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面向管理的 数量分析

第 **7** 版

Barry Render
Ralph M. Stair, Jr. / 著



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Quantitative
Analysis for
Management



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第 7 版

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·院长寄语·

北京大学光华管理学院秉承北大悠久的人文传统、深邃的学术思想和深厚的文化底蕴,经过多年努力,目前已经站在中国经济发展与企业管理研究的前列,以向社会提供具有国际水准的管理教育为己任,并致力于帮助国有企业、混合所有制企业和民营企业实现经营管理的现代化,以适应经济全球化趋势。

光华 MBA 项目旨在为那些有才华的学员提供国际水准的管理教育,为工商界培养熟悉现代管理理念、原理和技巧的高级经营管理人才,使我们的 MBA 项目成为企业发展致富之源,为学员创造迅速成长和充分发挥优势的条件和机会。

为了适应现代人才需求模式和建立中国的一流商学院,北京大学光华管理学院正在推出国际 MBA“双语双学位”培养方案;同时,为了配合北大 MBA 教育工作的展开,光华管理学院与北大出版社联合推出本套《当代全美 MBA 经典教材书系(英文原版)》,并向国内各兄弟院校及工商界人士推荐本套丛书。相信我们这些尝试将会得到社会的支持。而社会对我们的支持,一定会使光华 MBA 项目越办越好,越办越有特色。

北京大学光华管理学院院长

陈以宁

出版者序言

2001年12月10日中国加入了世界贸易组织,从此,中国将进一步加大与世界各国的政治、经济、文化各方面的交流与合作,这一切都注定中国将在未来世界经济发展中书写重要的一笔。

然而,中国经济的发展正面临着前所未有的人才考验,在许多领域都面临着人才匮乏的现象,特别是了解国际贸易规则、能够适应国际竞争需要的国际管理人才,更是中国在未来国际竞争中所必需的人才。因此,制定和实施人才战略,培养并造就大批优秀人才,是我们在新一轮国际竞争中赢得主动的关键。

工商管理硕士(MBA),1910年首创于美国哈佛大学,随后MBA历经百年风雨不断完善,取得了令世人瞩目的成绩。如今,美国MBA教育已经为世界企业界所熟知,受到社会的广泛承认和高度评价。中国的MBA教育虽起步较晚,但在过去10年里,中国的MBA教育事业发展非常迅速,也取得了相当显著的成绩。现在国内已经有50多所高等院校可以授予MBA学位,为社会培养了3000多名MBA毕业生,并有在读学员2万多人。

目前,国内的MBA教育市场呈现一片繁荣景象,但繁荣的背后却隐藏着种种亟待解决的问题。其中很大一部分问题的成因是因为目前我国高校使用的教材内容陈旧,与国外名校的名牌教材差距较大,在教学内容、体系上也缺乏与一流大学的沟通。为适应经济全球化,国家教育管理部门曾要求各高校大力推广使用外语讲授公共课和专业课,特别是在我国加入WTO后急需的上百万人才中,对MBA人员的需求更是占1/3之多,所以,大力开展双语教学,适当引进和借鉴国外名牌大学的原版教材,是加快中国MBA教育步伐,使之走向国际化的一条捷径。

目前,国内市场上国外引进版教材也是新旧好坏参差不齐,这就需要读者进行仔细的甄别。对于国外原版教材的使用,在这里我们要提几点看法。国外每年出版的教材多达几万种,如果不了解国外的教材市场,不了解国外原版教材的品质就可能找不到真正适合教学和学习的好的教材。对于不太了解外版教材的国内读者来说,选择教材要把握以下几点,即:选择国外最新出版的书;选择名校、名作者的书;选择再版多次并且非常流行的书。综合以上几点来看,目前国内市场上真正出新、出好、出精的MBA教材还是不多的。

北京大学出版社推出的《当代全美MBA经典教材书系(英文原版)》弥补了国内MBA教材市场的缺憾,给国内MBA教材市场注入了一股新鲜的血液。全套丛书共由22本书组成,覆盖了北京大学MBA的全部主修课程,包括:经济学、管理学、营销学、战略管理、管理信息系统、运作管理、人力资源管理、商务沟通、国际金融、金融管理、决策分析、货币银行学、会计学等。另外在十几门主课的基础上又增加了几门高级选修课程,包括:国际会计学、组织行为学、投资学、商务学、财务报表解析、管理会计、管理沟通、商业伦理学、企业家精神等。

本套丛书的筛选大体上本着以上所提到的几点原则,即,(1)出“新”。克服以往教材知识陈旧、落后的弊端,大部分教材的出版年限都选择在2002年,与国外原版书同步出版。(2)出“好”。本套丛书收入了美国哈佛大学、斯坦福大学、麻省理工学院等著名院校所采用的教材,如:《管理学》、《营销管理》、《管理信息系统》、《管理人力资源》、《财务会计》、《管理会计》、《面向管理的数量分析》等;本套丛书收入著名学术界宗师包括斯蒂芬·罗宾斯(《管理学基础》)、菲利

普·科特勒(《营销管理架构》)、查尔斯·亨格瑞(《财务会计》)、威廉·鲍莫尔(《经济学:理论、方针和政策》)等人的学术巨著。(3)出“精”。大多数教材都是再版多次,经过不断的修改和完善而成的,如:再版5次的《卓越的商务沟通》、《现代投资理论》、《商业伦理:概念和案例》等;再版6次的《货币、银行和金融市场经济学》、《商务学》、《财务报表解析》等;再版7次的《面向管理的数量分析》等;再版8次的《经济学:理论、方针和政策》、《财务会计》、《管理信息系统》等;甚至还有再版12次的《金融管理与政策》、《管理会计》。本丛书中每一本书的选择都依据该书旧的版本,或作者过去同类书籍的销售情况,选择居于该领域销售排行榜首位的教材。

本套《当代全美 MBA 经典教材书系(英文原版)》集合了美国经济学界和管理学界各个学科领域专家的权威巨著,该丛书经过北京大学光华管理学院及其他著名高校的知名学者的精心选编,包括了大量精深的理论指导和丰富的教学案例,真正称得上是一套优中选精的丛书。

致谢

本套教材是我社与国外一流专业出版公司合作出版的,是从大量外版教材中选出的最优秀的一部分。在选书的过程中我们得到了很多专家学者的支持和帮助,可以说每一本书都经过处于教学一线的专家、学者们的精心审定,北京大学出版社英文影印版教材的顺利出版离不开他们的无私帮助,在此,我们将对审读并对本套图书提出过宝贵意见的老们表示衷心的感谢,他们是:

北京大学光华管理学院:符国群、李东、梁钧平、陆正飞、王建国、王其文、杨岳全、于鸿君、张国有、张圣平、张志学、朱善利(按拼音排序)

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本套丛书的顺利出版还得到了培生教育集团(Pearson Education)北京代表处、汤姆森学习集团(Thomson Learning)北京代表处的大力支持,对他们的付出我们也非常感谢。

教辅材料说明

教材,顾名思义教学之材料,它和普通的书籍有一个很大的区别,就是必须以“方便教授教学”为主。所以,好的教材更需有完备的教学辅助材料相匹配,且每一本教材都要有教辅材料,只有配备了齐全的辅助材料才能称其为完整的教材。北京大学出版社的《当代全美 MBA 经典教材书系(英文原版)》系我社获全球最大的教育出版集团,美国培生教育集团(Pearson Education Group)独家授权之英文影印版本。Pearson Education 旗下的国际知名教育图书出版公司 Prentice Hall/Addison Wesley/Longman,以其高品质的经济类出版物,已成为全美乃至全球高校采用率最高的教材,享誉全球教育界、工商界。我社在选择此套教材的过程中,尽量选择教辅材料齐全的教材,这些教辅材料包括:教学指导用书、教学提纲、测试题、解答题、课堂演示文稿等,以书、幻灯片(Powerpoint Mesentation)、Disk、CD、CD-ROM 等形式出现。我社特获独家复制以上材料,并向采用该书的教师免费赠送。同时,这些材料还可通过访问培生教育集团相关站点:<http://www.prenhall.com>、<http://www.pearsoned.com>、<http://www.aw.com> 或国内站点:<http://www.digishop.com.cn> 免费下载。

欲获得相关教辅材料的教师烦请填写后面的《教辅资料支持表》,以确保此教辅材料仅为教师获得。

出版声明

本套丛书是对国外原版教材的直接影印,由于各个国家政治、经济、文化背景的不同,原作者所持观点还请广大读者在阅读过程中加以分析和鉴别。我们希望本套丛书的出版能够促进中外文化交流,加快国内经济管理专业教学的发展,为中国经济走向世界做出一份贡献。

我们欢迎所有关心中国 MBA 教育的专家学者对我们的工作进行指导,欢迎每一位读者给我们提出宝贵的意见和建议。

北京大学出版社

数字经实公司

2002 年 1 月

内 容 简 介

《面向管理的数量分析》第7版,共分16章,主要讲述了如何利用数量分析进行科学决策的过程,包括决策、规划、网络等决策模型的建立。本教材自出版以来一直受到广大师生的欢迎,被认为是最适合管理科学类课程的教材。本版教材保留并更新了旧的版本,涵盖范围广泛,相对于旧版而言,还增加了电子数据库并用以解决各章节的问题;本版还增加了软件包以方便广大师生的学习(可从相关站点下载)。本教材的每一个章节都包括1到4个案例,与其他同类书籍相比,数量更多。

适用性:适合本科生和 MBA 管理科学、定量分析、决策模型类课程,还可作为各企业、公司管理人员的培训教材和参考书。

畅销性:本书被美国哈佛大学等名校采用,流行于世界。

作者简介

Barry Render 是佛罗里达州 Winter Park 市的 Rollins 大学 Crummer 商务研究生学院 Charles Harwood 的杰出运作管理学教授。他从辛辛那提大学获得运作研究理学硕士学位和定量分析学博士学位(1975)。他曾经在乔治·华盛顿大学、新奥尔良大学、波士顿大学和乔治·美森大学教学,在那他因为决策科学方面的成就获得 GM 专业基金,同时还任决策科学部的主席。Render 博士还曾经在通用电器、道格拉斯公司以及国际航空和太空总署从事宇宙航天业的工作。

Render 教授有九本合著教材被培科(Prentice-Hall)出版社出版,包括:《运作管理原理》、《服务运作管理》、《管理学入门》和《管理学案例及解读》。他有涉及管理学各个方面的论文 100 多篇,分别发表于《决策科学》、《生产和运作管理》、《界面、信息和管理》、《管理信息系统杂志》、《社会经济学计划科学》和《运作管理评论》等刊物上。

Render 博士被授予 AACSB Fellow 的荣誉称号,1992 年和 1993 年分别被授予“最有前途学者”称号。他曾两次被选为决策科学协会东南地区副主席,从 1989 年到 1995 年他是 Decision Line 的软件评论编辑。从 1996 年起他还是《纽约时报》运作管理专栏的编辑。Render 教授还积极为政府代理部门和许多公司,如:国际航空和太空总署、美国联邦调查局、美国海军、费尔费克斯县、维吉尼亚和 C&P Telephone 做咨询工作。

他在维吉尼亚的 Rollins 大学教授 MBA 的运作管理学课程,并任 MBA 项目主任。他所在的学派将 1995 年命名为 Render 年。1996 年他因为杰出的学术成就被 Roosevelt 大学授予 St. Claire Drake 奖。

To Donna, Charlie, and Jesse

To Lila and Leslie

Preface

OVERVIEW

The seventh edition of *Quantitative Analysis for Management* looks to the future with the latest software and pedagogy. With over 20 years of service to the management science and quantitative analysis discipline, this edition builds on the traditions and strengths of past successes, while keeping an eye on the needs of future managers and decision makers.

The seventh edition continues to provide the reader with the skills to apply the techniques of quantitative analysis in all kinds of organizational decision-making situations. The chapters, supplements, and CD modules cover every major topic in the quantitative analysis/management science field. There is probably more material included than most instructors can cover in a typical first course, but we have found that the resulting flexibility of topic selection is appreciated by instructors who need to tailor their courses to different audiences and curricula.

We show how each technique works, discuss the assumptions and limitations of the models, and illustrate the real-world usefulness of each technique with many applications in both profit and nonprofit organizations. We have kept the notation, terminology, and equations standard with other books. As in the first six editions, we have tried to write a text that is easy to understand and use. Algebra is the only mathematics prerequisite.

FEATURES RETAINED FROM THE PREVIOUS EDITION

This book is student oriented; the following features have proved to be effective aids to the learning process.

- *QA in Action* boxes summarize published articles illustrating how real organizations have used quantitative analysis to solve problems. There are a dozen new *QA in Action* boxes in the seventh edition.
- *Solved problems*, included at the end of chapters, serve as models for students in solving their own homework problems.
- *Problems*, included in every chapter, are applications-oriented and test the student's ability to solve exam-type problems. They are graded by three levels: introductory (one bullet), moderate (two bullets), and challenging (three bullets).
- *INFORMS* videos are available for classroom use. The *INFORMS* videos are edited versions of award-winning presentations at the annual meeting.

- *Data set problems*, found in most chapters, require the computer to solve problems with larger amounts of data. These real-world problems are also available to instructors on data disks.
- *Modeling in the Real World* boxes help students apply the steps of the quantitative analysis approach, first presented in Chapter 1, to every technique discussed in the book.
- *Procedure Boxes* describe quantitative analysis techniques as a series of steps.
- *Margin Notes*, sentences or short paragraphs, are used to make it easier for students to understand important points.
- *Self Tests* allow students to test their knowledge of important terms and concepts to help them prepare for quizzes and examinations.
- *History* boxes briefly describe how a technique was developed.
- *Glossaries*, at the end of each chapter, define important terms.
- *Key equations*, which summarize the mathematical material, are listed at the end of each chapter.
- *Discussion questions*, at the end of each chapter, test the student's understanding of concepts.
- *Case studies*, at the end of each chapter, provide challenging managerial applications.
- *End-of-chapter bibliographies* provide a current selection of more advanced books and interesting articles.
- *QM for Windows* uses the full capabilities of Windows to solve quantitative analysis problems and is described either in the chapter or in an appendix at the end of the chapter.



KEY CHANGES IN THE TEXT

The seventh edition of *Quantitative Analysis for Management* has many new and exciting enhancements. In the text, you will find an increased emphasis on modeling, computer integration, and a variety of new features. In addition, new CD ROM modules, an extensive Companion Web Site, and a comprehensive set of supplements accompany and support the text.

Increased Emphasis on Modeling

The seventh edition stresses the use of modeling. Chapter 1 has been rewritten to introduce the importance of modeling in quantitative analysis. The title of Chapter 1 has been changed to *Introduction to Quantitative Analysis and Modeling* to emphasize this new orientation. This modeling emphasis has been incorporated into the other chapters. Modeling in the Real World boxes have been retained and enhanced. Many chapter titles have also been changed to reflect this new emphasis.

Computer Integration

The integration of the computer can be seen in the first chapter and throughout the book. The software features include Excel, Crystal Ball, TreePlan, Excel QM, and a new version of QM for Windows.

Excel. Excel is the featured software tool for the seventh edition. There is an increased use of Solver in the optimization chapters. Students are shown how Solver can be used to model a variety of quantitative analysis problems. In addition, the seventh edition has in-

corporated Crystal Ball and TreePlan into the simulation and decision-modeling chapters. These powerful Excel add-ins show students how Excel can be extended to solve simulation and decision-modeling problems. In addition, Chapter 1 shows how Goal Seek can be used to model a break-even problem.

Excel QM. Excel QM, a new program from Professor Howard Weiss, author of *QM for Windows*, solves many of the problems and examples found in the text. The use of Excel QM is integrated into most chapters. Students can see the power of this new software package in modeling and solving quantitative analysis problems. Excel QM is menu driven and easy to use. All of the power and convenience of Excel can be used to solve quantitative analysis problems.

QM for Windows. QM for Windows, our popular decision-support software for solving homework problems, has been upgraded and enhanced. Appendices at the end of most chapters show how this software tool can be used to solve quantitative analysis problems.

Free Software and Data Files on the Student CD-ROM. As a convenience to students, Excel QM, Crystal Ball, TreePlan, QM for Windows, and data files for examples will be conveniently packaged into a CD-ROM and included free to students as part of the text. Formerly, there was an additional charge for QM for Windows.

New Features in the Text

The text includes a number of new and exciting features to make teaching and learning easier. The new features in the text include:

- *New Student CD-ROM.* A new student CD-ROM accompanies every text. Included are Excel QM, QM for Windows, Crystal Ball, TreePlan, example data files, and new CD-ROM modules.
- *Example Data Files.* Data files used to solve the examples presented in this book and solved using Excel QM are included with the student CD-ROM.
- *Upgraded QA in Action Boxes.* The QA in Action boxes have been upgraded with many new applications.
- *Upgraded Modeling in the Real World Boxes.* Modeling in the Real World boxes have been upgraded to include new examples of how real companies have benefited from the modeling approach.
- *New Problems and Cases.* Most chapters have new problems and/or cases.
- *Updated Bibliographies.* The bibliographies at the end of the chapters have been updated to include newer applications of quantitative analysis. The classic references have been retained to give students a flavor of the history and development of the quantitative analysis field.

CD-ROM MODULES

To streamline the book, some chapters and supplements are now CD-ROM modules included with the student CD-ROM. These new CD-ROM modules have the same format and features of any chapter or supplement found in the text. The six CD-ROM modules are:

- Statistical Quality Control
- Dynamic Programming
- Decision Theory and the Normal Distribution

- Material Requirements Planning and Just-In-Time Inventory
- Mathematical Tools: Determinants and Matrices
- The Binomial Distribution

COMPANION WEB SITE

Our updated companion Web site uses the latest features of the Internet and the World Wide Web (WWW) with new content and features. Students can benefit from the updated Web site by seeing up-to-the-minute examples and real-world companies using the quantitative analysis approach. As with past editions, this edition also contains interesting Internet links, additional assignments, and numerous additional cases. The address for the Web site is <http://www.prenhall.com/render>.

SUPPLEMENTS

The supplements have been updated to reflect the new emphasis of the text and to provide students and instructors with the best teaching package possible. Here is a brief list of the supplements available with the text.

- *New Instructor CD-ROM*. A new instructor CD-ROM includes the complete Instructor's Solution Manual, the PowerPoint slides, and data files for end-of-chapter problems.
- *New PowerPoint Slides*. New PowerPoint slides are included with the Instructor CD-ROM.
- *Instructor's Solution Manual*. Available to adopters.
- *Updated Test Item File*. An updated test item file is available to adopters.
- *Prentice Hall's Test Manager for Windows*. This powerful test manager software is available to adopters.
- *Videos*. We have selected the best INFORMS videos from past editions and included them in a video package for this edition.

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