the entire learning package that accompanies this text. Professor Howard Weiss (Temple University) developed the Active Models, Excel OM, and POM for Windows software; Professor Jeff Heyl (Lincoln University) created the PowerPoint presentations; Jonathan Jackson (Providence College) authored 269 new additional Concept Questions for MyLab Operations Management; and Jianli Hu (Cerritos College) updated the test bank. Beverly Amer (Northern Arizona University) produced and directed the video series; Professors Keith Willoughby (Bucknell University) and Ken Klassen (Brock University) contributed the two Excel-based simulation games; and Professor Gary LaPoint (Syracuse University) developed the Microsoft Project crashing exercise and the dice game for SPC. We have been fortunate to have been able to work with all these people.

We wish you a pleasant and productive introduction to operations management.

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