

清华MBA核心课程英文版教材

Operations
Management
Sixth Edition

运作管理

(第6版)

Jay Heizer
Barry Render

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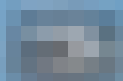
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(第六版)

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【Sixth Edition】

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Texas Lutheran University

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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的管理经验和掌握经济理论的前沿动态,清华大学出版社与国外著名出版公司合作影印出版一系列英文版经济管理方面的图书。我们所选择的图书,基本上是已再版多次、在国外深受欢迎、并被广泛采用的优秀教材,绝大部分是该领域中较具权威性的经典之作。在选书的过程中,我们得到了很多专家、学者的支持、帮助和鼓励,在此表示谢意!清华MBA核心课程英文版教材由清华大学经济管理学院毛波、刘丽文、朱武祥、朱岩、李东红、李明志、吴志明、钱小军、瞿卫菁等老师审阅,在此一并致谢!

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。

我们期望这套影印书的出版对我国经济科学的发展能有所帮助,对我国经济管理专业的教学能有所促进。

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

清华大学出版社第三编辑室

2001.8

世纪之交,中国与世界的发展呈现最显著的两大趋势——以网络为代表的信息技术的突飞猛进,以及经济全球化的激烈挑战。无论是无远弗界的因特网,还是日益密切的政治、经济、文化等方面的国际合作,都标示着21世纪的中国是一个更加开放的中国,也面临着一个更加开放的世界。

教育,特别是管理教育总是扮演着学习与合作的先行者的角色。改革开放以来,尤其是20世纪90年代之后,为了探寻中国国情与国际上一切优秀的管理教育思想、方法和手段的完美结合,为了更好地培养高层次的“面向国际市场竞争、具备国际经营头脑”的管理者,我国的教育机构与美国、欧洲、澳洲以及亚洲一些国家和地区的大量的著名管理学院和顶尖跨国企业建立了长期密切的合作关系。以清华大学经济管理学院为例,2000年,学院顾问委员会成立,并于10月举行了第一次会议,2001年4月又举行了第二次会议。这个顾问委员会包括了世界上最大的一些跨国公司和中国几家顶尖企业的最高领导人,其阵容之大、层次之高,超过了世界上任何一所商学院。在这样高层次、多样化、重实效的管理教育国际合作中,教师和学生与国外的交流机会大幅度增加,越来越深刻地融入到全球性的教育、文化和思想观念的时代变革中,我们的管理教育工作者和经济管理学习者,更加真切地体验到这个世界正发生着深刻的变化,也更主动地探寻和把握着世界经济发展和跨国企业运作的脉搏。

我国管理教育的发展,闭关锁国、闭门造车是绝对不行的,必须同国际接轨,按照国际一流的水准来要求自己。正如朱镕基总理在清华大学经济管理学院成立十周年时所发的贺信中指出的那样:“建设有中国特色的社会主义,需要一大批掌握市场经济的一般规律,熟悉其运行规则,而又了解中国企业实情的经济管理人才。清华大学经济管理学院就要敢于借鉴、引进世界上一切优秀的经济管理学院的教学内容、方法和手段,结合中国的国情,办成世界第一流的经管学院。”作为达到世界一流的一个重要基础,朱镕基总理多次建议清华的MBA教育要加强英语教学。我体会,这不仅因为英语是当今世界交往中重要的语言工具,是连接中国与世界的重要桥梁和媒介,而且更是中国经济管理人才参与国际竞争,加强国际合作,实现中国企业的国际战略的基石。推动和实行英文教学并不是目的,真正的目的在于培养学生——这些未来的企业家——能够具备同国际竞争对手、合作伙伴沟通 and 对抗的能力。按照这一要求,清华大学经济管理学院正在不断推动英语教学的步伐,使得英语不仅是一门需要学习的核心

课程，而且渗透到各门专业课程的学习当中。

课堂讲授之外，课前课后的大量英文原版著作、案例的阅读对于提高学生的英文水平也是非常关键的。这不仅是积累相当的专业词汇的重要手段，而且是对学习者思维方式的有效训练。

我们知道，就阅读而言，学习和借鉴国外先进的管理经验和掌握经济理论动态，或是阅读翻译作品，或是阅读原著。前者属于间接阅读，后者属于直接阅读。直接阅读取决于读者的外文阅读能力，有较高外语水平的读者当然喜欢直接阅读原著，这样不仅可以避免因译者的疏忽或水平所限而造成的纰漏，同时也可以尽享原作者思想的真实表达。而对于那些有一定外语基础，但又不能完全独立阅读国外原著的读者来说，外文的阅读能力是需要加强培养和训练的，尤其是专业外语的阅读能力更是如此。如果一个人永远不接触专业外版图书，他在获得国外学术信息方面就永远会比别人差半年甚至一年的时间，他就会在无形中减弱自己的竞争能力。因此，我们认为，有一定外语基础的读者，都应该尝试一下阅读外文原版，只要努力并坚持，就一定能过了这道关，到那时就能体验到直接阅读的妙处了。

在掌握大量术语的同时，我们更看重读者在阅读英文原版著作时对于西方管理者或研究者的思维方式的学习和体会。我认为，原汁原味的世界级大师富有特色的表达方式背后，反映了思维习惯，反映了思想精髓，反映了文化特征，也反映了战略偏好。知己知彼，对于跨文化的

To our families:

Kay, Donna, Kira, and Janée

Donna, Charlie, and Jesse

ABOUT THE AUTHORS



Jay Heizer holds the Jesse H. Jones Chair of Business Administration at Texas Lutheran University in 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 (1969). He was previously a member of the faculty at Memphis State University, the University of Oklahoma, Virginia Commonwealth University, and the University of Richmond. He has also held visiting positions at Boston University, George Mason University, and the Czech Management Center.

Dr. Heizer's industrial experience is extensive. He learned the practical side of operations management as a machinist apprentice at Foringer and Company, production planner for Westinghouse Airbrake, and at General Dynamics, where he worked in engineering administration. Additionally, 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 the American Production and Inventory Control Society.

Professor Heizer has co-authored five books and has published over thirty 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*, and *Engineering Management*, among others. He has taught operations management courses in undergraduate, graduate, and executive programs.

Barry Render is the Charles Harwood Distinguished Professor of Operations Management at the Crummer Graduate School of Business at Rollins College, in Winter Park, Florida. He received his M.S. in Operations Research and his Ph.D. in Quantitative Analysis at the University of Cincinnati (1975). He previously taught at George Washington University, University of New Orleans, Boston University, and George Mason University, where he held the GM Foundation Professorship in Decision Sciences and was Chair of the Decision Science Department. Dr. Render has also worked in the aerospace industry for General Electric, McDonnell Douglas, and NASA.

Professor Render has co-authored nine textbooks with Prentice-Hall, including *Quantitative Analysis for Management*, *Service Operations Management*, *Introduction to Management Science*, and *Cases and Readings in Management Science*. His more than one hundred 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*, and *Operations Management Review*, among others.

Dr. Render has also been honored as an AACSB Fellow and named as a Senior Fullbright Scholar in 1982 and again in 1993. He was twice vice-president of the Decision Science Institute Southeast Region and served as Software Review Editor for *Decision Line* from 1989 to 1995. He has also served as Editor of the *New York Times* Operations Management special issues since 1996. Finally, Professor Render has been actively involved in consulting for government agencies and for many corporations, including NASA, FBI, U.S. Navy, Fairfax County, Virginia, and C&P Telephone.

He teaches operations management courses in Rollins College's MBA and Executive MBA programs. In 1995 he was named as that school's Professor of the Year, and in 1996 was selected by Roosevelt University to receive the St. Claire Drake Award for Outstanding Scholarship.



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Foreword

FOREWORD TO THE SIXTH EDITION OF OPERATIONS MANAGEMENT

When I first entered a production operation in 1952 the world of business was divided into two parts, like the Red Sea had been. One part made big things out of little things; the other part purchased the little things, found the customers, took care of the money, sold stuff, and complained about the activities of the first part. The two portions of the company had nothing in common and little interest in each other.

Over the years it was discovered that there are no separate parts of an organization. It is a body that requires all components to function together as a unit if a successful life is to be obtained.

However everyone knew that the world was made up of separate parts. Markets were described as domestic and international. The latter was not part of the organization and often had a great deal of difficulty obtaining information about plans, products, and people. Now we have learned that we have suppliers and customers who do not speak our language or observe our holidays.

Functional operations used to be responsible for whatever noun was in their title. Manufacturing manufactured, purchasing purchased, personnel personneled, and quality was done by the quality department. When I was a quality manager top management held me personally responsible if a customer received something that was not proper. Everyone else were "bad guys" trying to get stuff by quality, and we were the "good guys." When enough things went wrong the practice was to find a tougher, smarter cop. There was no thought of getting things done right.

When I began preaching the prevention of problems, called quality management, it took a while for people to catch on. The breakthrough came with the determination of the "price of nonconformance." How much did it cost to do things wrong, and then fix them. Most companies came to the realization that it took 25% and more of their revenues to live that way. That was the beginning of the quality revolution.

When I talk to Professor Render's classes each year I am always impressed that the students are learning to look at the world from a platform that did not exist in my early career. The broad scope of this book assures that this will happen. It provides a place to begin the future by reviewing the past. The students always want to know about the "reality" of quality management, which is the general subject of my chat. I tell them that basic concepts are the important part of business management, that there are no "systems" to do the executive's work. Concepts come from understanding, understanding begins with learning, and learning comes from examining credible resources with an open mind.

I know you will enjoy yourself in this course.

PHILIP CROSBY
Winter Park, Fl.



Preface

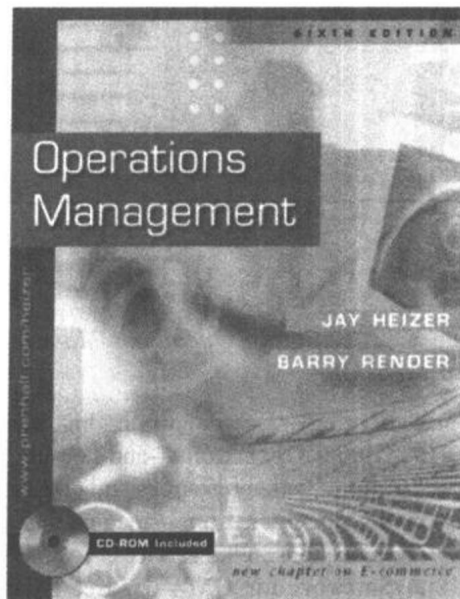
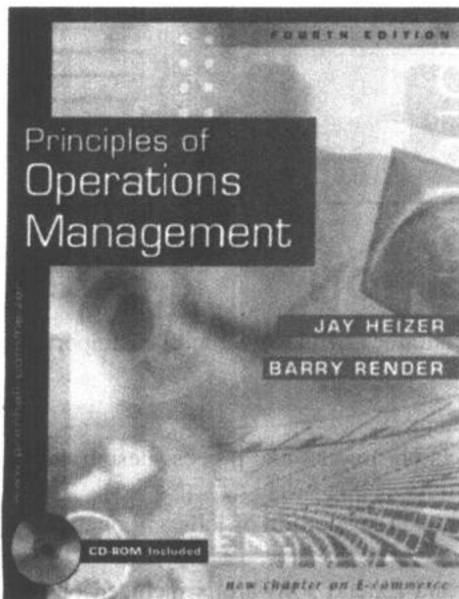
Welcome to *Operations Management*, Sixth Edition, written as a broad introduction to the field of operations management. In this book, we present a state-of-the-art view of the activities of the operations function. Operations is an exciting area of management that has a profound effect on manufacturing, services, and productivity. Indeed, few activities have as much impact on the quality of our lives. The goal of this text is to present the field of operations as realistic, practical activities that improve the quality of life.

Operations management includes a blend of topics from accounting, industrial engineering, management, management science, and statistics. Operations management jobs can be challenging, important, and rewarding, and can lead to successful careers. Even if you are not employed in the operations area, you will be working directly with people who are. This book can help you understand how OM functions and impacts society and your life. Certainly, you will better understand what goes on behind the scenes when you place an order through Amazon.com or buy a customized Dell computer over the Internet.

Although many of our readers are not OM majors, we think that the marketing, finance, accounting, and MIS students will find the material both interesting and useful. Over 250,000 readers of our earlier editions seem to have endorsed this premise.

TWO VERSIONS OF THE TEXT

This text is available to professors and students in two versions: *Operations Management*, Sixth Edition, which is hardbound, and *Principles of Operations Management*, Fourth Edition, a paperback. Both books include the identical core chapters 1–17. However, *Operations Management*, Sixth Edition, also includes six quantitative modules in Part IV.



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FOCUS OF THE NEW EDITION

This sixth edition of *Operations Management* continues to place a focus on important aspects of OM:

- **Strategy**—as our unifying link in every chapter
- **Global Operations**—and how this impacts on product and process design, location, human resources and other issues
- **Service operations**—recognizing the dominant proportion of jobs and operations decisions in the services
- **Software for OM**—our free Excel OM and Extend software is included on the CD-Rom in the back of this book

- **Thoroughly modern**—with coverage of the Internet, E-commerce, ERP, and mass customization. A whole new supplement to Chapter 11 called E-commerce and Operations
- **Real world operations**—to maximize interest and excitement in OM.

NEW TO THIS EDITION

Running Case Study In this edition, we add our first integrated, running case study, Southwestern University. Southwestern University faces a series of eight operations decisions as it expands its successful football program. The case continues in chapters 4, 6, 7, 8, 12, 13, and 16 and provides the first truly integrative OM textbook case.

■ Case Study ■

Southwestern University: (A)*

Southwestern University (SWU), a large state college in Stephenville, Texas, 30 miles southwest of the Dallas/Fort Worth metroplex, enrolls close to 20,000 students. In a typical town-gown relationship, the school is a dominant force in the small city, with more students during fall and spring than permanent residents.

A longtime football powerhouse, SWU is a member of the Big Eleven conference and is usually in the top 20 in college football rankings. To bolster its chances of reaching the elusive and long-desired number-one ranking, in 1995 SWU hired the legendary Bo Pitterno as its head coach. Although the number-one ranking remained out of reach, attendance at the five Saturday home games each year increased. Prior to Pitterno's arrival, attendance generally averaged 25,000 to 29,000 per game. Season-ticket sales bumped up by 10,000 just with the announcement of the new coach's arrival. Stephenville and SWU were ready to move to the big time!

The immediate issue facing SWU, however, was not NCAA ranking. It was capacity. The existing SWU stadium, built in 1953, has seating for 54,000 fans. The tal-

One of Pitterno's demands upon joining SWU had been a stadium expansion, or possibly even a new stadium. With attendance increasing, SWU administrators began to face the issue head-on. Pitterno had wanted dormitories solely for his athletes in the stadium as an additional feature of any expansion.

SWU's president, Dr. Marty Starr, decided it was time for his vice president of development to forecast when the existing stadium would "max out." He also sought a revenue projection, assuming an average ticket price of \$20 in 2001 and a 5% increase each year in future prices.

Discussion Questions

1. Develop a forecasting model, justifying its selection over other techniques, and project attendance through 2002.
2. What revenues are to be expected in 2001 and 2002?
3. Discuss the school's options.

*This integrated case study runs throughout the text. Other issues facing Southwestern's football stadium include: (B) quality of facilities (Chapter 6); (C) breakeven point for food sales; (D) where to locate a new stadium (Chapter 8); (E) inventory planning of football equipment (Chapter 12); and scheduling of games.

A Revamped Homework Problem Set One of the trademarks of our text has always been a large selection of homework problems, example problems, and solved problems. Now each and every problem has been re-examined, "stress-tested" for clarity, and each chapter's homework set expanded for more choices. The result is scores of new problems and rewritten problems, giving us the largest, clearest, most diverse problem set of any text. Problems are also now sequenced within each chapter by topic.

The number of homework problems has been expanded by almost a third to a total of 555 problems. These problems focus on problem formulation and interpretation as well as calculation. Each problem is identified as one of three levels; introductory (one dot), moderate (two dots), and challenging (three dots).

More Case Studies There are 55 case studies in this edition, with 29 being new to this edition. The cases are generally 1–2 pages in length, making them short enough to cover in weekly assignments, but detailed enough to add depth to each topic they represent. Thirty of the cases focus on the service sector, such as Shouldice Hospital, IKON, Chicago Southern Hospital, Mayo Clinic, Mutual Insurance of Iowa, and Accountfree. In addition, our home page, at www.prenhall.com/heizer, includes over 30 additional case studies. All are solved in the Instructor's Solutions Manual.

CHAPTER BY CHAPTER CHANGES

To highlight the extent of the revision of our previous edition, here are a few of the changes on a chapter-by-chapter basis.

Chapter 1: Operations and Productivity With new material on OM jobs, productivity, and the service sector, this revision sets the tone for goods and services throughout the book. Three new homework problems have been added.

Chapter 2: Operations Strategy for Competitive Advantage This chapter features an expanded coverage of strategy, with a focus on activity mapping at Southwest Airlines. One new problem has been added.

Chapter 3: Operations in a Global Environment This revised chapter introduces four new strategies: global, international, transnational, and multi-domestic. Two new homework problems and a case study on how GM is emulating Toyota's global strategy have been added. Two new *OM in Action* boxes on jobs in Mexico and on crime in foreign capitals have also been added.

Chapter 4: Forecasting This chapter contains new coverage of cyclical variation and trend projection. Nine new problems, a new case study (Southwestern University: A), and a new *OM in Action* box on Taco Bell have been added.

Chapter 5: Design of Goods and Services This chapter now includes Quality Function Deployment and new material on time-based competition, including joint ventures and alliances. Five new problems have been added.

Chapter 6: Managing Quality This chapter has a new focus on the seven tools of TQM, with new material on the Cost of Quality and Service Quality. Five new problems, a new case (Southwestern University: B), and a new *OM in Action* box on quality spies has been added. This chapter was Chapter 4 in the previous edition.

Supplement to Chapter 6: Statistical Process Control We have added the new topic of "Managerial Issues and Control Charts," and expanded coverage on building control charts. Ten new problems and a new *OM in Action* box on Unisys' Health Care Services have been added.

Chapter 7: Process Strategy and Capacity Planning This chapter is a major revision, with focus on mass customization and service blueprinting. New case studies on Southwestern University: C and Shouldice Hospital have been added as well as twelve new problems and a new *Global Company Profile* featuring Dell Computer's mass customization strategy. A new *OM in Action* box features Borders Books.

Supplement to Chapter 7: Operations Technology, The Internet, and ERP This supplement's major revision focuses on the Internet as an OM tool and on Enterprise Resource Planning, including "efficient consumer response" (ECR). New *OM in Action* boxes include Cisco's productivity gain via the Internet and ERP at Benetton. A new case study describing IKON's unsuccessful attempt at ERP is also included.

Chapter 8: Location Strategies This chapter now includes the topic of "clustering," an *OM in Action* box on Columbia Hospital's location decisions, and a new case study (Southwestern University: D). There are also seven new problems.

Chapter 9: Layout Strategies This chapter now begins with a *Global Company Profile* featuring McDonald's High Tech Kitchens. Also included is new material on retail layout called "servicescapes," an Excel OM module for layout, an *OM in Action* box on Amazon.com's warehouse, and two new problems.

Chapter 10: Human Resources and Job Design The new *Global Company Profile* features Southwest Airlines. New *OM in Action* boxes feature the Chicago Bulls basketball team and Northrop-Grumman's B-2 bomber.

Supplement to Chapter 10: Work Measurement Our revision includes a new treatment of work sampling, ten new homework problems, and a new case study, Chicago Southern Hospital.

Chapter 11: Supply Chain Management This chapter now features Internet purchasing (e-procurement) and includes an *OM in Action* box, "E-assembly Lines at GM and Ford."

Supplement to Chapter 11: E-commerce and Operations This brand new supplement continues our emphasis on e-commerce and the Internet. A wide variety of examples of business-to-business electronic commerce illustrate the importance of this exciting topic. A new case study is provided.

Chapter 12: Inventory Management Our *Global Company Profile* is now Green Gear Cycling and two new cases, Southwestern University: (E) and Mayo Clinic, have been added. Nine new homework problems have also been included.

Supplement to Chapter 12: Just-in-time Systems The topic of Lean Production is now included and a new case, Mutual Insurance Company of Iowa, is added.

Chapter 13: Aggregate Planning New material on aggregate planning in the hotel industry and the Andrew-Carter case have been added.

Chapter 14: Material Requirements Planning (MRP) An Excel OM module is now available for MRP. The problem set has been extensively modified with ten rewritten problems.

Chapter 15: Short-Term Scheduling This chapter has a new *OM in Action* box, New Brunswick Telephone Co., and a new case study of a Chicago software firm, Accountfree, Inc.

Chapter 16: Project Management We have revised Figure 16.1 on Project Planning Scheduling, and Controlling, included an example of an ERP Consulting Project, added a new Excel OM module, added two new problems, and added Southwestern University: G case study.

Chapter 17: Maintenance and Reliability We have added material on the full cost of maintenance and compared it to traditional costing approaches.

Quantitative Module A: Decision Making Tools This module now includes Decision Making under Uncertainty, including maximax, maximin, and equally likely criteria. There are two new problems and a new case study, Starting Right Corp.