



KRAJEWSKI / RITZMAN

Operations Management

STRATEGY AND ANALYSIS

Second Edition

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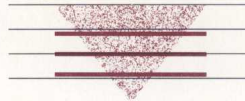
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Dedicated with love
to our families

Judie

*Gary, Jeff,
Dan, and Jon*

*Virginia and Jerry;
Virginia and Larry*

Barb

Todd and Karen

*Kathryn and Paul;
Mildred and Ray*

Cover photo: Skis awaiting the final finish (Courtesy of K2 Corporation). K2 (named for the world's second highest mountain) is the largest domestic manufacturer of skis, selling over 300,000 pairs of skis per year and employing about 400 people worldwide. The company directs its primary marketing thrust at the high end of the market, where model identification and a reputation for quality are particularly important. Toward this end, K2's marketing managers carefully monitor trends in the ski industry, and the research and development department employs product engineers who are highly trained in computer technology, as well as expert skiers.

While most ski manufacturers build skis using a laminate technology, layering various materials as in building a sandwich, K2 is one of a few who utilize a torsion-box construction. Their revolutionary triaxial braiding process (various stages are shown in the part opening photos) creates a tight fiberglass casing around a wood core, producing an extremely strong and durable ski. In an industry characterized by fierce competition, stagnant market size, and numerous technological advances, K2 is an excellent example of a firm that has used operations to gain the competitive edge.

PREFACE



The first edition of *Operations Management* reflected our firm belief that, to gain a competitive edge, organizations need a sound operations strategy. The second edition reaffirms that view. Once again, we approach the operations function as a potentially powerful tool for achieving organizational objectives and strategies. Moreover, since many students taking the introductory course will go on to become managers in service or manufacturing organizations, we have made the challenge of managing that function a focus of our text. Our goal is to help students discover the excitement to be found in the dynamic field of operations management. We want students to appreciate what operations managers do and to learn more about the tools they use to solve problems and support key decisions.

The Textbook

The second edition of *Operations Management* contains comprehensive coverage of the basic concepts and issues taught in an introductory operations management course. It also provides comprehensive coverage of the material tested on the American Production and Inventory Control Society certification exams.

Philosophy. This revision reflects our philosophy that OM texts should address both the strategic importance and the analytic tools of operations management. We have woven strategic/managerial issues into the fabric of each chapter in order to emphasize that the decisions managers make in each topical area also relate to a common operations strategy. We present the tools and

techniques for solving problems in the context of achieving a firm's overall goals and objectives. This philosophy is reflected in the organization of the text.

Organization. One of our goals was to write a textbook that offered considerable flexibility in order and depth of coverage, as well as in level (undergraduate or graduate). Thus, instructors will find that our table of contents adapts smoothly to various course syllabi. We chose a chronological organization that moves from positioning decisions to design decisions to operating decisions. However, once Chapters 1 and 2 have been covered, instructors can easily rearrange chapters to suit their individual teaching needs. Those who wish to give more emphasis to applying quantitative methods to operations can assign any of the five supplements (Linear Programming, Queuing Models, and so on) collected at the back of the book. These supplements are linked to earlier chapters through the advanced end-of-chapter problems.

Part 1, Positioning Decisions, consists of two chapters that explore how organizations use the operations function to gain a competitive edge. We discuss strategic issues related to product planning, competitive priorities, and quality management. The chapters in Part 2, Design Decisions, address the trade-offs managers make in creating an operating system that will meet their firms' needs. Issues covered include process design, choice of technology, work measurement, capacity, maintenance, location, and layout. Having determined the appropriate design for their operations, managers must make successful operating decisions. Part 3, Operating Decisions, examines the issues managers face as they coordinate day-to-day activities with an overall operations strategy. The ten chapters in this part explore topics such as forecasting, materials management, independent-demand inventory systems, production and staffing plans, master production scheduling, material requirements planning, just-in-time systems, scheduling, and quality control. Finally, Part 4, Conclusions, summarizes our broad view of operations as a competitive weapon.

Approach. To drive home the real-world implications of our philosophy, our part introductions describe the experiences of K2 Corporation, a world-class manufacturer of skis, as they relate to key concepts covered within that part. The introduction to Part 4 links the competitive weapon theme to service industries by discussing the issues faced by the management of Waterville Valley Ski Resort.

To ensure that students don't lose sight of the big picture, we emphasize the *practice* of operations management. Our general approach is to paint concepts in broad strokes, then follow up with real-world applications in manufacturing and service industries. A balanced treatment of manufacturing and services is integrated throughout the text. This procedure helps students view the field of operations management as a cohesive whole. We treat manufacturing and services separately when sufficient differences warrant it.

New Coverage. The bottom-line measure of success in the textbook business is acceptance in the marketplace. We were pleased that our first edition was well received. Thus, a challenge of creating a new edition was deciding what to retain and what to change. Naturally, there were new developments in the field to include and outdated material to cull. However, we also wanted to respond directly to our market. As a result, we asked those who use the book, both instructors and students, what improvements they wanted to see. Instructors of the course from various schools across the country offered constructive criticism and thoughtful suggestions, and students provided both written and verbal feedback. We were able to incorporate most of these recommendations into our revision.

To this edition, we added the following new material to enhance our coverage of the ever-changing field of operations management:

- *Time-based competition.* Chapter 2 contains a section addressing the competitive advantages of reducing lead times, illustrated by real company examples.
- *International operations.* Chapter 8 addresses international issues related to location decisions. In addition, examples of international operations are used throughout the text to illustrate the global economy.
- *Total quality control.* We added special sections on this important topic to Chapters 3 and 19. We also summarized the philosophies of numerous leading consultants in the area of quality management.
- *Continuous improvement.* Chapter 16 now addresses the use of just-in-time procedures to gain continuous improvements in operations.
- *Kanban signals.* We added a section to Chapter 16 that discusses the different kinds of kanban signals found in practice, even in the fast-food industry.

We expanded existing coverage in several areas:

- *Service examples.* We significantly increased examples of service operations, both within the text and in end-of-chapter problems.
- *Quantity discounts.* Chapter 12 contains an expanded discussion of the procedure for determining lot sizes when faced with a schedule of quantity discounts.
- *Just-in-time systems.* We increased our presentation of JIT systems in Chapter 16.
- *MPS and MRP.* We heavily revised the chapters on master production scheduling and material requirements planning to make the material easier for students to understand.

Teaching and Learning Aids

The second edition includes numerous features—some new to this edition—designed to motivate students and make this textbook a better teaching and

learning tool. In addition, our goal throughout has been to present concepts as clearly as possible, in simplified language. Some of the teaching and learning aids we have used include the following.


Chapter Outlines and Learning Objectives. Chapter outlines provide a quick overview of topics covered in each chapter. In addition, we have retained a very popular feature of the first edition: A series of “Key Questions for Managers” opens each chapter, preparing readers for important issues that will be discussed.

Key Terms. Key terms are boldfaced and defined where they first appear in the text; these terms are also gathered at the end of the chapter and page-referenced for easy review.

Managerial Practices. Boxed cases, prominently displayed in the text, contain real-world applications of operations management. We replaced most of the cases from the last edition with new ones and added many more in key locations.

Applications. New to the second edition are in-text applications, designed to help students understand the quantitative material. Whenever we present a new technique, we immediately apply it to a problem and walk the reader through the solution.

Solved Problems and Formula Reviews. Two other new features, solved problem and formula review sections, appear near the end of appropriate chapters. These special sections review key formulas and work through additional examples of techniques introduced in the chapter. The solved problems serve as models for students working homework problems and reinforce basic concepts.

End-of-Chapter Problems. We added 50 percent more problems to the end of each chapter and updated 80 percent of the problems from the first edition. In addition, we divided the problems according to level of difficulty to further assist instructors in preparing assignments. Fifty of the over 175 problems that students can solve using the package *Lotus® Templates for Production/Operations Management* are identified by a floppy disk logo: 

Art and Photo Programs. The art program was revised with a view to clarifying in-text concepts by using color strategically, not merely decoratively. We also significantly increased the number of photos illustrating real-world applications in both service and manufacturing operations. They are evenly dispersed throughout the text for broad coverage.

Quantitative Supplements. We divided the first edition's appendixes into five separate supplements: Financial Analysis, Linear Programming, Transportation Method, Queuing Models, and Simulation. They are grouped at the end of the text to emphasize their multiple applications and to maximize flexibility of use. The problems associated with these supplements appear at the end of the appropriate chapter in the text, emphasizing the link between technique and problem area.

Ancillary Materials

From an instructor's perspective, having a good textbook to work with is only half the battle. We are committed to creating a total package that will maximize students' learning potential and ease the instructor's burden. To this end, the following ancillary materials are available.

Instructor's Manual. The *Instructor's Manual* includes extensive lecture notes and teaching tips for each chapter. There are also short cases and assignments developed for selected chapters; an annotated bibliography of real-company "war stories"; a listing of useful videos and films and where to find them; and a cross-referencing guide that indicates which problems in the second edition can be solved using various software packages.

Solutions Manual. Solutions are organized in three sections. First, we provide short answers to all numerical problems; we have divided these answers into odd-numbered and even-numbered problems by chapter so that instructors can selectively assign some problems for study and others for grading. Second, we provide complete answers to all discussion questions and problems. Special attention is given to the art to allow easy conversion to transparency masters. Finally, there is a special section of computer solutions to the 50 problems identified by the floppy disk logo in the end-of-chapter problems.

Test Item File and Computerized Test Item File. We have compiled approximately 1200 multiple-choice questions, complete with answers that have been carefully checked for accuracy. The questions are coded according to level of difficulty and include an equal number of conceptual and technique questions. Both a printed version and a computerized version for the IBM PC® and compatibles are available free to adopters. The computerized version, consisting of a program disk and several data disks, enables instructors to custom-design their own quizzes and examinations.

Transparency Masters. Over 500 transparency masters feature key figures, photos, and selected solved problems. Over 250 of these are new visuals that

do not appear in the text. Many of the new transparency masters are lists or partial solutions designed to complement the lecture notes in the *Instructor's Manual*.

Study Guide. Prepared by Mohammad Ala of California State University in Los Angeles, the *Study Guide* contains learning objectives, an overview of each chapter's contents, illustrative cases and solved problems, and unsolved exercises.

Lotus® Templates. Richard Crandall of Appalachian State University has developed a software package, *Lotus® Templates for Production/Operations Management*, consisting of 34 templates designed with Lotus® 1-2-3®, version 2, with which students can solve over 175 end-of-chapter problems. A floppy disk logo identifies a representative sample of 50 of these problems in the text; solutions appear at the end of the *Solutions Manual*. Although specifically designed to accompany this revision, the templates are flexible enough to solve problems in other OM texts.

Computer Models for Operations Management (CMOM). CMOM is a user-friendly, stand-alone package developed by Owen P. Hall of Pepperdine University. Basic requirements include an IBM PC® with 256K memory and DOS 2.1 or above. Designed to expand undergraduate and graduate students' learning horizons beyond the problems in the text, the software offers a potpourri of analytical tools for solving many of the quantitative problems encountered in an operations management course.

Acknowledgments

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Finally, we wish to thank our families for once again putting up with our long periods of enforced solitude. As always, Judie and Barb were wonderfully supportive spouses, even though they must have known that our second elegant dinner at the Peppercorn Duck in only three years was to announce the beginning of the revision process.

Westerville, Ohio

L. J. K.

L. P. R.

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