

· 管理科学专业 ·

中国人民大学工商管理学院策划

MBA 专业精品教材

世界经济
管理文库

约翰 M. 尼古拉斯
(John M. Nicholas)

/ 著

竞争性制造管理

(英文版)

Competitive Manufacturing Management

Continuous Improvement, Lean Production,
and Customer-Focused Quality



机械工业出版社



McGraw-Hill

John M. Nicholas: Competitive Manufacturing Management: Continuous Improvement, Lean Production, and Customer-Focused Quality.

Copyright © 1998 by The McGraw-Hill Company, Inc. All rights reserved. Jointly published by China Machine Press/McGraw-Hill. This edition may be sold in the People's Republic of China only. This book cannot be re-exported and is not for sale outside the People's Republic of China.

RISBN 0071166041

本书英文影印版由 McGraw-Hill 公司授权机械工业出版社在中国大陆境内独家出版发行, 未经出版者许可, 不得以任何方式抄袭、复制或节录本书中的任何部分。

版权所有, 侵权必究。

本书版权登记号: 图字: 01-98-1031

图书在版编目 (CIP) 数据

竞争性制造管理: 英文/(美) 尼古拉斯 (Nicholas, J. M.) 著. - 影印版. - 北京: 机械工业出版社, 1998.12

(MBA 专业精品教材)

ISBN 7-111-06561-1

I. 竞… II. 尼… III. 企业管理: 生产管理-英文-影印本 IV. F273

中国版本图书馆 CIP 数据核字 (98) 第 15296 号

出 版 人: 马九荣 (北京百万庄大街 22 号 邮政编码 100037)

责任编辑: 江 颖

审 读 人: 陈亦峰

北京第二外国语学院印刷厂印刷·新华书店北京发行所发行

1998年 12 月第 1 版第 1 次印刷

787mm × 1092mm 1/16 · 54.5 印张

定价: 86.00 元

凡购本书, 如有缺页、倒页、脱页, 由本社发行部调换

出版者的话

在全球经济一体化的激烈竞争格局中，中国正处于前所未有的经济与产业结构调整与转型的关键时期。飞速发展的社会与错综复杂的变革要求我们的经济与管理水平有一个飞跃。

为了能让读者系统地学习、借鉴国际上先进的管理理论、方法和手段，机械工业出版社从一些世界著名出版公司引进了一批一流品质的经济管理名著，组成了这套《世界经济管理文库》。其中所选图书均为当前国际上最为流行和权威的教材，大部分多次修订重版，有的多达十几版。作者都是哈佛、芝加哥、斯坦福等著名商学院的教授，使您足不出国，便可领略世界知名学府的文化精粹。

为了给中国的MBA教学提供一套完整的MBA系列教材，继与清华大学经管学院、加拿大毅伟管理学院合作共同策划出版的《国际通用MBA教材》与《国际通用MBA教材配套案例》丛书之后，近期，我社又和中国人民大学工商管理学院联手，共同策划本套《MBA专业精品教材》丛书。《国际通用MBA教材》涉及了所有的MBA核心课程，而本套《MBA专业精品教材》包括了MBA各个不同专业方向的全部课程及选修课程，它为各类工商管理学院培养更适

合社会需要的专门管理人才提供了丰富的教材资源库。全套丛书按专业分类，包括经济学、战略管理与组织、管理科学、财务与金融管理、会计、市场营销、商务技能等7大系列、60多个品种。

为了保持原作的原汁原味，这套丛书是以英文原版的形式出版的。这样可以避免因翻译而造成的歧义和出版时间的滞后，以便让读者能亲身体味原作者的精彩文风，并在第一时间洞悉经济管理学科各个领域的最新学术动态。

由于作者所处的社会、政治环境的不同，书中所述难免有不妥之处，请读者在阅读时注意比较和鉴别，真正消化吸收其中的精华，这也就达到了出版者出版本套丛书的目的。我们真诚地希望这套《世界经济管理文库》的出版，能为提高中国的MBA教学水平、推动中国的改革开放事业尽点绵薄之力。

机械工业出版社

1998年8月

序 言

当前，我国正处于知识经济初露端倪的时代，管理科学已经成为兴国之道，这给我国工商管理教育带来新的机遇与挑战。今年9月，又将有4000余名工商管理硕士生满怀着理想与希望进入各大学学习。一大批机关分流干部与经贸委系统的管理人员也要经过入学考试，在职学习并申请工商管理硕士学位。如何办好工商管理硕士（MBA）项目，为国家和社会培养出一批又一批符合市场需求的高质量工商管理硕士，是全国可以授予工商管理硕士学位的56所院校所共同考虑与研究的问题。

在这里，MBA课程设计是成功的关键环节之一。记得在1984年的夏天，在加拿大国际开发总署的资助下，加拿大蒙特利尔大学、麦吉尔大学、康克迪亚大学以及魁北克大学蒙特利尔分校的教授们为中国人民大学的年轻教师讲授了管理经济学、会计学、管理学以及管理信息系统等MBA课程。在1985年夏天，加拿大的教授们又讲了另外4门MBA课程。当时，我并没有真正了解这些MBA课程与我过去所学的管理课程在实质上有多大的区别，也没有理解这些课程之间的内在联系，对于MBA核心课与选修课以及专业的主修与副修的区别与联系更是知之甚少，只是感

到加拿大教授的教学在内容和手段上与我们传统方式有较大的区别。1988年初，我到加拿大麦吉尔大学管理学院研修后，才真正对MBA的课程设计有所了解。此后，我先后到美国布法罗纽约州立大学管理学院与澳大利亚悉尼科技大学管理学院任教，又对MBA课程之间的内在联系有了更切身的体会。为了更好地了解美国MBA教育的新潮流，今年6月，我又随中国管理学院院长代表团考察了美国著名管理学院，出席了在芝加哥举办的“全球管理教育论坛会”。

综观北美的工商管理教育，在全球化、信息化与整合化的挑战下，实在是强调其实用性。纵然有的教授学者看重自己的象牙宝塔，勾画着纯理论的模型与理论。但在MBA的教育上，美国现有的750余所管理学院，特别是为美国管理学院联合会（The American Assembly of Collegiate School of Business, AACSB）所承认的300余所管理学院，培养目标明确，课程设计体现出其为社会需求与市场服务的宗旨，没有半点的含糊。美国著名的管理院校明确自己的教育使命，把视野放在全球与创新上，不断地迎接新的挑战，将所授的知识与社会的实际需求密切地结合起来，期望培养出真正的高质量的管理人才。例如，哈佛商学院明确地提出，该院的使命是“影响企业的实践”，培养全面的管理者（general managers），指出“我们要对企业的领导人在如何完成他们的工作上，即在他们如何提出与解决问题、确定战略方向和采取行动上施加重大的影响。同时，我们鼓励从实践中获得反馈，以便了解这些领导人如何在实践中应用我们的思想与知识，从而进一步发展与提炼我们的理论与知识。”麻省理工学院斯隆管理学院的使命“尊重有用的工作”，“为产业提供服务”，提出“作为管理教育与研究的世界领导者，麻省理工学院斯隆管理学院要培养能在快速发展与高度竞争的全球企业环境中获得成功的管理者。当前持续不断的技术创新已成为每个产业各个方面生产力和增长的关键，因此，这正是我们的时机。”伯克利加利福尼亚大学商学院从学院的成立始，就将教育的重点放在国际与企业家的舞台上，研究迅速发展的全球经济，为学生提供创新的学习机会。

根据上述的使命，美国著名的管理学院教育模式基本上有三大流派：一是以哈佛商学院为代表的培养全面管理人员的模式。斯坦福商学院的培养方式也是属于这种模式。他们培养的是全面的MBA，而不是专业化的MBA，通过

为学生提供必要的专业知识，使之毕业以后成为企业或其他组织中高层的有效的全面管理者，而不是职能部门的管理人员。二是以芝加哥大学管理学院为代表的培养专业管理人员的模式，其方向是为企业和组织培养专业的管理人员。斯隆商学院亦属于这种类型。三是介于两者之间的模式。美国多数管理院校采用的是这种培养目标，如伯克利商学院、西北大学的凯洛格商学院、洛杉矶加州大学、康乃尔大学管理学院以及杜克大学管理学院等。因此，各个管理学院在其课程设计上有着不同的战略重点。

哈佛商学院MBA课程设计的思路是“在日益增长的全球商务环境中，提高学生进行战略性与关键性思考的能力。”斯坦福商学院MBA课程设计的思路是“确保学生获得管理运行的知识，了解企业运行的经济、政治和社会环境，以及掌握作为管理者所必须的行为技能。”同时，“MBA项目也要设计成为一种可以终身学习的模式。这样，今天的学生将在今后贯穿其事业的复杂而快速变化的管理世界中有能力自如地作出调整。”斯隆管理学院MBA课程设计的思路是“对日益增长的市场全球化和密集的竞争正在改变工作性质的这一事实作出反映。”哥伦比亚商学院MBA课程设计的思路是“让学生掌握作为管理者能够在全全球经济中进行有效竞争所需的基本学科与应用的职能领域。”

总之，这些学院在设计MBA课程时，首先，考虑的是学生要了解全球的竞争环境。其次，考虑学院所在的地域和环境。例如，哥伦比亚商学院极其强调该院处于纽约这个金融中心，其战略重点是国际、金融和纽约，培养出的学生要适合在国际大城市从事金融工作。因此，该学院在课程设计上就对财务与金融等相关课程有所侧重。再次，考虑学院自身资源的特点，如斯隆管理学院在技术管理上设置较多的课程，而哈佛商学院则在全面管理与竞争战略课程上有所突出。最后，要使学生获得相关的专业知识，了解研究与实践的前沿，如企业伦理、领导精神、创新、以及企业与政府关系等。

在课程设计的内容上，美国管理学院根据自己的情况，多按传统划分为核心课程与选修课程。课程内容上并不划一，门数上也多少不等。在学习核心课之前，学生要预先学习计算机应用和技能、商务沟通以及基本数量分析方法等课程。在核心课上，各学院基本上开设了经济学、统计或数据分析、会计、财务、市场营销、运作管理、组织行

为、人力资源管理、战略管理以及公共管理等课程。当然,也有例外。芝加哥大学管理学院就不设置核心课。在选修课程上,除哈佛商学院外,各学院基本上设置了专业,如管理经济学(Managerial Economics)、会计(Accounting)、财务管理(Financial Management)、税收(Taxation)、管理科学(Management Science)、信息系统(Information Systems)、市场营销(Marketing)、组织行为学(Organization Behavior)、人力资源管理(Human Resource Management)、国际商务(International Business)、战略管理(Strategic Management)以及公共管理(Public Management)等。最具特色的是斯隆管理学院的课程设计。该学院除了设计出体现管理基础原理和技能的六门核心课以外,根据学生今后所要从事的工作方向,创造性地设计自我管理模块(Self Managed Track)与管理模块(Management Track)。自我管理模块包括应用宏观与国际经济学、财务管理或财务理论、信息技术、产业关系与人力资源管理、运作管理导论和市场营销导论等六门课。如果学生希望将来从事较为全面的管理工作,则可以选择自我管理模块。而学生希望成为更专业的管理人员,则可以选择管理模块。在这个模块中,有六个分模块,即战略管理与咨询(Strategic Management and Consulting)、新产品与风险开发(Product and Venture Development)、信息技术与企业变革(Information Technology and Business Transformation)、金融工程(Financial Engineering)、财务管理(Financial Management)以及制造与运作(Manufacturing and Operations)。这种设计打破传统职能性课程的框架,切实反映市场的声音,力图符合具体职业领域的要求,使学生能在今后的工作中更快地进入某个具体的管理角色。

我国工商管理硕士教育总体来说,还处在试点阶段之中。在课程设计上,全国工商管理硕士教育指导委员会规定了核心课的指导大纲。经过多年的建设,MBA核心课的教材已经初步满足教学的需求。当然,在质量上还有待进一步完善。随着MBA教学的深入发展,一些院校在培养全面管理人员的基础上,进一步根据自己院校的区域环境和办学条件,探索开设专业方向,以便培养出更适合社会需要的专门管理人才。这就对课程设计提出了新的要求,希望有更专门化的课程支持不同的专业方向。这不仅对教师的科研提出了更高的要求,而且对教材的建设也提出新的

需求。教材不足便是当前工商管理教育中最大的困惑之一。

为了满足工商管理专业方向的发展以及相应的课程设计，在中国人民大学工商管理学院的策划下，机械工业出版社推出了英文版的《MBA专业精品教材》，填补教学用书中空白，力图缓解MBA各专业教学上的急需。在这套丛书中，我们精心选择了北美在经济学、战略管理与组织、管理科学、财务与金融管理、会计、市场营销以及商务技能等7个专业的英文版教材，期望对国内各管理学院所开设的管理专业有所帮助。同时，有志于学好MBA某个专业的管理人员、研究生甚至本科生也可以通过系统地学习该专业所列的教材，掌握个中三昧。

当然，在学习西方的管理理论与经验时，需要认真对待其内在的文化底蕴。正如同样是绘画，西方的绘画注重光线与颜色，体现出一种形象思维，而中国画则注重线条，体现出内在的逻辑思维，从而表现出中国文化与西方文化的差异。本世纪初以来，我国知识分子一直在研究与吸收西方文化，力图西学中用。正如有人所讲，学习的方法有三种形式，一是鸟瞰的方法，二是仰视的方法，三是平视的方法。鸟瞰者，恃才傲物，看不起其他民族的文化，更看不起其他民族的管理理念与方法。仰视者，自卑自弃，看不起自己民族的文化，盲目追求其他民族的管理理念与方法。要真正作到西学中用，而不是仅仅学到一些皮毛的话，则需要运用平视的方法，拉开距离，去观察与学习世界上一切优秀的管理理念与方法。今天，我们利用西方的管理理论与实践，是为了更合理地推动中国的管理教学与科研，促进中国的管理实践，切不可邯郸学步，而是真正做到“以我为主、博采众长、融合提炼、自成一家”。

徐 = 明 博士

中国人民大学管理学教授
中国人民大学工商管理学院院长
全国MBA教育指导委员会委员
1998年盛夏于北京

To Frank and Emily,
Elmer and Dolores

PREFACE

Around 1989, after having talked to some former students who had become practitioners and consultants in manufacturing and having read Richard Schonberger's *World-Class Manufacturing: The Lessons of Simplicity Applied* (The Free Press, 1986), Robert Hall's *Zero Inventories* (Dow Jones-Irwin, 1983), and Kiyoshi Suzaki's *The New Manufacturing Challenge* (The Free Press, 1987), I decided to offer a course for operations management majors focused exclusively on just-in-time (JIT) and total quality management (TQM). While developing the curriculum, I encountered what seemed to be three difficulties: JIT and TQM are two very broad topics, they are highly interrelated, and there was no textbook.

Some people equate JIT and TQM with production and quality control techniques. In fact each is a complete management philosophy that encompasses not only techniques but also convictions about the role of workers and how to treat employees and suppliers. The volume of journal literature about JIT and TQM was enormous.

Having grasped the expanse of the subject areas, I decided to focus only on JIT. I soon

learned, however, that JIT and TQM are highly related and that (as explained in Chapter 4) you cannot completely understand JIT without also somewhat understanding TQM. To cover JIT, I would also have to cover aspects of TQM.

I then set out to find a textbook. At the time there were a few textbooks on TQM and some trade books on JIT, but the TQM books were not about JIT, and the JIT books were written for practicing managers in a style and at a level inappropriate for college students. Hence, to the chagrin of my class, the required material for the course came to consist of a TQM textbook, a JIT trade book, and a packet of journal articles. Trade books do not include homework questions and problems, so I had to prepare them on my own. Over the years I supplemented more and more of this material with my own writings. About the time that these writings covered half the topics in the course, I decided to write a book and put everything in one place.

At times it did seem as if, indeed, I was writing about *everything*, since JIT and TQM touch on virtually every aspect of management. To contain the size of the book and make sure I could finish it, I had to restrict the coverage of

many topics. (After all, I kept reminding myself, this is an *introductory* book on JIT and TQM, albeit an in-depth one.) There is much to know about these subjects, and I have included references in the endnotes for interested readers. You can also learn about manufacturing JIT and TQM from *Production and Inventory Management* and *Target*, the journals of the American Production and Inventory Control Society and the Association for Manufacturing Excellence, respectively.

Not long ago a friend, Avi Soni, asked me whether JIT is dead. This was based on his observation that the appearance of the term JIT in articles and seminars is declining. In the ensuing conversation we agreed that the reason for the decline is probably because concepts associated with JIT have been absorbed into mainstream production management and into what is now termed manufacturing excellence or competitive manufacturing. Management concepts seem to come and go with the seasons, but the important ones remain active, even though the terminology changes. Although Richard Schonberger, still among the most prolific and best writers in the field, seldom uses the term in his recent book *World-Class Manufacturing: The Next Decade* (The Free Press, 1996), familiar JIT concepts run throughout the book. JIT is alive and well. Avi Soni could question the status of JIT because the company where he is employed as a manager began the transition to JIT/TQM more than a decade ago and now has a JIT/TQM *modus operandi*. Folks at his plant do not think of what they are doing as innovative or different and probably not as JIT/TQM, *per se*.

In and around my city, Chicago, there are enough factories that one has ample opportunity to see both the best and the worst in manufacturing management. I have been excited and encouraged in visiting plants that have embraced continuous improvement, lean production, and customer-focused quality. Managers and workers in these plants display high enthu-

siasm in talking about what they are doing. Students of mine often express the same level of enthusiasm. Yes, they discover, JIT/TQM is cool—in a way. Some students (sometimes the same ones) also express frustration because of problems in their workplace and management's ignorance about JIT/TQM or unwillingness to change. I can relate to that, having visited plants that seem like throwbacks to 50 years ago and talked to workers who dislike their jobs and managers who are out of touch with the workforce and customers.

The management concepts and principles described in this book will guide manufacturing practice for the next few decades, at least. They have become very much a part of today's business, mostly because they work. Beyond that, I personally find some of the principles satisfying because of the somewhat high level of responsibility and dignity they attach to the jobs of workers on the shop floor. I was raised in a working-class family and always felt that my parents' abilities far exceeded what they could exercise in the workplace. My dad was one of the smartest and all-around most capable men I have ever known and I always thought he could build or fix anything requiring mechanical, electrical, or carpentry skill. When I think about teams of workers in JIT/TQM organizations, I envision people like my parents, for certainly they are representative of many millions of workers. That is not to say that JIT/TQM organizations are a kind of utopia, but that, on balance, workers in JIT/TQM factories have more opportunity to find meaning in their jobs and to get more earned respect from management than workers in other factories.

Einstein said, "I know why there are so many people who love chopping wood. In this activity one immediately sees the results." JIT and TQM practices are that way too. Both represent pragmatic approaches to chopping away at waste and problems in organizations. In many factories you can start to see results on the shop floor not too long after putting aspects of JIT

and TQM into practice (improvements on the balance sheet happen too, but they take a little longer).

AUDIENCE AND USE OF THIS BOOK

Competitive Manufacturing Management was written for three audiences:

1. Bachelor of business and MBA students *majoring* in production and operations management.
2. Industrial and manufacturing engineering students.
3. Practicing manufacturing managers and engineers seeking an understanding of JIT/TQM.

It is intended for a second-level course in production and operations management. Students who have already taken an introductory course should be readily able to understand the material.

It will be difficult to cover all of this book in depth in a typical one-term college course, and

the instructor must decide on which topics to focus. The book is divided into an introductory chapter and five main parts. Chapter 1 and Part I provide foundation concepts for everything that follows. Part II covers lean production and core concepts of JIT manufacturing. I believe that everything in this part should be covered in some depth. Part III is about design quality and manufacturing quality control. In schools that offer courses in TQM and SP[®], portions of this part may be scanned or deleted. Chapters 12 and 15, however, should be read since they describe concepts used in later chapters. Part IV covers integrated planning and control in pull production—another key aspect of JIT. Depending on students' prior exposure to planning and control, however, portions of this part may also be scanned or deleted. Part V covers topics important to the success of JIT/TQM but not usually included in a manufacturing book. At minimum, Chapter 19 should be read in full. My suggestion is to not completely skip any chapter. Most of the topics in this book are interrelated: to gain a full understanding of JIT/TQM, it is necessary to know about all of them.

John M. Nicholas

ACKNOWLEDGMENTS

In writing *Competitive Manufacturing Management* I have been fortunate to have had the assistance of many bright and capable people. Two are my friends and colleagues at Loyola University Chicago, Drs. James Zydiak and Enrique Venta who read many parts of this book and provided useful suggestions. Others who helped the most were my research assistants during the last 3 years, Sosamma Mammen, Marco Menaguale, Marlene Abeysinghe, and Omar Saner. In case you find the going difficult with some of what you will read, you can only imagine what it was like for them many drafts earlier. On the other hand, if perchance the material reads with exceptional clarity, it is no doubt partly due to their exceptional efforts. I also wish to credit Leslie Bailyn and Diane Petrozzo for their editing and gopher support, and Dr. Larry Metzger for reviewing and critiquing Chapter 20.

Thanks also to Mr. Avi Soni and Mr. Al Brouillette, two enthusiastic managers on the front lines and at the leading edge of manufacturing. I learned a great deal about JIT/TQM

from frequent visits to their plants and discussions with them and their co-workers.

I also want to acknowledge the reviewers of this book whose comments and suggestions greatly improved the end product: Mary Jo Maffei, formerly University of Cincinnati; Behnam Malakooti, Case Western Reserve University; Unny Menon, California Polytechnic State University; George Schneller, Baruch College—CUNY; Kenneth Ramsing, University of Oregon; Joe Biggs, California Polytechnic State University; Karen Donohue, University of Pennsylvania; Vaidyanathan Jayaraman, University of Southern Mississippi; Pitu Mirchandani, University of Arizona; Byron Finch, Miami University; and George Petrakis, University of Missouri.

Thanks also to the folks at Irwin/McGraw-Hill, especially to Dick Hercher for encouraging me from the beginning, Carol Rose for reviewing and improving the entire manuscript, and Maggie Rathke for attending to myriad details and bringing them all together between two covers.

Finally there is my wife Sharry, who has my deepest appreciation for patiently assuming responsibility for managing virtually every aspect of our home life so I could work undistracted.

The assistance of so many people made writing this book not only doable but enjoyable. Most of them share with me an excitement about modern methods of manufacturing management. My one wish is that you, after having

read this book, come away with that same sense of excitement.

My apologies in advance for any typos and mistakes. I had final say over everything, so I accept responsibility for these as well as for any other source of anguish this book might cause. For your sake I hope there aren't too many, but I do appreciate hearing from you about them.

John M. Nicholas

BRIEF CONTENTS

- 1 Race without a Finish Line 2

PART I

CONTINUOUS IMPROVEMENT, WASTE ELIMINATION, CUSTOMER FOCUS

- 2 Fundamentals of Continuous Improvement 34
3 JIT: Value Added and Waste Elimination 70
4 TQM: Customer-Focused Quality 110

PART II

ELEMENTS OF LEAN PRODUCTION

- 5 Small-Lot Production 146
6 Setup-Time Reduction 176
7 Maintaining and Improving Equipment 208
8 Pull Production Systems 254
9 Focused Factories and Group Technology 308
10 Workcells and Cellular Manufacturing 350
11 Standard Operations 394

PART III

QUALITY PRODUCTS, QUALITY PROCESSES

- 12 Quality of Design 420
13 Quality Inspection and Statistical Sampling 460

- 14 Statistical Process Control 490
15 Systems for Eliminating Defects 542

PART IV

SIMPLIFIED PRODUCTION PLANNING AND CONTROL SYSTEMS

- 16 Scheduling for Smooth Flow 564
17 Synchronizing and Balancing Processes 608
18 Planning and Control in Pull Production 638

PART V

BEYOND THE PRODUCTION SYSTEM

- 19 Managing the Supply Chain 672
20 Activity-Based Costing 712
21 Performance Measurement: Making Bean
Counting Relevant 740

- Appendix MRP-Based Production Planning and Scheduling 780

CONTENTS

1 Race without a Finish Line 2

Competitive Advantage:

Better, Cheaper, Faster,
More Agile 4

Just-in-Time and Total Quality
Management 5

JIT, TQM, and the
Production Pipeline 5

The JIT/TQM Difference
in Organizations 6

Evolution of Manufacturing 7

The Machine that Changed
the World 7

Craftsmanship Yields to
Industrialization 8

Craft Production of Automobiles 9

Ford's Mass Production System 10

Emergence of Modern

Mass Production 11

Mass Production
around the World 12

Toyoda and Ohno 12

America's Fall from

Manufacturing Grace 16

Climbing Back 17

Modern Developments 18

The Quality Movement 19

Inspection 19

Statistical Process Control 21

Quality Assurance 22

Total Quality Management 24

The Imperative 25

Organization of the Book 25

PART I

CONTINUOUS IMPROVEMENT, WASTE ELIMINATION, CUSTOMER FOCUS

2 Fundamentals of Continuous Improvement 34

Continuous Improvement as Tactics
and Strategy 36

Incremental

Improvement: Kaizen 36

Improvement Threshold 38

Innovation Improvement 38

Making the Leap 39

Improvement as Strategy 41

Finding and

Implementing Improvements 43

PDCA Cycle 44

Five-Why Process 46

Value Analysis/

Value Engineering 46

Process Reengineering 50

Reengineering Fundamentals 51

Role of Systems Analysis 51