

运营管理基础 (第4版)

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Fundamentals of Operations Management
(Fourth Edition)



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Fundamentals of Operations Management 4th edition
EISBN: 0-07-240285-7

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图书在版编目(CIP)数据

运营管理基础 = Fundamentals of Operations Management: 英文(第4版) / (美) 戴维斯(Davis, M. M.), (美) 阿奎拉诺(Aquilano, N. J.), (美) 蔡斯(Chase, R. B.) 著. —影印本. —北京: 清华大学出版社, 2004.11

(美国麦格劳—希尔教育出版公司工商管理最新教材)

ISBN 7-302-09879-4

I. 运… II. ①戴… ②阿… ③蔡… III. 企业管理—高等学校—教材—英文 IV. F270

中国版本图书馆 CIP 数据核字(2004)第 114378 号

出版者: 清华大学出版社

<http://www.tup.com.cn>

社总机: (010) 6277 0175

地 址: 北京清华大学学研大厦

邮 编: 100084

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责任编辑: 王 青

印 装 者: 清华大学印刷厂

发 行 者: 新华书店总店北京发行所

开 本: 201×252 印张: 31

版 次: 2004 年 11 月第 1 版 2004 年 11 月第 1 次印刷

书 号: ISBN 7-302-09879-4/F · 987

印 数: 1~4000

定 价: 45.00 元

本书如存在文字不清、漏印以及缺页、倒页、脱页等印装质量问题, 请与清华大学出版社出版部联系调换。联系电话: (010) 62770175-3103 或 (010) 62795704

出 版 说 明

为了适应经济全球化的发展趋势,满足国内广大读者了解、学习和借鉴国外先进经济管理理论和管理经验的需要,清华大学出版社与国外著名出版公司McGraw-Hill教育出版集团合作影印出版了一系列商科英文版教材。鉴于大部分外版教材篇幅过长,且其中部分内容与我国的教学需要不符,我们请专家学者结合国内教学的实际要求,对所选图书进行了必要的删节。我们所选择的图书,基本上是在国外深受欢迎、并被广泛采用的优秀教材的缩减版,其主教材均是该领域中较具权威性的经典之作。在选书和删节的过程中,我们得到了清华大学刘丽文老师的支持、帮助和鼓励,在此表示谢意!

由于原作者所处国家的政治、经济和文化背景等与我国不同,对书中所持观点,敬请广大读者在阅读过程中注意加以分析和鉴别。

我们对本书的第3章附录、第5章附录、第6章、第11章附录和第12章进行了删节。我们在对原版图书进行删节的同时仍采用了原书的页码,因此读者在阅读过程中可能会发现跳页的现象,而且文中提到的页码或内容有可能已被删掉从而无法找到,由此给读者带来的诸多不便,我们深表歉意。

我们期望这套影印书的出版对我国经济管理科学的发展能有所帮助,对我国商科的教学,尤其是商学本科的教学能有所促进。

欢迎广大读者给我们提出宝贵的意见和建议;同时也欢迎有关专业人士向我们推荐您所接触到的国外优秀图书。

清华大学出版社经管事业部

2004. 11

中国的学生要不要使用英文版的教材，一直有争议。有人认为，我们应该使用自己编写的教材，这样才能更准确地反映我们在课堂上所要表述的观点。用国外的原版教材，有些隔靴搔痒，不能解决中国的实际问题。持不同意见的观点认为，尽管各国在管理体制上有意识、制度、文化等差异，但管理本身是在国际环境下具有共同性的问题。特别是，中国的企业在经济全球化的环境下，需要更多地了解国外的管理理论与现状。在这种情况下，就需要引进一些外版的教材。一则，用于满足我们教学的部分需求；二则，更好地了解外版教材的教学服务体系；三则，为我们的师生创造英语教学的环境。

在进行2004年本科教指委的工作规划时，我曾特别谈及，要加强对本科教育中教书育人、服务于学生的使命的认识，继续优化专业课程设计，扩大精品课程建设，增加专业导向课程，尤其要加强对国际商科与经济管理学学科教学进展的研究，并引进最新的教学成果，包括教材及教学资源。这一切都是为了更好地为国家与社会培养更好的人才。

为此，清华大学出版社与美国麦格劳-希尔教育出版公司的合作，引进出版这套“精编版”的英文工商管理教材，也是体现这一理念。这套教材吸收国际最新教学成果，提供全方位的教学资源，并借助英语的语言媒介，将会大力提升与发展中国工商管理教学水平，提高学生使用英语语言和网络手段获得长久的终生学习的能力和兴趣，从而提高我国工商界的国际竞争力。这是一件具有重大意义的工作。

讲到美国麦格劳-希尔教育出版公司，就要提到该公司的中国首席代表姜峰先生。我同他认识已经多年了。1995年，他供职西蒙与舒斯特公司北京代表处。从那时起，他便开始来学校拜访，打破出版社坐等教师上门的惯例。他这种服务教学的理念就是直接同我们的教师见面，为教师提供教学资源，从早期的印刷版图书到磁盘、光盘，到在线资源、在线系统。这些年，姜峰先生尽管已经换到目前的公司工作，但他始终坚持着这一服务教学的理念，认真实践着他的教育出版观。

在同姜峰先生讨论引进国际上在工商管理教学的最新成果时，基本上确定了引进本套教材及教学资源的基本格调，即对“国际最新教学成果”的几个共同认识：一是国际上教学技术的进展究竟走到了哪一步，我们就引进到哪一步；二是要注意教学技术的发展给教学及教材带来的影响，我们要借鉴新的教学辅助手段。

最近几年，我在美国授课的过程中，注意到教学网络技术：CMS（课程管理系统）。通过这个教学辅助系统，教师可以将所要讲授的课程内容简单地张贴到一个系统化的

网页上,包括教学演示文件PPT、章节提要(Lecture Notes)、在线阅读资料,以及问答题、简答题还有课后大作业等,还可以很简单地开设自己课程的在线论坛BBS。学生在注册后,便成为在线学生,通过该平台与教师交互,完成习题、在线提交作业,在线考试,自动出评测分析报告。这一切是以教师为中心,完全解决了教师对于自己教学内容,以及对学生和教学过程的网络化数字化管理的问题,并可多次复用、异地复用。这个在线学习系统(BlackBoard, WebCT, eCollege)等不同于国内各高校自己研发的以学籍管理或基于录像、课件的远程教学为中心的校园管理平台,直接解决大学的核心问题,即“大师”们对课程教学内容的管理问题,成为对教师授课最好的在线数字化辅助支持平台。

2003年12月底,从姜峰先生处得知BlackBoard在中国落地,便通过他与赛尔毕博公司接触,很快决定在中国人民大学商学院引进该平台支持教学。2004年的春季学期,我商学院247位教师,所有364门课程全面上线,2000多名学生在线注册学习,引发了人大商学院一场真正意义上的“教学革命”。教师与学生实现了很好的沟通与互动,学生之间也有了很好的学习谈论的天地。目前,我商学院的经验,已经成为赛尔毕博支持国内院校教学上线发展的典范,成为BlackBoard在国内的示范教学网站。

课堂教学同网络平台结合之后,又给教学带来了新的挑战,也给教材和教材的出版商们带来了新的机遇。历史悠久的麦格劳-希勒教育出版公司积极适应这种挑战,在商科及经管教材的出版上做了战略性的调整:即将教材本身做“薄”,出版一批新型的、跨媒介的教材;将研讨性、探索性、展开式的学习内容放到网上,将动态交互性的内容放到网上;印刷版的教材从过去强调各章节内容全面,呈现教学过程、学习环节,转向注重概念性及引导性,展现学习的核心内容。同时,他们将教材配套的教学资源做得更“全”,将更多的内容上线后全面依托网络,更加动态地呈现教学内容及教学过程;并为不同的教学平台提供完全解决方案,提供跨平台的不同版本的内容“子弹”。无论采用BlackBoard还是WebCT等平台,教师们都可以从出版商处获得标准的教学资源包,为自己采用的教材轻松搭建课程网站,实现教学的在线革命。

总之,教学在革命,教学的手段也在革命。我们要看到工商管理教学在国际上的各种变化,努力跟上时代的发展变化,使我们的学生真正获得国际水准的教育。为此,我衷心地感谢这批教材的国外作者们,正是他们不懈的教学实践,给我们学科的发展带来源源的活力;同时感谢国内外的出版界人士,感谢他们对教材、教材市场的永恒追求,不断地帮助我们提升教学的水准;衷心希望这批适应新的教学需要的国际最新教材的出版能抛砖引玉,再次带动整个工商管理教育,无论是本科、高职高专教学还是MBA、EMBA教学的发展。

子曰:“学而时习之,不亦说乎。”在这场教学革命中,我们有更大的勇气面临新的教学挑战,将中国的工商管理教育推向世界一流的前列!

徐二明

教育部高校工商管理类教学指导委员会主任委员
中国人民大学商学院院长

2004年金秋于北京

**To our wives
Cookie, Nina, and Harriet**

**And to our children
Andy and Alex
Don, Kara, and Mark
Laurie, Andy, Glenn, and Rob**

About the Authors

Mark M. Davis Dr. Davis is professor of Operations Management at Bentley College in Waltham, MA. He received his BS degree in Electrical Engineering from Tufts University and his MBA and DBA degrees from Boston University's School of Management. He worked as a manufacturing engineer for the General Electric Company and is a graduate of its Manufacturing Management Program. He was also a programs manager for the U.S. Army Natick Research Laboratories.

Dr. Davis's primary research interest is service operations management with a focus on customer waiting time issues. He has published articles in this area in several journals, including *The Journal of Operations Management*, *Decision Sciences*, *The Journal of Services Marketing*, *The Journal of Business Forecasting*, *OM Review*, *The International Journal of Production and Operations Management*, and *The International Journal of Service Industry Management*.

Dr. Davis is currently secretary of the Decision Sciences Institute and is a past president of the Northeast Decision Sciences Institute. In 2000, he was named a Fellow in the Decision Sciences Institute. In 1998, Dr. Davis received Bentley College's Scholar of the Year Award. He was appointed to the 1996 Board of Examiners for the Malcolm Baldrige National Quality Award. Dr. Davis currently serves the editorial review board of *The International Journal of Service Industry Management*.

Richard B. Chase Dr. Chase is professor of Operations Management and director of the doctoral program at the Marshall School of Business, University of Southern California. He received his Ph.D. in Operations Management, as well as an MBA and BS from UCLA. He has taught at the Harvard Business School, IMD (Switzerland), and the University of Arizona. He has written and lectured extensively on the subject of service. His other books include *Service Management Effectiveness*, *Fail-Safe Service* and *Operations Management for Competitive Advantage*. Two of his *Harvard Business Review* articles, "Where Does the Customer Fit in a Service Operation?" and "The Service Factory" (with D. Garvin), have been cited as classics.

Recent articles include "Want to Perfect Your Company's Service? Use Behavioral Science" (with S. Dasu), forthcoming in the *Harvard Business Review*; "Constructing an Empirically Derived Measure for Customer Contact" (with D. Kellogg) in *Management Science*; "Beefing Up Operations in Service Firms" (with R. Hayes) and "Make Your Service Failsafe" (with D. Stewart), both in the *Sloan Management Review*; "The Mall Is My Factory: Reflections of a Service Junkie" in *Production and Operations Management*; and "The Strategic Levers of Yield Management" (with S. Kimes) in *The Journal of Service Research*.

In 1995, the *Journal of Retailing* identified him as one of the leading scholars in services marketing. His work has been quoted in Tom Peters' *Liberation Management* and Davidow and Malone's *The Virtual Organization*, and most recently in Heskett et al., *The Service Profit Chain*. He is a Fellow of the Academy of Management and the Decision Sciences Institute, and served as an examiner for the Malcolm Baldrige National Quality Award. His money-back service guarantee for his MBA course on Service Management has received international attention in the business press.

Nicholas J. Aquilano Dr. Aquilano, now in well-deserved retirement, was professor of *Management at the University of Arizona in Tucson*, where he has been writing books and teaching undergraduate and graduate-level courses in Operations Management and Project Management for over 25 years. He received his Ph.D. from UCLA and has taught at Northeastern University.

Preface

Operations management continues to be an evolving discipline. Just as the economies of the major countries of the world were once largely dependent on manufacturing for growth, operations management initially focused almost exclusively on manufacturing-related issues. In the last 20 years, however, the field of operations management has changed dramatically. The reasons are many, including: (a) the emergence of a truly global economy, (b) significant advances in technology, specifically information economy, and (c) the continued growth of services in all of the world's economies, to the point where services now represent a major portion of the economies in the more highly developed countries.

For these same reasons, the fundamentals of managing a business, in general, have also changed. No longer are the functional areas within a firm seen as being independent from each other; instead they are viewed as being interrelated. As a consequence, operations management cannot be studied in isolation from marketing and finance. Equally important, the study of operations management is no longer confined to manufacturing. Today, operations management also includes services. In addition to the growing importance of services in today's economies, manufacturers are also recognizing the need to provide their customers with high-quality service, which can provide them with a significant advantage in today's highly competitive environment.

A major goal of this edition of *Fundamentals of Operations Management* is to reflect these changes that have taken place in business. The inclusion of services has always been a hallmark of *Fundamentals of Operations Management*. This fourth edition continues to set the standard by placing even greater emphasis on services, and the need for manufacturing and services to become more fully integrated in order to better meet customer requirements. To reinforce this emphasis on services, examples from a wide variety of service organizations have been liberally included throughout the text to provide students with both a link between theory and practice, as well as a contemporary view of operations management.

Another goal of this fourth edition has been to acknowledge the significant impact of technology on the study of operations management. As we embark on the twenty-first century, technology, and especially information technology, continues to change the ways in which companies do business. And we are seeing only the tip of the iceberg. Technology will continue to advance in the form of faster and more accurate transmission lines, more powerful computers, and larger electronic data storage equipment that is capable of storing *petabytes* of data (1 petabyte = 1,125,899,906,842,624 bytes). At the same time, unit costs in all of these areas will continue to decrease.

In addition, barriers to trade across national borders continue to be lowered with the creation of regional free trade zones such as the European Union, the North American Free Trade Agreement (NAFTA), and Mercosur (a free trade agreement among several South American countries).

The combination of advances in technology and lower trade barriers has facilitated the world's economies to continue their trend toward a single *global village* or *global landscape*. Both customers and suppliers now exist in every corner of the world, with no company being immune to international competition. In such a hypercompetitive environment, it is imperative that managers continue to develop innovative applications for these new technologies as they become available. This ever-changing environment has a significant impact on the operations management function in terms of how goods and services are produced and delivered.

To address these changes, as well as to link theory with practice, this fourth edition provides

- New coverage and emphasis on several topics in operations management that are currently high-priority issues with both business and operations managers. Two new chapters are devoted to this coverage: new product and service development (Chapter 3) and the role of technology in operations management (Chapter 4).
- A pedagogical feature, entitled “Managerial Issues,” begins the text in each chapter to provide students with not only a managerial framework for the topic, but also an understanding of how the topic contributes to the success of the organization.
- The continued development of relevant concepts in operations management that are now recognized as critical success factors in business. These include yield management (Chapters 15 and 16), which focuses on maximizing capacity utilization and profits in service operations, and supply chain management (Chapter 13), which addresses both the changing role of the supplier and the fact that supply chains are becoming longer as firms now look to the four corners of the world for suppliers.
- Recognition that the operations function in every organization involves individuals and that their role is changing as are the organizations themselves. As part of these changes, there is an increasing emphasis on teamwork (Chapters S3 and 10).
- Demonstration of how operations management needs to be fully integrated with the other functional areas within an organization, and that many of the operations management tools are being applied in these other functional areas, such as marketing, engineering, and finance. For example, business process analysis can show engineering managers how to accelerate the development and introduction of new products (Chapters 3 and 4), and just-in-time (JIT) concepts (Chapter 14) are used to market mass-customized products that can be delivered to customers with minimal delays. These tools and techniques from operations management are also now used in a wide variety of new applications that go far beyond the walls of the traditional factory. As an illustration, quality management tools (Chapter S6) such as statistical process control (SPC) are now used to predict impending medical problems for patients with asthma or congestive heart failure.

We tried to do this in a brief and interesting way, focusing on core concepts and utilizing quantitative techniques only where necessary while making the mathematics intuitive and less formal.

Specific Objectives of This Book

Most students do not major in operations management. In fact, many schools and colleges do not even offer a major in operations management. Nevertheless, it is important for you to understand how the operations management function contributes to the overall success of an organization. The reasons are twofold. First, understanding how the different elements within the OM function fit into the overall organizational structure will provide you with a broader perspective that, in turn, will allow you to do your own job better. In addition, as we stated above, the concepts developed initially within the OM function have application in all of the other functional areas within an organization. Understanding and applying these tools and concepts can improve your ability to be both effective and efficient in the way you do your work.

Many students don't appreciate the importance of operations management until after they graduate and begin work. For example, consider the "hot" employment area of information technology (IT). Specialists in IT really should have a working knowledge of the best practices in process management, forecasting, quality control, and project planning to correctly apply many of the software tools that they will encounter on the job.

For these reasons, the specific objectives of this book are to

1. Introduce the various elements that comprise the field of operations management, and some of the new and evolving concepts within OM.
2. Identify some of the OM tools and concepts that can be applied to a wide variety of situations, including non-OM-related areas.
3. Develop an appreciation of the need for interaction between operations management and the other management functions within an organization.
4. Explain the role of technology in operations management and its impact on the different OM elements.
5. Describe the growing trend toward globalization among firms and how it affects operations management.
6. Demonstrate that manufacturing and services are becoming more integrated within companies.
7. Provide an integrated framework for understanding the field of OM as a whole and its role in an organization.



With respect to the last objective, our goal is to demonstrate that operations management is not just a loosely knit aggregation of tools but rather a *synthesis* of concepts and techniques that relate directly to operating systems and enhance their management. This point is important because OM is frequently confused with operations research (OR), management science (MS), and industrial engineering (IE). The critical difference between OM and these fields is this: OM is a field of management, whereas OR and MS are branches of applied mathematics and IE is an engineering discipline. Thus, while operations managers use the tools of OR and MS in decision making, and are concerned with many of the same issues as IE, OM has a distinct business management role that differentiates it from OR, MS, and IE.

Special Features of the Book

In an attempt to facilitate the learning process, we have incorporated several pedagogical features, including

- *Chapter objectives.* At the beginning of each chapter, a list of objectives is presented to highlight the important concepts on which the chapter focuses.
- *Vignettes.* Each chapter begins with a short vignette that shows how the chapter topic is actually applied in a real-world setting, to create student interest for the chapter material.
- *Application of OM concepts.* Examples of how many of the OM concepts presented in this text are applied in actual business situations are provided throughout the text. The use of real-world examples reinforces the critical role of operations management, showing how it contributes to the overall success of an organization. These applications take several forms, including the opening vignette to each chapter and Operations Management in Practice boxes, as well as in the numerous examples that are included throughout the text itself.

- *Internet exercises.* The Internet continues to be a powerful tool for obtaining and disseminating information, and this information is constantly changing. Where appropriate, an Internet exercise is provided at the end of a chapter to encourage students to obtain the latest information on a particular topic.
- *The application of Excel® spreadsheets.* Again, where appropriate, examples are provided using Excel® spreadsheets that encourage the student to explore alternative solutions.
- *Highlighting links with other functional areas.* Ideas and processes flow seamlessly across traditional functional boundaries in successful organizations, often to the point where it is practically impossible to determine where one function leaves off and another begins. To emphasize this integration within organizations, icons are used throughout the text to highlight examples of how OM is linked to other functional areas.
- *Global perspective.* Another feature of the book is its emphasis on the global impact of operations today; where appropriate, we show how the concepts apply in a global context. Special icons are used in the book to highlight this area.
- *Margin definitions.* Key terms are in boldface when first defined and definitions added in the margin. At the end of the chapter these key terms are listed with page numbers for quick student reference.
- *Full-color art.* This fourth edition includes photos and exhibits to enhance the visual appeal and interest of students, to clarify and extend the text discussions, and to help students see operations in action.
- *Examples with solutions.* Examples follow quantitative topics and demonstrate specific procedures and techniques. These are clearly set off from the text and help students understand the computations.
- *Formula review.* Key formulas and equations are numbered within each of the more quantitative chapters and are repeated in summary form at the end of those chapters for easy student review.
- *Solved problems.* Representative example problems are included at the end of appropriate chapters. Each includes a detailed, worked-out solution and provides another level of support for students before they try homework problems on their own.
- *Review and discussion questions.* These questions allow students to review the chapter concepts before attempting the problems and provide a basis for classroom discussion. Suggested responses are included in the Instructor's Manual.
- *Problems.* A wide range of problem material follows each chapter, asking students to solve realistic, interesting problems.
- *Cases.* Located at the end of most chapters, short cases allow students to think critically about issues discussed in the chapter. These also can provide good classroom discussions or provide a capstone problem for the chapter. We've included both long and short cases such as Kristen's Cookie Company from Harvard.



Ancillary Materials

- *Student CD-ROM,* packaged with each copy of the text, contains chapter quizzes, Excel® spreadsheets, PowerPoint® slides, and short video clips illustrating key operations topics.

- *Instructor's Resource CD-ROM* is an all-in-one resource offered to adopters of the text. It contains the Instructor's Manual, Test Bank, and PowerPoint slides (described below), as well as video clips, all text exhibits, and Excel templates.
- *Instructor's Manual*, prepared by Ross Fink of Bradley University, includes answers to discussion and review questions and solutions to text problems. There is a useful reference grid showing which problems correspond to specific topics in the chapters for ease in assignment.
- *Test Bank*, prepared by Daniel Tracy of University of Tennessee at Martin, provides true/false, multiple/choice, and narrative problems for each chapter. Along with the manual, a separate computerized testing package is available allowing instructors to generate, add, and edit questions; save and reload tests; and select questions based on type or level of difficulty.
- *PowerPoint Presentation Slides*, prepared by Charlie Cook of University of West Alabama, provides lecture outlines plus graphic material from the text to complement and customize lectures.
- **Videos. The Irwin Operations Management Video Series** consists of 29 segments on eight volumes covering quality, inventory, lean production, computer-integrated manufacturing, production processes and services, and global supply chains. They show students chapter concepts at work and how critical operations management is to organizations such as Motorola, Toyota, Hewlett-Packard, United Airlines, and others.
- *Operations Management Center Website* (<http://www.mhhe.com/pom/>). This site supports students and faculty in search of resources related to all aspects of operations management. There are sites with company tours, organizations, on-line publications, resources by topic, and textbook support.

We also have tried to practice what we preach. In applying the quality concept of continuous improvement, we have attempted to incorporate many of the suggestions made by our reviewers.

There is an old Chinese proverb that states, "May you live in interesting times." Like it or not, from an operations management perspective, those "times" are now and we should take full advantage of the opportunity—and enjoy it while doing so!

Acknowledgments

Although only three names appear on the cover of this book, a project of this magnitude could not be successfully completed without the assistance and cooperation of many individuals. Specifically, we would like to thank the reviewers for their evaluation of the second edition text and for their manuscript reviews. We thank them for their suggestions and comments. They include

Sal Agnihothri, State University of New York

Gary Alcorn, University of Pittsburgh

Kwasi Amoako-Gyampah, University of North Carolina–Greensboro

Fred P. Anderson, Indiana University of Pennsylvania

Bonnie F. Daily, New Mexico State University

Harry Ekholm, Texas Christian University

Michael R. Godfrey, University of Wisconsin–Oshkosh

Robert D. Klassen, University of Western Ontario
Ajay K. Mishra, State University of New York
Philip Musa, University of Alabama
Leonard Presby, William Paterson University
Robert M. Saltzman, San Francisco State University
Stephen Starling, California State University–Hayward
Constantin A. Vaitsos, University of Southern California
Samuel Wathen, Coastal Carolina University
Joel Wisner, University of Nevada

Several chapters were either written or rewritten with the assistance of colleagues. Specifically we would like to acknowledge the following individuals for their contributions to this fourth edition:

Richard Franza, *Bentley College* (Chapter 3 on New Product and Service Development and Process Selection)

James Salsbury, *Bentley College* (Chapter 13 on Supply Chain Management)

We once again thank those individuals whose contributions to past editions have helped the book evolve to its present form: Timothy Bergquist, *University of Oregon*; Dave Carhart, *Bentley College*; Gayla DeLong, *Northwestern Oklahoma State University*; Lissa Galbraith, *Florida State University*; John Haehl, *Lewis-Clark State College*; Janelle Heineke, *Boston University*; Marilyn Jones, *Winthrop College*; Birsan Karpak, *Youngstown State University*; Dennis Krumwiede, *Kansas State University*; Vicki LaFarge, *Bentley College*; Rich Luebbe, *Miami University (Ohio)*; Mary Jo Maffei, *Miami University (Ohio)*; Robert Mefford, *University of San Francisco*; Rao Tatikonda, *University of Wisconsin–Oshkosh*; and Hans Thamhain, *Bentley College*.

Special thanks to Constantin A. Vaitsos who solved all of the examples and problems and checked our answers for accuracy. Ross Fink of Bradley University prepared the Instructor's Manual, Charlie Cook of University of West Alabama prepared the PowerPoint slides, and Daniel Tracy of University of Tennessee at Martin prepared the Test Bank. These supplements take a great deal of time and effort to write and we appreciate their efforts.

Finally, we wish to thank the staff at Irwin/McGraw-Hill for their support, encouragement, and assistance: Scott Isenberg, Executive Editor; Wanda Zeman, Senior Developmental Editor; Zina Craft, Senior Marketing Manager; Christine Vaughan, Senior Project Manager; Gina Hangos, Production Supervisor; and Pam Verros, Designer.

Mark M. Davis
Nicholas J. Aquilano
Richard B. Chase

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