

"McGrath has again crafted new ideas to drive product development."  
—William A. Kozy, President, BD DIAGNOSTICS

**NEXT GENERATION**

**PRODUCT**

**DEVELOPMENT**

**How to Increase  
Productivity, Cut Costs,  
and Reduce Cycle Times**

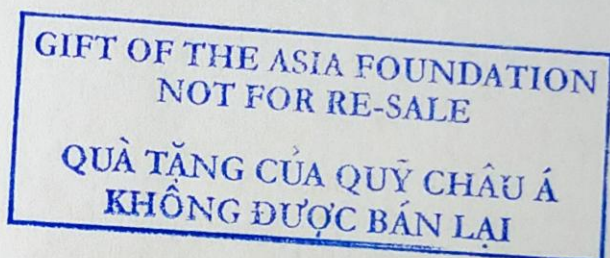
**MICHAEL E. MCGRATH**

# NEXT GENERATION PRODUCT DEVELOPMENT

How to Increase  
Productivity, Cut Costs,  
and Reduce Cycle Times



**MICHAEL E. McGRATH**



**McGraw-Hill**

New York   Chicago   San Francisco   Lisbon   London  
Madrid   Mexico City   Milan   New Delhi   San Juan  
Seoul   Singapore   Sydney   Toronto

The McGraw-Hill Companies

Copyright © 2004 by The McGraw-Hill Companies, Inc. All rights reserved. Printed in the United States of America. Except as permitted under the United States Copyright Act of 1976, no part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the publisher.

5 6 7 8 9 0 DOC/DOC 0 9 8 7 6

ISBN 0-07-143512-3

McGraw-Hill books are available at special quantity discounts to use as premiums and sales promotions, or for use in corporate training programs. For more information, please write to the Director of Special Sales, McGraw-Hill, Professional Publishing, 2 Penn Plaza, New York, NY 10121-2298. Or contact your local bookstore.



This book is printed on recycled, acid-free paper containing a minimum of 50% recycled de-inked fiber.

# C O N T E N T S

---

Preface xvii

## SECTION ONE

---

### INTRODUCTION

#### Chapter 1

---

#### **Previous Generations and the Promise of the New 3**

Invention and Commercialization Generation 5

Project Success Generation 9

*Project Scheduling 9*

*Project Team Organization 10*

Time-to-Market Generation 12

*Phase-Based Decision Making 12*

*Cross-Functional Teams 14*

*Standard Development Processes 15*

*Portfolio and Pipeline Management 16*

*Benefits of the TTM Generation 17*

*Adoption of TTM Generation Practices 18*

Genesis of the R&D Productivity Generation 20

#### Chapter 2

---

#### **The R&D Productivity Generation 23**

Information Transforms Strategy, Processes, and Practices 24

*The MRP Example 24*

*The Integrated Accounting Example 26*

*The Operation Iraqi Freedom Example 27*

Characteristics of the R&D Productivity Generation 28

*Product Strategy and Portfolio Management 29*

*Resource Management 30*

*Project Management 32*

Benefit Model of the R&D Productivity Generation	33
<i>Improved R&amp;D Capacity Utilization</i>	35
<i>Increased Project Resource Efficiency</i>	35
<i>Developer Productivity</i>	36
<i>Gains from Partnering/Outsourcing</i>	37
<i>Increased R&amp;D Administration Efficiency</i>	38
<i>Pipeline Effectiveness</i>	38
<i>Improved Product Strategy and Product Success</i>	38
<i>Resulting Benefits</i>	39
Development Chain Management Systems	41
Common Concepts	43
<i>Management Process Levels</i>	43
<i>Stages of Maturity</i>	45
Commercial Robotics Incorporated	45

## SECTION TWO

### RESOURCE MANAGEMENT

#### Chapter 3

#### **Improving R&D Productivity through Increased Capacity Utilization 49**

Measuring the Opportunity to Increase Capacity Utilization	51
The New Paradigm for R&D: Capacity Management	54
Understanding R&D Utilization	55
Measuring Trends and Goal Setting	57
<i>Trend Reporting and Goal Setting</i>	57
<i>Basis for Computing Utilization: Assignments versus Actual-Time Utilization</i>	59
<i>Levels of Reporting</i>	60
Best Practices for Improving Utilization	61
<i>Capacity-Based Portfolio and Pipeline Management</i>	62
<i>Increased Awareness of Capacity Utilization</i>	63
<i>Resource-Based Phase-Review Decisions</i>	63
<i>Resource-Based Project Planning</i>	64
<i>Resource Group Assignment Balancing</i>	65
<i>Longer-Term Capacity Planning and Management</i>	65
<i>Skill Planning</i>	66
<i>Resource Charge-Out</i>	66
<i>R&amp;D Outsourcing</i>	67
Summary	67

---

**Chapter 4****Stages of Maturity in Resource Management 69**

- Three Levels of Resource Management 70
  - Level 1: Project Resource Scheduling 71*
  - Level 2: Resource Requirements Planning and Management 72*
  - Level 3: Workload Management 73*
  - Flow between Levels 74*
- Resource Management Stages of Maturity 74
  - Stage 0: Informal Resource Management 76*
  - Stage 1: Short-Term Utilization Management 77*
  - Stage 2: Medium-Term Capacity Planning and Management 78*
  - Stage 3: Resource Requirements Planning (RRP) 79*
  - Stage 4: Integrated Resource Management 79*
  - How the Levels and Stages Work Together 80*
- Roadmap for Improving Resource Management 81
- Summary 82

---

**Chapter 5****Stage 1—Short-Term Utilization Management 83**

- Resource Assignment 84
  - Project Resource Assignment 85*
  - Resource Group Assignment Management 87*
  - Utilization Reporting 91*
- Resource Assignment Costs 92
- Requirements 93
- Benefits 96
- Summary 97

---

**Chapter 6****Stage 2—Medium-Term Resource Capacity Planning and Management 99**

- Resource Capacity Planning 100
  - Short-Term Resource Capacity Planning 102*
  - Medium-Term Resource Capacity Planning 103*
  - Integration with Annual Financial Planning 104*
  - Pipeline Capacity Management 105*
  - Long-Term Resource Capacity Planning 106*
- Project Resource Needs 106
  - Project Planning with Resource Needs 107*
  - Resource Needs and Skill Categories 109*
  - Resource Group Management with Resource Needs 110*

Resource Transaction Process	112
<i>Resource Needs</i>	113
<i>Resource Requests</i>	113
<i>Resource Assignments</i>	115
Requirements	115
Benefits	117
Summary	118

---

## Chapter 7

### Stage 3—Project Resource Requirements Planning and Management 119

Project Resource Requirements Planning (RRP)	122
<i>Using Resource Requirement Guidelines</i>	123
<i>Making Preliminary Resource Estimates</i>	123
<i>Time-Phasing Steps to Balance Resources</i>	126
<i>Balancing Resource Requirements among Skills</i>	128
Transforming Resource Requirements into Resource Needs	129
Resource Requirements Management	131
Workload Reconciliation	134
Requirements	136
Benefits	137
Summary	138

---

## Chapter 8

### Stage 4—Fully Integrated Resource Management 139

Level 1 Points of Integration	141
<i>Integration with Pipeline/Portfolio Management</i>	141
<i>Reconciliation with Functional Budgets</i>	142
<i>Integration with Annual Financial Planning</i>	142
<i>Integration with Project Budgets</i>	143
<i>Product Strategy Integration</i>	143
<i>Integration with HR Systems Skill Categories</i>	144
<i>Integration with Multiple Resource Groups</i>	144
<i>Integration with External Resources</i>	144
Level 2 Points of Integration	146
<i>Integration with Project Planning</i>	146
<i>Closed-Loop Time Collection</i>	146
<i>Integration with Knowledge Management Systems</i>	148

Level 3 Points of Integration	148
Requirements	149
Benefits	149
Summary	149

---

**SECTION THREE**

---

**PROJECT MANAGEMENT****Chapter 9**

---

**Stages of Project Management 153**

Stage 3—Enterprise Project Management	155
<i>Enterprise Project Planning and Control</i>	155
<i>Networked Project Teams</i>	156
<i>Enhanced Phase-Review Process</i>	157
Stage 4—Advanced Project Management Practices	158
<i>Integrated Financial Planning and Project Budgeting</i>	158
<i>Distributed Program Management</i>	158
<i>Collaborative Development Management</i>	159
<i>Context-Based Knowledge Management</i>	159
Summary	160

**Chapter 10**

---

**Enterprise Project Planning and Control Process 161**

Enterprise Project Planning Architecture	163
<i>Enterprise System versus Project Planning Tool</i>	164
<i>Hierarchical Structure</i>	164
<i>Top Down versus Bottom Up</i>	166
<i>Distinction between Project Planning and Work Management</i>	167
<i>Integration with Resource Management</i>	168
The Enterprise Project Planning and Control Process	169
<i>Collaborative Project Planning</i>	170
<i>Collaborative Project Control</i>	172
<i>Integration with Project Planning Standards</i>	173
<i>Integration of Project Plans</i>	174
<i>Project Plan as the Basis for the Networked Team</i>	175
Enterprise Project Planning and Control at CRI	175
Benefits	178
Summary	179



**Chapter 11****Networked Project Teams 181**

- Cross-Functional Core Team Management 182
  - Traditional Cross-Functional Core Team Model* 183
  - Distributed Email Communications in Core Teams* 185
- The Networked Project Team 188
- Project Communication in Networked Project Teams 189
- Project Coordination in Networked Teams 191
  - Project Schedule-Items* 192
  - Project Calendar-Items* 193
  - Project Deliverables* 194
  - Project Action-Items* 194
  - Issue-Resolution Items* 195
  - Project Bulletin Boards* 196
- Content Management in Networked Project Teams 197
  - Project Document Management* 197
  - Collaborative Document Preparation* 198
- Networks of Networked Teams 199
- Requirements 200
- Benefits 201
- Summary 202

**Chapter 12****Enhanced Phase-Review Management 203**

- Phase Reviews 203
  - Product Approval Committee (PAC)* 204
  - Phase-Review Process* 204
  - Phase-Review Process Limitations* 206
- Enhanced Phase-Review Management Improvements 207
  - Phase-Review Decisions with Resource Availability Information* 207
  - Combined Phase Reviews* 209
  - Project Tolerances* 209
  - PAC Information System* 211
  - Focus of Phase Review* 212
- Requirements 213
- Benefits 213
- Summary 214

**Chapter 13****Integrated Financial Planning and Project Budgeting  
for New Products 215**

- Integration of Financial Information 217
  - Common Planning Models* 220
  - Project Budgets Automatically Derived from Resource Assignments* 220
  - Financial Data Directly Based on Source Data* 221
  - Incorporation of Financial Information in Project Documents* 222
  - Project Budget Updates with Actual Costs* 222
  - Consolidation of Financial Information across Projects* 223
- Integrated Financial Planning at CRI 224
  - Revenue Projection* 224
  - Product Cost Estimate* 227
  - New Product Financial Plan* 229
- Integrated Project Budgeting at CRI 230
  - Development Resource Cost* 230
  - Expense Budget* 231
  - Project Budget* 231
  - Capital Budget* 233
  - Project Financial Analysis* 233
- Financial Management of New Product Project 236
  - Actual-Cost Management* 236
  - Earned-Value Analysis* 238
  - Revision Control* 239
- Requirements 240
- Benefits 241
- Summary 241

**Chapter 14****Distributed Program Management 243**

- Product Development Programs 245
  - Coordinating Multiple Versions of a Product* 246
  - Managing a Complex Project as Subprojects* 247
  - Integrating Common Technology Development Projects with  
Multiple Product Development Projects* 247
  - Coordinating Related Product and Process Development* 248
- Distributed Program Planning and Control 249
- Distributed Program Team Coordination 250
- Integrated Program Financial Management 253

Requirements	256
Benefits	257
Summary	257

## Chapter 15

### **Collaborative Development Management 259**

Categories of Collaborative Development	260
<i>Customers</i>	261
<i>Development Partners</i>	264
<i>Contractors</i>	265
<i>Suppliers</i>	266
<i>Channel Partners</i>	267
Collaboration Systems Services	267
<i>Collaboration Based on Email</i>	268
<i>Using a Shared File Server</i>	269
<i>Collaborating with a Web-Based Workspace</i>	269
<i>Integrating Partnering Capabilities into the DCM System</i>	270
<i>Integrating DCM systems</i>	272
Outsourcing of R&D	274
Requirements	274
Benefits	275
Summary	276

## Chapter 16

### **Context-Based Knowledge Management 277**

Types of Knowledge and Experience in R&D	278
<i>Standards, Guidelines, and Policies</i>	279
<i>Templates</i>	281
<i>Financial Models</i>	282
<i>Experience Gained from Previous Projects</i>	282
<i>Reference Documents</i>	283
<i>Project Plans and Step Planning</i>	284
<i>Educational Materials</i>	284
<i>External Information</i>	285
Delivering Product Development Knowledge through DCM Systems	286
<i>Step Libraries</i>	286
<i>Linking Knowledge to Tasks and Roles</i>	287
Collecting Product Development Knowledge	289
Requirements	290
Benefits	290
Summary	291

---

**SECTION FOUR**


---

**PORTFOLIO MANAGEMENT AND PRODUCT STRATEGY**


---

**Chapter 17**


---

**Stages of Portfolio Management and Product Strategy 295**

Process Levels of Portfolio Management and Product Strategy 297

*Product Strategy Process Level 298*

*Portfolio and Financial Management Process Level 299*

*Pipeline Management Process Level 300*

*Integration with Other Processes 301*

Stages of Portfolio Management and Product Strategy 302

*Stage 0—No Portfolio or Pipeline Management 303*

*Stage 1—Periodic Portfolio and Pipeline Management 303*

*Stage 2—Dynamic Portfolio and Pipeline Management 305*

*Stage 3—Comprehensive Financial Management of R&D 306*

*Stage 4—Integrated Product Strategy 307*

Summary 308

---

**Chapter 18**


---

**Dynamic Portfolio and Pipeline Management 309**

Dynamic Portfolio Management 311

*Real-Time Integration with Project Data 311*

*On-Demand Portfolio Analysis 313*

*Integrated Portfolio Management Process 314*

Dynamic Pipeline Management 315

*Real-Time Integration with Project Resource Management 316*

*Pipeline Simulation and Optimization 318*

*Integrated Pipeline Management Process 320*

Requirements 321

Benefits 321

Summary 322

---

**Chapter 19**


---

**Comprehensive Financial Management of R&D 323**

The CFO's New Role in R&D 324

Consolidation of New Product Financial Information 326

*Consolidated Revenue Projection 327*

*Consolidated Capital Plan 330*

*Consolidated New Product Profitability and Expense 331*

*Consolidated Project Budgets 331*

Reconciliation of Functional and Project Budgets	331
<i>Tracking Functional Budget Allocation to Projects</i>	332
<i>Basing Functional Budgets on Expected Resource Requirements</i>	334
Requirements	335
Benefits	335
Summary	336

---

## Chapter 20

### **Integrated Product Strategy Process 337**

A System and a Process for Product Strategy	338
Product Line Plan	340
<i>Planned Products</i>	341
<i>Standard Planned Product Profiles</i>	343
<i>Simulating the Feasibility of a Product Line Plan</i>	344
Idea Management	344
Technology Planning	347
Requirements	348
Benefits	349
Summary	349

---

## SECTION FIVE

### **CONCLUSION**

---

#### Chapter 21

### **Getting Started 353**

DCM Systems	353
Processes and Practices	354
Implementation Planning	355
Conclusion	357

Endnotes 359

Glossary 361

Index 365