

# Applied Production and Operations Management

**JAMES R. EVANS**

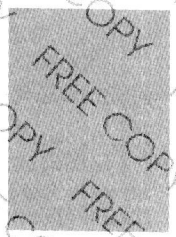
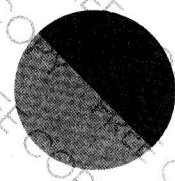
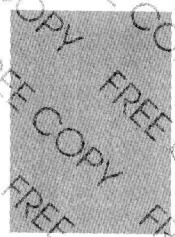
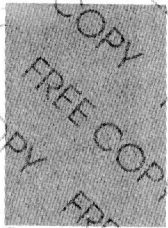
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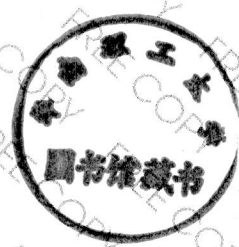


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**James R. Evans**

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FOURTH EDITION

# Applied Production and Operations Management

To Beverly, Kristin, and Lauren



# P R E F A C E

**T**he purpose of *Applied Production and Operations Management*, Fourth Edition, is to provide students of business administration with a sound understanding of the concepts, techniques, and applications of production and operations management (P/OM). As we approach the next century, our country's need for improvements in quality and productivity has never been so important. Our international competitiveness and survival in the global marketplace depend upon our ability to make these improvements. Students in all functional areas of business must acquire a body of basic knowledge and appreciations in order to apply the concepts that promote quality and productivity in their future jobs. This philosophy is the basis of this book.

*Applied Production and Operations Management* combines the managerial issues of P/OM with technical tools and quantitative applications. To accomplish this, we emphasize practical applications in actual manufacturing and service organizations throughout the book, as well as with the original end-of-chapter "P/OM in Practice" feature.

## CHANGES IN THE FOURTH EDITION

Several major changes have been made in the organization and content of this edition to reflect the many new developments and trends in P/OM. All chapters have been updated where appropriate with new explanatory material, new P/OM in Practice cases, and new real-world examples. Short "minicases" have been added to many chapters.

### Organization

The book's content is logically organized into six parts and six supplementary chapters:

**Part I: *Foundations of P/OM*.** The first three chapters provide foundation material on basic concepts and issues in P/OM, productivity and quality, and quantitative tools for analysis and decision making (a new chapter). The importance of quality is a particularly strong theme of the book and it is introduced in Part I.

**Part II: *Long-Term Planning and Decision Making*.** Chapters 4 through 7 focus on strategic planning, product design and development, capacity planning, facility location, and distribution.

**Part III: *People and Technology*.** Chapters 8 through 11 deal with the issues of technology and automation, process design and layout, reliability and maintenance (a new chapter), and human resources.

**Part IV: *Materials Management and Production Planning*.** The chapter on just-in-time production is now in this section to provide a more natural flow and development of materials-management issues. This section also includes an introduction to inventory management, quantitative decision models for inventory management, aggregate production planning, master scheduling, and material requirements planning.

**Part V: *Scheduling and Control*.** This part consists of operations scheduling, production-activity control, project planning and management, and quality control.

**Part VI: *Conclusion*.** A short concluding chapter on competitive advantage and world-class manufacturing provides an integrative summary of current trends in production and operations management.

**Supplementary Chapters.** All major discussions of quantitative methods appear in the six supplementary chapters at the back of the book. This gives the instructor flexibility in selecting and sequencing quantitative material in the course design.

In addition, tables useful in many quantitative computations, a comprehensive glossary of Key Terms, and chapter-by-chapter references are found at the end of the book.

## Content

As with the two previous editions, the coverage of quality issues and their relevance to P/OM decisions has been increased in the Fourth Edition. In addition, there is increased emphasis on the role of P/OM in international competitiveness and in service organizations. The Fourth Edition also provides greater integration of quantitative material throughout the book. This has been accomplished through the organizational change of moving the quantitative supplements to the back of the book and by including applications and illustrations of the new *The Operations Manager* software package throughout the book.

Each chapter has been updated to reflect new and current trends in P/OM. Many chapters have been revised significantly. Some of the major changes are the following:

- **Chapter 1 *Introduction to Production and Operations Management*.** New material on the importance of quality, time-based competition, and globalization has been added.
- **Chapter 2 *Productivity and Quality*.** The sections on quality have been completely revised to provide more comprehensive introduction to the subject and to focus on total quality management (TQM). New sections on quality in service organizations, the philosophies of Deming and Juran, TQM, Kaizen and the Deming Cycle, and the Malcolm Baldrige National Quality Award have been added.
- **Chapter 3 *Tools for Analysis and Decision Making*.** This new chapter provides a review of basic statistical concepts used in the quantitative applications throughout the remainder of the book, graphical tools for analysis and quality improvement (the "Seven QC Tools"), and an overview of the applications of management science in P/OM. *The Operations Manager* software package is introduced in this chapter.

- **Chapter 4 *P/OM and Strategic Planning*.** A new section on strategy and competitive advantage, with a focus on time-based competition has been added to this chapter. Discussions of the product life cycle and process technology and their strategic implications have been moved to this chapter to make its focus more cohesive.
- **Chapter 5 *Product Design and Development*.** This chapter has been revised significantly to emphasize the role of quality concerns in product design and development. Topics such as the voice of the customer, quality perceptions, reducing product-development time, design for manufacturability, concurrent engineering, quality function deployment, and design for disassembly are introduced.
- **Chapter 6 *Long-Term Capacity Planning*.** We have revised our definition of capacity to reflect current APICS (American Production and Inventory Control Society) definitions.
- **Chapter 7 *Facility Location and Distribution System Design*.** We use the transportation model for distribution planning and present practical guidelines for strategic distribution planning.
- **Chapter 8 *Process Technology and Automation*.** The process technology and automation chapters from the Third Edition have been merged and condensed to place less emphasis on the engineering aspects of these decisions. Descriptions of many new applications of automation in the service sector have been added.
- **Chapter 9 *Process Design and Facility Layout*.** We have added some new material on assembly line balancing.
- **Chapter 10 *Reliability and Maintenance*.** This new chapter consolidates material that appeared in various chapters of the Third Edition. The discussion of reliability measurement has been improved, and the discussion of the concept of total productive maintenance is new.
- **Chapter 11 *Job Design and Human Resource Management*.** The “engineering” content of this chapter has been reduced, while its emphasis on “managerial” content has been increased.
- **Chapter 12 *Materials and Inventory Management*.** The economic order quantity and economic log-size models are now introduced in this chapter to support inventory-management concepts. More importantly, these models are used to introduce and illuminate the modern views of inventory as *waste* and of the desirability of reducing work-in-process inventories and set-up times. This provides a natural introduction to just-in-time production, the subject of Chapter 13.
- **Chapter 13 *Just-In-Time Production*.** New material as JIT purchasing has been added.
- **Chapter 14 *Decision Models for Inventory Management*.** The Operations Manager Software is used to illustrate the various models.
- **Chapter 15 *Aggregate Production Planning and Master Scheduling*.** The development of alternative aggregate production plans is described more thoroughly in a “what if” framework, and *The Operations Manager* software is used to illustrate the example.
- **Chapter 16 *Material Requirements Planning*.** A new P/OM in Practice case illustrates the implementation of MRP in a Mexican factory. The case illuminates a number of international issues in P/OM.
- **Chapter 17 *Operations Scheduling*.** A new section on the theory of constraints has been added.

- **Chapter 18 *Project Planning and Management*.** Crashing, which was treated as a chapter supplement in previous editions, is now integrated into this chapter.
- **Chapter 19 *Quality Control*.** This chapter has been revised significantly to reflect the current de-emphasis on acceptance sampling as a tool for quality control and the increased focus on statistical process control. New sections on implementing statistical process control, SPC in service organizations, and nonstatistical techniques for quality control have been included.
- **Chapter 20 *Competitive Advantage and World-Class Manufacturing*.** In this summary chapter, we have added a discussion of the influence of the Malcolm Baldrige Award on quality and productivity improvement and a discussion of Motorola's achievements in quality improvement.
- **Supplementary Chapters.** New topics include decision making without probabilities, economic analysis of waiting lines, and Vogel's approximation method. The discussions of formulating linear programming models and next-event simulation have been expanded.

## Flexibility

*Applied Production and Operations Management*, Fourth Edition, provides the instructor with substantial flexibility in selecting topics to meet specific course needs. For example, instructors who wish to focus on the broad managerial issues of P/OM (particularly if their students have had prior exposure to management-science techniques) might use this one-quarter course outline:

- Introduction to P/OM (Chapter 1)
- Productivity and Quality (Chapter 2)
- P/OM and Strategic Planning (Chapter 4)
- Product Design and Development (Chapter 5)
- Long Term Capacity Planning (Chapter 6)
- Process Technology and Automation (Chapter 8)
- Human Resource Management and Job Design (Chapter 11)
- Materials and Inventory Management (Chapter 12)
- Just-in-Time Production (Chapter 13)
- Competitive Advantage and World-Class Manufacturing (Chapter 20)

On the other hand, instructors who desire more emphasis on quantitative techniques and management-science applications in P/OM might use this one-quarter course outline:

- Introduction to P/OM (Chapter 1)
- Productivity and Quality (Chapter 2)
- Tools for Analysis and Decision Making (Chapter 3)
- Selected supplementary chapters on management science
- Strategic and technology issues (selected portions of Chapters 4 through 11)
- Inventory management and models (Chapters 12–14)
- Aggregate Production Planning and Master Scheduling (Chapter 15)
- Material Requirements Planning (Chapter 16)
- Scheduling and Control (selected material from Chapters 17–19)

One-semester courses can expand in either direction, depending on the instructor's orientation and the students' knowledge and experience. It is probably not possible to cover adequately all material in the book in one semester.

## ANCILLARIES

A number of ancillaries are available to assist instructors and students:

- **For the Instructor.** An *Instructor's Manual* prepared by the author contains answers or solution suggestions to all questions, problems, and cases in the book. The Instructor's Manual has been independently checked for accuracy. A *Test Bank*, written by Michael Peters, is available on WESTEST, a microcomputer test-generated program for IBM-PCs<sup>1</sup> and compatibles and for the Apple II<sup>2</sup> family of computers. A set of approximately fifty *Transparencies* is also available.
- **For the Student.** A *Student Study Guide* prepared by John T. Gutknecht and Cindy House Randall contains review and discussion questions and other features designed to aid students in mastering the material in *Applied Production and Operations Management*, Fourth Edition.

### Computer Software

A new computer software package, *The Operations Manager* by David R. Anderson, James R. Evans, Dennis J. Sweeney, and Thomas A. Williams, is available from West Publishing Company for computer support in solving quantitative problems in P/OM as well as general problems in management science. This package includes forecasting, learning-curve calculations, decision analysis, center-of-gravity method, the transportation problem, assembly-line balancing, waiting lines, work measurement, inventory models, lot-sizing for dynamic demand, aggregate planning, linear programming, material-requirements planning, operations-scheduling models, PERT/CPM, and quality control. Output from the package is used throughout this book to illustrate computer solutions for P/OM applications.

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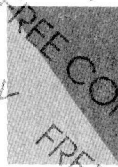
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JAMES R. EVANS



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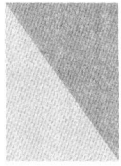
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