

# Long Contents

<i>About the Author</i>	v
<i>Short Contents</i>	vii
<i>Long Contents</i>	ix
<i>List of Case Examples</i>	xxiii
<i>Plots and Characters</i>	xxv
<i>Preface</i>	xxix
Approach	xxix
Structure and content	xxx
Learning aids	xxx
New to this edition	xxxi
Case matrix	xxxii
Companion resources	xxxiii
<b>PART 1</b>	<b>1</b>
<b>1 Managing Operations</b>	<b>3</b>
Introduction	4
The content and planning of the book	5
Managing operations: an overview of the role	6
Case example 1 Operations management tasks at Portioli sandwich and coffee bar	6
Origins of the name 'operations management'	7
The nature of organizations	8
The operations manager's task	8
Exhibit 1.1 – Overview of the operations process – transforming inputs into outputs	8
Exhibit 1.2 – An overview of the service and manufacturing sectors	9
Exhibit 1.3 – Examples of service and product processing	10
The operations manager within the organization	11
Exhibit 1.4 – Operations management functions in a large manufacturing company	11
Exhibit 1.5 – Operations jobs and specialist functions in three organizations	12
Operations management in a developing economy	12
Exhibit 1.6 – Percentage of GDP by sector group for selected countries, 1980 and 1996	13
The purchase – a mix of services and products	13
Exhibit 1.7 – Service/product mixes in a range of purchases	14
Size of the operations task	14
The role of the operations manager	15
Exhibit 1.8 – Managing the subsystems and specialist support can have its off day!	17
Exhibit 1.9 – Work and money flows	18
Exhibit 1.10 – Strategic vision normally offers more direction than provided by Mr James	19
Case example 2 The Royal Mail Group	20
Case example 3 Key link in the retail chain	20
Services versus manufacturing	21
Exhibit 1.11 – Aspects of product, information and customer processing	22
Reflections	23

Exhibit 1.12 – The levels of learning	24
Key Elements of Managing Operations	25
Self-check	25
Study activities	26
Exploring further	27
Notes and references	27
<b>2 Operations Strategy</b>	<b>29</b>
What is strategy?	31
Exhibit 2.1 – The purpose of strategy – the Mr James approach!	32
Evolution of strategy within a business	32
Levels of strategy	32
Exhibit 2.2 – Levels of strategy and their distinctive tasks	33
Exhibit 2.3 – Examples of functional strategic responsibilities	33
Exhibit 2.4 – Market-driven and market-driving strategies	34
A recap on functional strategy development	35
Exhibit 2.5 – Markets at the centre of strategy development	35
Operations strategy in action	35
Case example 1 Comparing success at Kmart and Wal-Mart	36
Exhibit 2.6 – Sales revenue: Kmart and Wal-Mart	36
Exhibit 2.7 – Earnings before tax: Kmart and Wal-Mart	37
Executive roles – day-to-day and strategic dimensions	37
Business unit strategy	38
Exhibit 2.8 – Strategic group composition	38
Exhibit 2.9 – Ideal business unit strategy-making process	39
Exhibit 2.10 – Real-life business unit strategy-making process	39
Exhibit 2.11 – Mr James's view of strategy – the big picture, not whether functions can make it happen	40
Reasons for current approaches to developing strategy	40
Exhibit 2.12 – Result of researchers' market review	42
Exhibit 2.13 – Gianni proposes the marketing strategy to take the firm from good to great	43
Reasons for reactive role of operations in strategy development	44
The need to recognize difference at the level of strategy formulation	45
Linking marketing and operations	46
Exhibit 2.14 – Operations and marketing perspectives on key issues	47
Case example 2 Price leadership strategies at Sam's, Aldi and IKEA	48
Case example 3 Operations developments at Benetton	48
Case example 4 American Express's differentiation strategy	49
Case example 5 Restructuring within the healthcare industry	49
Linking corporate objectives and functional strategies through markets	49
Exhibit 2.15 – Framework for reflecting operations strategy issues in corporate decisions	50
Exhibit 2.16 – The interactive, ongoing nature of the strategy debate	51
Understanding markets – the reality	51
Case example 6 Market positioning of bottled water	52
Case example 7 Customer segmentation in the electricity industry	53
Understanding markets – the approach to follow	54
Implementing an operations strategy	55
Exhibit 2.17 – Translating order-winners and qualifiers into actions	56
Operations strategy – an illustration	56
Exhibit 2.18 – Order-winners and qualifiers in three markets of a contract hire car company	57
Exhibit 2.19 – Operations actions arising from Exhibit 2.18	57
Reflections	58
Exhibit 2.20 – The market interface	59
Key Elements of Operations Strategy	59
Self-check	60
Study activities	61
Exploring further	61
Notes and references	62

<b>3</b>	<b>Managing People</b>	<b>65</b>
	Introduction	67
	Changes in the workplace	68
	<b>Case example 1</b> Introducing work teams at San Diego Zoo	70
	General definitions	71
	Exhibit 3.1 – Depth and scope of two jobs	71
	Traditional approaches to work design	72
	Exhibit 3.2 – Mr James’s introduction of job rotation needs a little more thought!	75
	New approaches to work design	75
	Exhibit 3.3 – Mr James attempts to build a shared vision within his team	77
	Exhibit 3.4 – Organizational levels	79
	<b>Case example 2</b> Opportunities for involvement at Unipart	81
	Exhibit 3.5 – From involvement to self-management: the four stages of the job redesign programme	82
	Exhibit 3.6 – Evolution of specialist functions in an organization	83
	Exhibit 3.7 – Separation of the three facets of work	83
	Exhibit 3.8 – Integration of the three facets of work	84
	Exhibit 3.9 – Examples of activities best undertaken by providers and those best completed by specialists	85
	Exhibit 3.10 – Perhaps not the desired intention of flexitime	86
	Other people-related issues	86
	Exhibit 3.11 – Mr James reviews Gianni’s performance while Gianni reviews his car’s performance	88
	Reflections	89
	Exhibit 3.12 – Aligning corporate and individual goals – a two-way street on which Mr James and Gianni need to do more!	90
	Key Elements of Managing People	91
	Self-check	91
	Study activities	92
	Exploring further	92
	Notes and references	93
<b>PART 2</b>		
	<b>Designing Services, Products and Delivery Systems</b>	<b>95</b>
<b>4</b>	<b>Designing and Developing Services and Products</b>	<b>97</b>
	Designing and developing services and products	98
	<b>Case example 1</b> Service and product design at Fiat	99
	Exhibit 4.1 – Fiat’s Multipla	99
	Exhibit 4.2 – Fiat’s Gingo	99
	<b>Case example 2</b> Service and product design at Asahi Breweries	99
	The research and development process	100
	<b>Case example 3</b> Product research and development at Microsoft 1	101
	<b>Case example 4</b> Product research and development at Microsoft 2	101
	Exhibit 4.3 The Ford Motor Company ‘effectiveness lever’	102
	The design and development process for services and products	103
	Exhibit 4.4 – The design and development process for services and products	103
	<b>Case example 5</b> Design and development at GlaxoSmithKline (GSK)	104
	Exhibit 4.5 – The need to screen ideas!	106
	Exhibit 4.6 – Designing products around customer research – the approach to avoid	108
	Design – the reality	109
	Corporate strategy issues	110
	Exhibit 4.7 – The generalized service/product life cycle	110
	Exhibit 4.8 – Service/product portfolio analysis	112
	<b>Case example 6</b> Product design for different market segments at Handels Bank NW	113
	<b>Case example 7</b> Market segmentation in the hotel industry	114
	Exhibit 4.9 – The implications of the non-repeat and repeat nature of a service or product	116
	Operations techniques and approaches related to design	117
	<b>Case example 8</b> Operations techniques: oil and gas	118
	<b>Case example 9</b> Operations techniques: Toyota	118
	<b>Case example 10</b> Operations techniques: Sonoco	118
	Exhibit 4.10 – How quality function deployment links customer needs to operations requirements	120
	Exhibit 4.11 – Using quality function deployment matrix I: the ‘house of quality’	121

Exhibit 4.12 – Ratio of purchases to employment costs and net capital expenditure for selected sectors	123
Exhibit 4.13 – Reducing service/product development lead times by undertaking tasks in parallel	127
Exhibit 4.14 – Product analysis by annual sales revenue	129
<b>Case example 11 Capitalizing through volume at Assa Abloy</b>	<b>129</b>
<b>Reflections</b>	<b>130</b>
<b>Case example 12 Increasing the freshness of bread in supermarket bakeries</b>	<b>131</b>
<b>Case example 13 Product design changes at Altrack</b>	<b>131</b>
<b>Case example 14 Flying first and business class at British Airways and Virgin Atlantic</b>	<b>131</b>
<b>Key Elements of Designing and Developing Services and Products</b>	<b>132</b>
Self-check	133
Study activities	134
Exploring further	135
Notes and references	136
<b>5 Designing Service Delivery Systems</b>	<b>139</b>
Introduction	140
Distinctive characteristics of service operations	141
<b>Case example 1 Tipping as a measure of customer service</b>	<b>144</b>
Factors involved in delivering services	145
Exhibit 5.1 – Range of operations requirements within the service delivery system	146
Exhibit 5.2 – The nature of service processing	147
Exhibit 5.3 – Service categories	147
Service delivery systems – overall design	148
Exhibit 5.4 – Elements within service delivery system design	149
Exhibit 5.5 – Customer problems and retention rates	149
Exhibit 5.6 – Dissatisfied customers’ repurchase intentions	149
Exhibit 5.7 – Customer satisfaction: response time	150
Exhibit 5.8 – Customer satisfaction: number of contacts	150
Service delivery system – detailed design	150
Exhibit 5.9 – Examples of front-, middle- and back-office activities in selected service organizations	152
<b>Case example 2 Influencing customer perceptions at The Royal Bank (Canada)</b>	<b>152</b>
<b>Case example 3 Changing the customer interface point</b>	<b>153</b>
Exhibit 5.10 – Implications in delivery system design for non-repeat and repeat services	154
Exhibit 5.11 – Patients visiting a dental surgery – an example of a multi-step delivery system	156
IT-based and other service delivery system designs	156
Exhibit 5.12 – Technology is a business as well as a technical issue	157
<b>Case example 4 Telephone service delivery at Thomas Cook/West Deutsche Landesbank</b>	<b>159</b>
<b>Case example 5 Telephone banking at HSBC’s First Direct</b>	<b>160</b>
<b>Case example 6 Providing personal service online at Garden Escape</b>	<b>160</b>
<b>Case example 7 Service delivery at a local high street bank branch</b>	<b>161</b>
<b>Case example 8 Service delivery at the Moscow Scientific Institute for Eye Microsurgery</b>	<b>161</b>
Exhibit 5.13 – Dr Svyatoslav Fyoderov’s eye microsurgery unit	161
Other issues that may be considered in delivery system design	162
Exhibit 5.14 – A personalized note	162
Exhibit 5.15 – Informing customers about standards	162
Exhibit 5.16 – Complimentary provision notice	163
Exhibit 5.17 – The time stamp as a tangible symbol of freshness	163
Exhibit 5.18 – Customers as participants in the delivery system – not quite the experience that Wiggins expected!!	164
Exhibit 5.19 – Success factors of self-service approaches	165
<b>Case example 9 Self-scanning in supermarkets</b>	<b>165</b>
<b>Case example 10 Service delivery at Direct Line</b>	<b>166</b>
Service profiling	167
Exhibit 5.20 – Service profiling	169
Exhibit 5.21 – The nature of work, customer relationships and key management tasks within each market segment	169
<b>Reflections</b>	<b>170</b>
Exhibit 5.22 – Factors in reactive and proactive service delivery system design	170

Exhibit 5.23 – Trends in annual profit per customer	171
Key Elements of Designing Service Delivery Systems	171
Self-check	172
Study activities	173
Exploring further	173
Notes and references	174
<b>6 Designing Manufacturing Processes</b>	<b>177</b>
Introduction	178
Factors involved in making products	179
Exhibit 6.1 – Categories of product	179
Types of manufacturing (or production) processes	180
Exhibit 6.2 – Project – key characteristics	181
Exhibit 6.3 – Jobbing – key characteristics	181
Exhibit 6.4 – Printing – a multi-step batch process	182
Exhibit 6.5 – Batch – key characteristics	184
Exhibit 6.6 – Different stages on the Land Rover vehicle assembly line	184
Exhibit 6.7 – Line – key characteristics	185
Exhibit 6.8 – ExxonMobil's ethylene cracking plant – Fife, Scotland	186
Exhibit 6.9 – Continuous processing – key characteristics	186
Product categories and production processes reflections	186
Exhibit 6.10 – Manufacturing processes and their relationship to product categories	187
Exhibit 6.11 – Process choices	188
Exhibit 6.12 – Tasks undertaken by jobbing, batch and line processes	189
Exhibit 6.13 – Creating a high volume process	190
<b>Case example 1 Old and new car plants</b>	<b>190</b>
Exhibit 6.14 – Mr James introduces his idea of flexible and agile processes	191
<b>Case example 2 Manufacturing processes at Meindorf GmbH</b>	<b>193</b>
Implications reflected in manufacturing process alternatives	193
Exhibit 6.15 – Potential transitions between manufacturing processes	194
Exhibit 6.16 – Implications reflected in manufacturing process alternatives	195
<b>Case example 3 Manufacturing in small quantities at Toshiba</b>	<b>196</b>
Hybrid processes	196
Exhibit 6.17 – Batch layout	197
Exhibit 6.18 – Cellular layout	197
Exhibit 6.19 – The position of cells and linked batch relative to batch and line processes	198
Exhibit 6.20 – Changing from process to Nagare cell layout	199
Product profiling	200
Exhibit 6.21 – Profile analysis for two plants	201
Reflections	203
Exhibit 6.22 – Binominal model of an organization	203
Key Elements of Designing Manufacturing Processes	204
Self-check	205
Study activities	206
Exploring further	206
Notes and references	207
<b>7 Location and Layout</b>	<b>209</b>
Location	211
<b>Case example 1 Growth at Software Technology Parks of India</b>	<b>215</b>
<b>Case example 2 Growth at Plastic Omnium</b>	<b>217</b>
Exhibit 7.1 – There's more than one factor when choosing where to locate!	218
Exhibit 7.2 – The location of Au Bon Pain's outlets	218
<b>Case example 3 HSBC relocates call centre operations</b>	<b>219</b>
Exhibit 7.3 – Weighted-factor method of choosing a coffee/sandwich bar site	220
Exhibit 7.4 – Centre of gravity method of siting a new distribution centre	221
Exhibit 7.5 – Number of weekly van deliveries to each supermarket	221
Layout	222
<b>Case example 4 Creating space on passenger jets</b>	<b>224</b>
Exhibit 7.6 – Types of layout used by different types of service delivery system and manufacturing process	225

Exhibit 7.7 – Process layout for a tool-making company	227
Exhibit 7.8 – Overview of one delivery system in a hospital based on a process or functional layout	229
Exhibit 7.9 – Example of a product going through the process layout of a manufacturing company	230
Exhibit 7.10 – Cellular layout	232
<b>Case example 5 Functions at a telecommunications company call centre</b>	<b>233</b>
Exhibit 7.11 – Delivery system layouts permitting adaptations for peak and non-peak demand periods	234
Exhibit 7.12 – Mr James introduces his version of hot desking	234
Exhibit 7.13 – Layout of a typical call centre	235
<b>Case example 6 Building communal learning spaces at various North American universities</b>	<b>236</b>
<b>Detailed layout design</b>	<b>237</b>
Exhibit 7.14 – Collecting data using a load, movement or trip frequency chart	239
Exhibit 7.15 – Simplified analysis of # trips in Step 1, Exhibit 7.14	240
Exhibit 7.16 – A relationship chart used in the detailed layout design of a hospital	241
Exhibit 7.17 – Cafeteria process times	242
Exhibit 7.18 – Cafeteria flow diagram – current arrangements	242
Exhibit 7.19 – Cafeteria flow diagram – proposed arrangements	242
Exhibit 7.20 – Hybrids and their process origins	243
<b>Reflections</b>	<b>243</b>
<b>Key Elements of Location and Layout</b>	<b>244</b>
<b>Self-check</b>	<b>244</b>
<b>Study activities</b>	<b>245</b>
<b>Exploring further</b>	<b>247</b>
<b>Notes and references</b>	<b>248</b>
<b>PART 3</b>	<b>249</b>
<b>8 Managing and Controlling the Operations System</b>	<b>249</b>
<b>8 Managing Capacity</b>	<b>251</b>
Introduction	252
Capacity – general factors	253
Exhibit 8.1 – Time needs to be calculated and not plucked from the air	256
Exhibit 8.2 – Machine utilization at Conform	257
Exhibit 8.3 – Calculating efficiency for machine operators at Conform	258
Exhibit 8.4 – Salon opening and hairdressing hours	259
Exhibit 8.5 – Daily facilities utilization levels at John Michael	259
<b>Factors affecting the definition of capacity</b>	<b>260</b>
<b>Case example 1 Increasing restaurant capacity</b>	<b>264</b>
<b>Case example 2 Dell's customer support capacity</b>	<b>264</b>
Exhibit 8.6 – Capacity-related implications of service delivery system choice	265
Exhibit 8.7 – Capacity-related implications of manufacturing process choice	266
<b>Issues in determining levels of capacity</b>	<b>267</b>
<b>Case example 3 Predicting capacity at Pret a Manger</b>	<b>269</b>
<b>Planning and managing capacity</b>	<b>269</b>
Exhibit 8.8 – Operations planning and control systems	270
<b>Resource planning</b>	<b>271</b>
Exhibit 8.9 – Air traffic growth – scheduled passengers (2003–2007)	274
Exhibit 8.10 – Global airline industry – operating profit as % of operating revenues (1970–2004)	274
<b>Case example 4 Wal-Mart uses scale to compete in the US food market</b>	<b>276</b>
<b>Rough-cut capacity planning</b>	<b>278</b>
Exhibit 8.11 – Handling demand/capacity differences by order backlog/queue	281
Exhibit 8.12 – Handling demand/capacity differences by finished goods and work-in-progress inventory	281
Exhibit 8.13 – Handling demand/capacity differences by order backlog/queues and finished goods inventory	281
Exhibit 8.14 – A level capacity plan and its effect on capacity and inventory for the rough-cut planning period	282
Exhibit 8.15 – Chase demand capacity plans for a luxury Italian hotel	283
Exhibit 8.16 – A mixed plan involving level capacity (for eight months of the year), inventory and an increase in capacity from September to December inclusive	284
<b>Managing demand and capacity</b>	<b>284</b>
Exhibit 8.17 – Temporary staff market	286

<b>Case example 5 Flexible working at BMW</b>	288
<b>Case example 6 A job to suit the business and your lifestyle</b>	288
Reflections	289
Exhibit 8.18 – What it takes Delta to feed its passengers from Atlanta airport on one day	289
Exhibit 8.19 – Position in the late 1990s for four car plants in China	290
Key Elements of Managing Capacity	291
Self-check	292
Study activities	292
Exploring further	293
Notes and references	294
<b>9 Technology Developments</b>	<b>297</b>
General technology applications in services	298
Exhibit 9.1 – Technology can't solve all your problems	300
Specific technology applications	301
<b>Case example 1 The increased use of telemedicine</b>	304
<b>Case example 2 Smart card technology in urban transport</b>	305
<b>Case example 3 Fast turnaround times at Singapore's container port</b>	306
Exhibit 9.2 – Technology helps to deter shoplifting!	307
<b>Case example 4 Faster processing of insurance claims</b>	309
Technology applications in manufacturing systems and procedures	309
Exhibit 9.3 – Graphics work station for a CAD system	310
<b>Case example 5 Technology developments in the printing industry</b>	312
Product and process technology applications	312
Exhibit 9.4 – Different levels of automation and the corresponding machine configuration	313
Exhibit 9.5 – Variable vanes cell – Rolls-Royce Inchinnan (Scotland) plant	314
Exhibit 9.6 – Inline measurement on the body framework of the BMW 5 Series – BMW's Dingolfing plant	315
Exhibit 9.7 – Layout of a flexible manufacturing system	316
Exhibit 9.8 – Spot welding robots – Mini production, Oxford plant, BMW Group	317
Exhibit 9.9 – Robots at work – Land Rover, paint shop 21	317
Exhibit 9.10 – Comparative data for selected countries – robot densities and market size in 1997 and 2002	318
Exhibit 9.11 – Major components of a robot system	319
Exhibit 9.12 – Major categories of robot applications in manufacturing	319
Exhibit 9.13 – Some principal types of hand applications for level 1 robots	320
<b>Case example 6 Robots are taking over the electronics industry</b>	320
<b>Case example 7 Cross-docking warehouse systems</b>	321
Reflections	322
Exhibit 9.14 – Neil's in love with technology!	323
<b>Case example 8 The productivity paradox in information work</b>	324
Key Elements of Technology Developments	324
Self-check	325
Study activities	325
Exploring further	326
Notes and references	327
<b>10 Operations Scheduling and Execution</b>	<b>329</b>
Introduction	330
Exhibit 10.1 – Cushioning the operations delivery systems from the instability of the market	331
Exhibit 10.2 – Operations planning and control systems	332
Exhibit 10.3 – Overview of the main phases in planning and control	333
Operations planning and control – the interface	333
Exhibit 10.4 – Aspects of the demand and capacity review by phase in the operations planning and control system	334
<b>Case example 1 Demand planning at MK Electric</b>	334
Operations control – scheduling and execution	335
Operations control – basic tasks	336
Operations scheduling – systems	338
Exhibit 10.5 – Bar chart representing assignment allocations	339
Exhibit 10.6 – Bar chart for scheduling initial tasks	340

Exhibit 10.7 – Bar chart showing orders against machine processes	340
Exhibit 10.8 – The principal building blocks used to construct networks	341
Exhibit 10.9 – Mr James and Gianni have been working out the brief for a new project	342
Exhibit 10.10 – Introducing the use of a dummy activity	343
Exhibit 10.11 – Network representing the task above	343
Exhibit 10.12 – The activities involved in preparing an educational cassette	344
Exhibit 10.13 – Network for the activities given in Exhibit 10.12 for preparing an educational cassette	345
Exhibit 10.14 – Explanation of the information contained in an event node	346
Exhibit 10.15 – Mr James doesn't want to hear that the project due date is unrealistic	348
Exhibit 10.16 – Master schedule for a service or product at a point in time	352
Exhibit 10.17 – Elements of the planning horizon	352
Exhibit 10.18 – Rules concerning the level of change allowed to the master schedule at different times on the planning horizon	353
Exhibit 10.19 – Photographs of an EIW 20 mm gland as detailed in Exhibit 10.20	354
Exhibit 10.20 – The bill of materials for an EIW 20 mm gland	355
Exhibit 10.21 – Master schedule for EIW 20 mm gland	356
Exhibit 10.22 – Gross and net requirements for EIW 20 mm gland for Period 7	357
Exhibit 10.23 – The direction of orders and flow of the operations process in an MRPI and JIT system	359
<b>Case example 2 JIT system developments at Nissan</b>	<b>360</b>
Exhibit 10.24 – Simplified operations unit controlled by a JIT system	362
Exhibit 10.25 – JIT brings a change in attitudes, or else (smiles)!	363
Exhibit 10.26 – Finished goods inventory at a Mitsubishi outlet in California	364
Exhibit 10.27 – The different orientation of traditional and JIT approaches	366
Exhibit 10.28 – Excess inventory covers over problems that are consequently not exposed and dealt with	367
Exhibit 10.29 – ERP system	370
<b>Case example 3 IT systems changes at Dell</b>	<b>373</b>
<b>Reflections</b>	<b>374</b>
Exhibit 10.30 – Operations scheduling systems and service delivery system type	375
Exhibit 10.31 – Operations scheduling systems and manufacturing process type	375
<b>Key Elements of Operations Scheduling and Execution</b>	<b>378</b>
<b>Self-check</b>	<b>379</b>
<b>Study activities</b>	<b>379</b>
<b>Exploring further</b>	<b>381</b>
<b>Notes and references</b>	<b>381</b>
<b>11 Managing Quality</b>	<b>385</b>
<b>What is quality and why is it important?</b>	<b>387</b>
Exhibit 11.1 – The quality offering	388
<b>Case example 1 Guaranteed refunds at Hampton Inns</b>	<b>388</b>
<b>Case example 2 No-frills bar code printers</b>	<b>388</b>
<b>Case example 3 Service quality at UPS</b>	<b>389</b>
<b>Specifying the service or product</b>	<b>389</b>
Exhibit 11.2 – The technical and business specifications of a service or product offering	389
<b>Quality conformance</b>	<b>390</b>
Exhibit 11.3 – Redefining a general quality characteristic into constituent elements	390
Exhibit 11.4 – The broad stages in the operations process where quality conformance checks can be made	391
<b>Case example 4 Regaining consumer confidence at Johnson &amp; Johnson</b>	<b>392</b>
<b>Case example 5 Marlboro brand</b>	<b>393</b>
<b>Case example 6 Tarnished reputations at Coca-Cola and Perrier</b>	<b>393</b>
<b>Quality principles</b>	<b>393</b>
<b>Case example 7 On-time flights</b>	<b>394</b>
<b>Quality philosophies</b>	<b>395</b>
Exhibit 11.5 – Juran's sporadic and chronic quality problems	400
Exhibit 11.6 – Minimizing the costs of quality	401
Exhibit 11.7 – Crosby's quality management maturity grid	404
Exhibit 11.8 – Crosby's quality vaccine	405
<b>Tools and techniques – general issues</b>	<b>406</b>
<b>Case example 8 Motivation and support are not enough to do your job</b>	<b>406</b>
<b>Case example 9 Anstruther Fish Bar's secret batter recipe</b>	<b>406</b>

Exhibit 11.9 – Data on 15 deliveries in Quarter 1	407
<b>Process tools and techniques</b>	<b>408</b>
Exhibit 11.10 – Pareto analysis of reasons for flight departure	408
Exhibit 11.11 – Checklist of frequency of problems at a retail outlet	409
Exhibit 11.12 – Cause and effect diagram used to ascertain the cause of flight delays	410
Exhibit 11.13 – Scatter diagram	411
Exhibit 11.14 – Double sampling plan	413
Exhibit 11.15 – Multiple sampling plan	413
<b>The operations process – managing quality in practice</b>	<b>414</b>
Exhibit 11.16 – General relationships of an OC curve	416
Exhibit 11.17 – OC curves for different sampling sizes	417
Exhibit 11.18 – The OC curve for 100 per cent inspection	418
<b>Case example 10 Customer satisfaction at the Royal Bank of Scotland</b>	<b>418</b>
Exhibit 11.19 – Control chart for variables	420
Exhibit 11.20 – Control chart for attributes	420
Exhibit 11.21 – Control charts in a call centre	421
<b>Six-sigma quality</b>	<b>422</b>
Exhibit 11.22 – Specification limit and corresponding percentage good quality and # defects per million	422
<b>Case example 11 General Electric's six-sigma quality goal</b>	<b>423</b>
<b>Case example 12 Airline industry's safety record</b>	<b>423</b>
<b>Formalizing the search for quality</b>	<b>424</b>
Exhibit 11.23 – ISO 9000 certification – what it isn't!	424
Exhibit 11.24 – Baldrige Award – 2004 criteria for performance excellence	426
Exhibit 11.25 – European Quality Award: categories and weights (2004)	427
<b>Total quality management (TQM)</b>	<b>429</b>
<b>Case example 13 Committing to quality improvement</b>	<b>431</b>
<b>Reflections</b>	<b>431</b>
Exhibit 11.26 – The evolution in managing quality	432
<b>Key Elements of Managing Quality</b>	<b>433</b>
<b>Self-check</b>	<b>434</b>
<b>Study activities</b>	<b>435</b>
<b>Exploring further</b>	<b>437</b>
<b>Notes and references</b>	<b>438</b>
<b>12 Managing Inventory</b>	<b>441</b>
Exhibit 12.1 – Flow of materials and position and types of inventory	442
Exhibit 12.2 – Rate of supply and demand and level of inventory	443
<b>Corporate attitudes</b>	<b>444</b>
<b>Inventory – role, types and functions</b>	<b>444</b>
Exhibit 12.3 – Process stage and types of inventory	446
Exhibit 12.4 – Role of different types of inventory	447
Exhibit 12.5 – Inventory functions related to categories of inventory in manufacturing	448
Exhibit 12.6 – Inventory functions related to manufacturing processes of jobbing, batch and line	448
Exhibit 12.7 – Inventory functions in relation to different service delivery systems	450
<b>Managing and controlling inventory – general issues</b>	<b>451</b>
Exhibit 12.8 – General preferences of three key functions towards the level of holding by type of inventory	452
<b>Managing and controlling inventory – specific issues</b>	<b>453</b>
Exhibit 12.9 – A representative sample of inventory items in order of decreasing ARV	455
Exhibit 12.10 – Summary of items in Exhibit 12.9	455
Exhibit 12.11 – Pareto curve and ABC analysis for items in Exhibit 12.9	456
Exhibit 12.12 – The downside of bulk buying without some analyses	457
<b>Inventory decisions</b>	<b>458</b>
<b>Case example 1 Holding inventory in retail outlets</b>	<b>460</b>
<b>Case example 2 Pre-prepared food in restaurants</b>	<b>460</b>
<b>Case example 3 Balancing inventory approaches</b>	<b>460</b>
Exhibit 12.13 – Control of an individual part through an order point system	462
Exhibit 12.14 – Above-average demand above the reorder level followed by below-average demand	462
Exhibit 12.15 – Below-average demand above the reorder level followed by above-average demand	463
Exhibit 12.16 – Normal distribution curve	464

Inventory systems	465
Exhibit 12.17 – One value of regular stocktaking	466
Exhibit 12.18 – Inventory/staff hour ratios	469
Inventory analysis	470
<b>Case example 4 Reducing the level of customer support inventory</b>	<b>471</b>
<b>Case example 5 Reducing the level of operations inventory</b>	<b>471</b>
Reflections	471
Key Elements of Managing Inventory	472
Self-check	473
Study activities	474
Exploring further	475
Notes and references	475
<b>13 Managing the Supply Chain</b>	<b>477</b>
What is a supply chain?	479
Supply chain management	479
Exhibit 13.1 – Supply chain for a high street sandwich bar and a manufacturer of consumer goods	480
Exhibit 13.2 – Managing the supply chain and synchronizing the business dimensions involved	481
The make-or-buy decision	481
The reality of make-or-buy decisions	483
<b>Case example 1 Strategic outsourcing decisions</b>	<b>483</b>
Advantages and disadvantages of making and buying	484
<b>Case example 2 Land Rover's single sourcing policy</b>	<b>486</b>
Domestic vs offshore sourcing options and strategic fit	486
Exhibit 13.3 – Sourcing location, percentage of goods purchased and discounts available	487
Exhibit 13.4 – Suppliers' latitude for volume or mix change before and during the sales season, by geographical region	487
<b>Case example 3 Creating a positive retailer experience at Fender International</b>	<b>488</b>
Alternatives to the make-or-buy option	488
Exhibit 13.5 – Responses to the question 'Are joint ventures a viable alternative?'	489
Exhibit 13.6 – Reasons for forming joint ventures	489
Managing the supply chain	490
<b>Case example 4 Chiquita relocates from Cincinnati to Costa Rica</b>	<b>491</b>
Supply chain management issues	491
Exhibit 13.7 – Outsourcing in the supply chain continues to grow	491
Exhibit 13.8 – Why Mr James wants to outsource the customer service call centre!	492
Exhibit 13.9 – Rising level of markdowns in the retail sector	493
Exhibit 13.10 – Customer/supplier dependence	493
Exhibit 13.11 – Mr James wants to introduce strategic alliances so he can threaten suppliers more formally	494
<b>Case example 5 FedEx and Kinko joined forces to speed delivery</b>	<b>495</b>
Developing the supply chain	495
Exhibit 13.12 – Phase 1 – fragmented supply chains	496
Exhibit 13.13 – Phase 2 – integrating supply chain activities within a business	496
Exhibit 13.14 – Phase 3 – coordinating activities between businesses	496
Exhibit 13.15 – Phase 4 – real-time planning and execution of activities across the supply chain	497
<b>Case example 6 The direct alpine approach to mountain climbing</b>	<b>498</b>
Aspects of change	498
<b>Case example 7 Japanese companies' approach to suppliers</b>	<b>499</b>
Exhibit 13.16 – Phases in changing customer attitudes to suppliers	499
<b>Case example 8 Electronic service alerts at Caterpillar</b>	<b>500</b>
<b>Case example 9 Stockholding and inventory at GAP</b>	<b>500</b>
Exhibit 13.17 – The evolving role of IT in managing supply chains	501
Exhibit 13.18 – One type of internet fraud	501
Exhibit 13.19 – A vulnerable side of the internet	502
<b>Case example 10 Supply chain integration at Dell</b>	<b>502</b>
<b>Case example 11 Synchronizing the supply chain at Calyx and Corolla</b>	<b>504</b>
E-procurement	504
Exhibit 13.20 – E-procurement system	505

Process tools within supply chain management	506
Exhibit 13.21 – The weighted-factor rating approach to supplier selection	509
Distribution and transportation systems	510
Exhibit 13.22 – A comparison of transportation systems	511
E-commerce	512
Exhibit 13.23 – Main goal of IT investment	513
Reflections	514
Exhibit 13.24 – Some unforeseen consequences of e-commerce	515
Exhibit 13.25 – How companies rank market drivers as potential order-winners and qualifiers	516
Exhibit 13.26 – Changing nature of customer–supplier practices	517
Key Elements of Managing the Supply Chain	518
Self-check	518
Study activities	519
Exploring further	520
Notes and references	521
<b>14 Process and Delivery System Reliability and Maintenance</b>	<b>523</b>
Process reliability – making a system fail-safe	525
Process reliability – checking for failure	526
Exhibit 14.1 – The bathtub curve	527
Maintenance and terotechnology	529
Maintenance – the concept	530
Maintenance – the task	530
Exhibit 14.2 – Typical maintenance activities	531
Which parts of a process to maintain	532
Case example 1 Aircraft maintenance requirements influence flight patterns	532
Different types of maintenance	533
Planned maintenance	535
Exhibit 14.3 – Neil and his so-called stand-by equipment	536
Exhibit 14.4 – Benefits from using RCM	537
Other policy issues	537
Total productive maintenance	539
Exhibit 14.5 – Benefits resulting from the introduction of TPM	541
Case example 2 Introducing TPM	541
Case example 3 Cultural benefits of TPM at Forties Alpha	542
Energy management	542
Exhibit 14.6 – Lloyd undertakes an energy audit	543
Managing the maintenance function	543
Exhibit 14.7 – Part of a maintenance plan for a zinc plating unit	544
Exhibit 14.8 – Overall equipment effectiveness (OEE)	546
Reflections	546
Key Elements of Process and Delivery System Reliability and Maintenance	547
Self-check	548
Study activities	548
Exploring further	550
Notes and references	550
<b>PART 4 Improving Operations</b>	<b>551</b>
<b>15 Time and Productivity</b>	<b>553</b>
Time – the common denominator in managing operations	555
Exhibit 15.1 – Heath Motors – output in terms of units produced	555
Exhibit 15.2 – Heath Motors – output in terms of hours produced	556
Measuring the content of work	556
Exhibit 15.3 – The reasons for and objectives of measuring work	556
Exhibit 15.4 – Factors affecting the time to complete a task and approaches to overcoming these factors	557
Approaches to measuring work content	557
Exhibit 15.5 – Steps to establish a standard time for a job	559
Exhibit 15.6 – Exhibit 15.5 details shown diagrammatically	559
Exhibit 15.7 – Types of estimating to determine the time to be allocated to complete a task	561

Exhibit 15.8 – Approaches to measuring work – some typical service applications	564
<b>Reflections</b>	<b>564</b>
<b>Productivity</b>	<b>564</b>
Exhibit 15.9 – Trends in output per hour in manufacturing for selected countries 1960–2000 (1992=100)	565
Exhibit 15.10 – Share of world trade in manufactured goods for selected countries, 1980–96	565
Exhibit 15.11 – GDP per capita for selected countries 1983–2002	566
<b>Approaches to measuring productivity</b>	<b>566</b>
Exhibit 15.12 – European Automotive Productivity Index, 2002: top five and bottom five	567
Exhibit 15.13 – Added value in relation to bought-out materials/services and sales	568
<b>Ways to improve productivity</b>	<b>568</b>
Exhibit 15.14 – Approaches to improving productivity and some of the trade-offs involved	569
<b>Service applications</b>	<b>569</b>
Exhibit 15.15 – Percentage changes in productivity for the total business (excluding farming) and the manufacturing sectors in the USA (1984–2003)	569
Exhibit 15.16 – One way to create productivity improvements by involvement	570
Exhibit 15.17 – Examples of single-factor and multi-factor productivity measures	571
<b>Case example 1 Productivity at Convergys</b>	<b>572</b>
<b>Reflections</b>	<b>572</b>
Exhibit 15.18 – Comparative prices for a three-minute international telephone call for selected countries (1994–2003)	573
<b>Key Elements of Time and Productivity</b>	<b>573</b>
<b>Self-check</b>	<b>574</b>
<b>Study activities</b>	<b>575</b>
<b>Exploring further</b>	<b>576</b>
<b>Notes and references</b>	<b>576</b>
<b>16 Improving Operations</b>	<b>579</b>
<b>Measuring performance</b>	<b>580</b>
Exhibit 16.1 – Operations tasks and some relevant performance measures	581
Exhibit 16.2 – Calculating the weekly efficiency for distribution warehouse staff	582
Exhibit 16.3 – The experience curve principle showing cost/volume or price/volume relationships expressed on both a linear and log-log scale	583
Exhibit 16.4 – Experience curve over a six-year period – voucher processing centre	584
Exhibit 16.5 – Mr James's way to make delivery performance look good	585
<b>Stepped versus incremental approaches to improvement</b>	<b>586</b>
<b>Case example 1 Sheffield City Council's geographic information system</b>	<b>587</b>
<b>Case example 2 Revolutionizing productivity in South African gold mining</b>	<b>587</b>
<b>Case example 3 The Personal Shopping Assistant at Metro's Future Store</b>	<b>587</b>
<b>Case example 4 Minimizing costs at McDonald's</b>	<b>587</b>
Exhibit 16.6 – Stepped versus incremental change programmes	588
<b>Case example 5 Introducing lean operations at Porsche</b>	<b>588</b>
Exhibit 16.7 – Features of stepped and incremental approaches to improvement	589
<b>Continuous improvement</b>	<b>589</b>
Exhibit 16.8 – The cost iceberg	589
<b>Case example 6 Measuring productivity at IBM</b>	<b>590</b>
<b>Case example 7 Saving energy at Volvo</b>	<b>591</b>
<b>Case example 8 Cutting costs at Ricoh</b>	<b>591</b>
<b>An approach to improvement: the Deming cycle</b>	<b>591</b>
Exhibit 16.9 – The Deming cycle	591
<b>Tools and techniques for improvement</b>	<b>592</b>
Exhibit 16.10 – Process chart symbols	593
Exhibit 16.11 – Symbols used in drawing service maps	593
Exhibit 16.12 – Relationship of charting techniques	594
Exhibit 16.13 – An example of a cause and effect diagram	598
Exhibit 16.14 – Mr James wants to start a BPR project	600
Exhibit 16.15 – Re-engineering principles in practice	601
<b>Case example 9 Reviewing the accounts function at the Ford Motor Company</b>	<b>601</b>
<b>Case example 10 Reducing processing times at Mutual Benefit Life</b>	<b>602</b>
<b>Case example 11 Radically improving performance at Taco Bell</b>	<b>602</b>

<b>Case example 12</b> Reducing take-off costs at Jet Blue Airways	602
<b>Case example 13</b> Improving productivity at Western Provident Association	602
Employee involvement	603
<b>Case example 14</b> Improving work systems at Unipart	603
Reflections	603
<b>Case example 14</b> Improving work systems at Unipart	603
Exhibit 16.16 – Change programmes in selected sectors of a European bank	604
Key Elements of Improving Operations	606
Self-check	606
Study activities	607
Exploring further	607
Notes and references	608
<b>PART 5</b>	
<b>Managing Operations in Practice: Long Case Studies</b>	<b>609</b>
1 Ash Electrics	611
2 Berwick Carpets	612
3 British Airways	616
4 Caltrex Engineering (A)	620
5 Caltrex Engineering (B)	624
6 Fabritex	626
7 Future Investments Group	633
8 Georgian Frames	638
9 Ghent Fireworks	640
10 Holmgren Engineering	646
11 Hunting Swift	653
12 The Ipswich Hospital NHS Trust	654
13 Lloyds TSB	664
14 McDonald's Corporation	670
15 Northmore Finance Direct	679
16 Platt Green Electronics	688
17 Pret A Manger	689
18 Redman Company	696
19 Richmond Plastics	698
20 Riviona Bank	699
21 Selfridges	706
22 Southwest Airlines	710
23 Spencer Thompson	715
24 Tile Products	716
25 Too Short the Day	719
26 The Turn of an Unfriendly Card	723
27 Weavers Homeopathic Products	729
28 What They Teach You at Disney U(niversity)	733
29 Wilson Pharmaceuticals	736
30 Yuppie Products	738
31 Zara	745
<i>Acknowledgements</i>	751
<i>Answers to Self-check Tests</i>	752
<i>Index</i>	753