

Operations and Process Management

Principles and practice for strategic impact

Fifth edition



 Pearson

Nigel Slack and
Alistair Brandon-Jones

OPERATIONS AND PROCESS MANAGEMENT



Pearson

At Pearson, we have a simple mission: to help people make more of their lives through learning.

We combine innovative learning technology with trusted content and educational expertise to provide engaging and effective learning experiences that serve people wherever and whenever they are learning.

From classroom to boardroom, our curriculum materials, digital learning tools and testing programmes help to educate millions of people worldwide – more than any other private enterprise.

Every day our work helps learning flourish, and wherever learning flourishes, so do people.

To learn more, please visit us at www.pearson.com/uk



OPERATIONS AND PROCESS MANAGEMENT

Principles and Practice for Strategic Impact

Fifth Edition

Nigel Slack

Alistair Brandon-Jones



Pearson

Harlow, England • London • New York • Boston • San Francisco • Toronto • Sydney • Dubai • Singapore • Hong Kong
Tokyo • Seoul • Taipei • New Delhi • Cape Town • São Paulo • Mexico City • Madrid • Amsterdam • Munich • Paris • Milan

PEARSON EDUCATION LIMITED

Kao Two
Kao Park
Harlow CM17 9NA
United Kingdom
Tel: +44 (0)1279 623623
Web: www.pearson.com/uk

First published 2006 (print)
Second edition published 2009 (print)
Third edition published 2012 (print and electronic)
Fourth edition published 2015 (print and electronic)
Fifth edition published 2018 (print and electronic)

© Pearson Education Limited 2006, 2009 (print)
© Pearson Education Limited 2012, 2015, 2018 (print and electronic)

The rights of Nigel Slack and Alistair Brandon-Jones to be identified as authors of this work have been asserted by them in accordance with the Copyright, Designs and Patents Act 1988.

The print publication is protected by copyright. Prior to any prohibited reproduction, storage in a retrieval system, distribution or transmission in any form or by any means, electronic, mechanical, recording or otherwise, permission should be obtained from the publisher or, where applicable, a licence permitting restricted copying in the United Kingdom should be obtained from the Copyright Licensing Agency Ltd, Barnard's Inn, 86 Fetter Lane, London EC4A 1EN.

The ePublication is protected by copyright and must not be copied, reproduced, transferred, distributed, leased, licensed or publicly performed or used in any way except as specifically permitted in writing by the publishers, as allowed under the terms and conditions under which it was purchased, or as strictly permitted by applicable copyright law. Any unauthorised distribution or use of this text may be a direct infringement of the authors' and the publisher's rights and those responsible may be liable in law accordingly.

All trademarks used herein are the property of their respective owners. The use of any trademark in this text does not vest in the author or publisher any trademark ownership rights in such trademarks, nor does the use of such trademarks imply any affiliation with or endorsement of this book by such owners.

Pearson Education is not responsible for the content of third-party internet sites.

ISBN: 978-1-292-17613-0 (print)
978-1-292-17617-8 (PDF)
978-1-292-17618-5 (ePub)

British Library Cataloguing-in-Publication Data

A catalogue record for the print edition is available from the British Library

Library of Congress Cataloguing-in-Publication Data

Names: Slack, Nigel, author. | Brandon-Jones, Alistair, author.

Title: Operations and process management principles and practice for strategic impact / Nigel Slack, Alistair Brandon-Jones.

Description: Fifth edition. | United Kingdom : Pearson Education Limited, [2018] | Includes bibliographical references and index.

Identifiers: LCCN 2017050767 | ISBN 9781292176130 (Print) | ISBN 9781292176178 (PDF) | ISBN 9781292176185 (ePub)

Subjects: LCSH: Manufacturing processes. | Process control.

Classification: LCC TS183 .O64 2018 | DDC 658.5--dc23

LC record available at <https://lcn.loc.gov/2017050767>

10 9 8 7 6 5 4 3 2 1
22 21 20 19 18

Front cover image © PM Images/Getty Images
Print edition typeset in 9.25/12.5pt Syntax Com by SPi Global
Printed in Slovakia by Neografia

NOTE THAT ANY PAGE CROSS REFERENCES REFER TO THE PRINT EDITION



Brief contents

Guide to case studies	xiii
Preface	xv
About the authors	xix
Acknowledgements	xxi
Publisher's acknowledgements	xxii
1 Operations and processes	1
2 Operations and strategic impact	39
3 Product and service innovation	81
4 Operations scope and structure	117
5 Process design 1 – Positioning	161
6 Process design 2 – Analysis	191
7 Supply chain management	237
8 Capacity management	273
9 Inventory management	309
10 Resource planning and control	343
11 Lean synchronisation	385
12 Improvement	419
13 Quality management	459
14 Risk and resilience	499
15 Project management	531
Index	567



Contents

Guide to case studies	xiii
Preface	xv
About the authors	xix
Acknowledgements	xxi
Publisher's acknowledgements	xxii
1 Operations and processes	1
Executive summary	2
Does the organisation understand the potential of operations and process management?	4
Does the business take a process perspective?	9
Does operations and process management have a strategic impact?	20
Are processes managed to reflect their operating circumstances?	24
Are operations and process decision-making appropriate?	27
Critical commentary	30
Summary checklist	31
Case study: <i>Design house partnerships at concept design services</i>	32
Applying the principles	35
Notes on chapter	36
Taking it further	37
2 Operations and strategic impact	39
Executive summary	40
Does operations have a strategy?	43
Does operations strategy reflect business strategy (top-down)?	50
Does operations strategy align with market requirements (outside-in)?	54
Does operations strategy learn from operational experience (bottom-up)?	59
Does operations strategy develop the capability of its resources and processes (inside-out)?	60
Are the four perspectives of operations strategy reconciled?	64
Does operations strategy set an improvement path?	68
Critical commentary	72
Summary checklist	73

Case study: <i>McDonald's: half a century of growth</i>	74
Applying the principles	78
Notes on chapter	79
Taking it further	80
3 Product and service innovation	81
Executive summary	82
What is the strategic role of product and service innovation?	84
Are the product and service innovation process objectives specified?	90
Is the product and service innovation process defined?	93
Are the resources for developing product and service innovation adequate?	100
Is the development of products and services and of the process that created them simultaneous?	103
Critical commentary	108
Summary checklist	109
Case study: <i>Developing 'Savory Rosti-crisps' at Dreddo Dan's</i>	110
Applying the principles	113
Notes on chapter	114
Taking it further	115
4 Operations scope and structure	117
Executive summary	118
Does the operation understand its place in its supply network?	120
How vertically integrated should the operation's network be?	125
How do operations decide what to do in-house and what to outsource?	128
What configuration should a supply network have?	131
How much capacity should operations plan to have?	134
Where should operations be located?	139
Critical commentary	143
Summary checklist	144
Case study: <i>Aarens Electronic</i>	145
Applying the principles	147
Notes on chapter	148
Taking it further	149
Supplement: Forecasting	150
5 Process design 1 – Positioning	161
Executive summary	162
Does the operation understand the importance of how it positions its process resources?	164
Do processes match volume–variety requirements?	167
Are process layouts appropriate?	173
Are process technologies appropriate?	178

Are job designs appropriate?	180
Critical commentary	184
Summary checklist	185
Case study: <i>McPherson Charles Solicitors</i>	186
Applying the principles	188
Notes on chapter	190
Taking it further	190
6 Process design 2 – Analysis	191
Executive summary	192
Is the importance of detailed process design understood?	194
Are process performance objectives clear?	197
How are processes currently designed?	200
Are process tasks and capacity configured appropriately?	205
Is process variability recognised?	215
Critical commentary	220
Summary checklist	221
Case study: <i>The Action Response Applications Processing Unit (ARAPU)</i>	222
Applying the principles	224
Notes on chapter	226
Taking it further	227
Supplement: Queuing analysis	228
7 Supply chain management	237
Executive summary	238
Is the importance of supply chain management understood?	240
Are supply chain objectives clear?	245
How should supply chain relationships be managed?	249
How is the supply side managed?	252
How is the demand side managed?	256
Are supply chain dynamics under control?	260
Critical commentary	263
Summary checklist	265
Case study: <i>Supplying fast fashion</i>	266
Applying the principles	268
Notes on chapter	270
Taking it further	271
8 Capacity management	273
Executive summary	274
Is capacity management integrated across levels?	277
What is the operation's current capacity?	281

How well are demand–capacity mismatches understood?	284
What should be the operation’s base capacity?	287
How can demand–capacity mismatches be managed?	289
How should capacity be controlled?	297
Critical commentary	299
Summary checklist	300
Case study: <i>Blackberry Hill Farm</i>	301
Applying the principles	306
Notes on chapter	308
Taking it further	308
9 Inventory management	309
Executive summary	310
Is the role of inventory understood?	312
Why should there be any inventory?	316
Is the right quantity being ordered?	321
Are inventory orders being placed at the right time?	329
Is inventory being controlled effectively?	332
Critical commentary	336
Summary checklist	338
Case study: <i>supplies4medics.com</i>	339
Applying the principles	341
Notes on chapter	342
Taking it further	342
10 Resource planning and control	343
Executive summary	344
Do resource planning and control have all the right elements?	345
Are resource planning and control information integrated?	352
Are core planning and control activities effective?	356
Critical commentary	368
Summary checklist	369
Case study: <i>subText Studios Singapore</i>	370
Applying the principles	373
Notes on chapter	376
Taking it further	376
Supplement: Materials requirements planning (MRP)	377
11 Lean synchronisation	385
Executive summary	386
What are the benefits of lean synchronisation?	388

What are the barriers to 'lean synchronisation'?	393
Is flow streamlined?	398
Does supply exactly match demand?	402
Are processes flexible?	403
Is variability minimised?	404
Is lean synchronisation applied throughout the supply network?	407
Critical commentary	410
Summary checklist	413
Case study: <i>Saint Bridget's Hospital</i>	414
Applying the principles	416
Notes on chapter	418
Taking it further	418
12 Improvement	419
Executive summary	420
Why is improvement so important?	422
What is the gap between current and required performance?	426
What is the most appropriate improvement path?	437
What techniques should be used to facilitate improvement?	443
How can improvement be made to stick?	447
Critical commentary	451
Summary checklist	452
Case study: <i>Ferndale Sands Conference Centre</i>	453
Applying the principles	456
Notes on chapter	458
Taking it further	458
13 Quality management	459
Executive summary	460
Is the importance of quality management universally understood and applied?	462
Is quality adequately defined?	468
Is quality adequately measured?	471
Is quality adequately controlled?	474
Does quality management always lead to improvement?	478
Critical commentary	481
Summary checklist	482
Case study: <i>Turnround at the Preston Plant</i>	483
Applying the principles	485
Notes on chapter	487
Taking it further	487
Supplement: Statistical process control (SPC)	488

14 Risk and resilience	499
Executive summary	500
Is there an integrated approach to operations risk and resilience?	502
Have potential failure points been assessed?	507
Have failure prevention measures been implemented?	514
Have failure mitigation measures been implemented?	518
Have failure recovery measures been implemented?	522
Critical commentary	525
Summary checklist	526
Case study: <i>Slagelse Industrial Services</i>	527
Applying the principles	528
Notes on chapter	530
Taking it further	530
15 Project management	531
Executive summary	532
Is the applicability of project management understood?	534
Is the nature of the project and its stakeholders understood?	537
Is the project well defined?	543
Is project management adequate?	544
Has the project been adequately planned?	547
Is the project adequately controlled?	554
Critical commentary	557
Summary checklist	558
Case study: <i>United Photonics Malaysia Sdn Bhd</i>	559
Applying the principles	562
Notes on chapter	564
Taking it further	565
Index	567

Supporting resources

Visit www.pearsoned.co.uk/slack to find valuable online resources

For lecturers

- Instructor's Manual, including teaching notes for each chapter, model answers to all questions in the book and guided solutions for all case studies.
- PowerPoint slides

For students

- The student companion website provides model answers to the first two 'Applying the Principles' in each chapter.
For more information, please contact your local Pearson Education sales representative or visit www.pearsoned.co.uk/slack.

Guide to case studies

Chapter	Case name and description	Region	Manufacturing/service	Company size	Topics/techniques
Chapter 1 Operations and processes	Design house partnerships at concept design services	Europe	M,S	Medium	Role of operations, process objectives, types of operation and process
Chapter 2 Operations and strategic impact	McDonald's: half a century of growth	World	S	Large	Operations strategy, operations objectives, strategic fit
Chapter 3 Product and service innovation	Developing 'Savory Rosti-crisps' at Dreddo Dan's	World	M	Large	Product development, operations strategy, process performance
Chapter 4 Operations scope and structure	Aarens Electronic	Europe	S/M	Medium	Location, capacity, scope of operations
Chapter 5 Process design 1 – Positioning	McPherson Charles Solicitors	UK	S	Medium	Process design, job design, process technology, process resourcing
Chapter 6 Process design 2 – analysis	The Action Response Applications Processing Unit (ARAPU)	Africa, Asia, UK	S	Small	Process design, process mapping, balancing, Little's law
Chapter 7 Supply chain management	Supplying fast fashion	World	S M	Large	Outsourcing, supply chain design, fast response
Chapter 8 Capacity management	Blackberry Hill Farm	UK	S M	Small	Capacity management, forecasting, cumulative production and demand plotting
Chapter 9 Inventory management	supplies4medics.com	Europe	S	Medium	Inventory management, Inventory information systems, ABC analysis
Chapter 10 Resource planning and control	subText Studios Singapore	Singapore	S	Medium	Planning and control, Gantt charts, activity monitoring, controlling activities
Chapter 11 Lean synchronisation	Saint Bridget's Hospital	Europe	S	Medium	Improvement, quality, application of lean principles
Chapter 12 Improvement	Ferndale Sands Conference Centre	Australia	S	Small	Improvement, performance, prioritisation
Chapter 13 Quality management	Turnround at the Preston plant	Canada	M	Medium	Improvement principles, statistical process control, process learning, operations capabilities
Chapter 14 Risk and resilience	Slagelse Industrial Services (SIS)	Denmark	S M	Large	Risk, failure prevention, supplier selection, relationship management
Chapter 15 Project management	United Photonics Malaysia Sdn Bhd	Malaysia	S	Large	Project planning, project risk, project monitoring



Preface

Why is operations and process management essential?

Because it is about getting things done. Because without effective operations and processes there can be no long-term success for any organisation. Because it is at the heart of what all organisations do; they create value through their productive resources. Because it is the essential link that connects broad long-term strategy and day-to-day ongoing activities. This is why operations and process management has been changing. It has always been exciting, and it has always been challenging, but now it has acquired a much more prominent profile. The current edition reflects this in a number of ways.

It stresses the importance of operations and process management

Of course, it has always been important, but increasingly managers in all types of enterprise are accepting that operations management can make or break their businesses. Effective operations management can keep costs down, enhance the potential to improve revenue, promote an appropriate allocation of capital resources and, most important, develop the capabilities that provide future competitive advantage.

It stresses the real strategic impact of operations and process management

Operations are not always operational. The operations function also has a vital strategic dimension, and operations management is now expected to play a part in shaping strategic direction, not just responding to it.

It stresses that operations and process management matters to all sectors of the economy

At one time operations management was seen as being most relevant to manufacturing and a few types of mass service businesses. Now the lessons are seen applying to all types of enterprise; all types of service and manufacturing, large or small organisations, public or private, for-profit or not-for-profit.

It stresses that operations and process management is of interest to all managers

Perhaps most importantly, because operations management is accepted as being founded on the idea of managing process, and because managers in all functions of the business are now accepting that they spend much of their time managing processes, it is clear that to some extent, all managers are operations managers. The principles and practice of operations management are relevant to every manager.

It extends the scope of operations and process management

The obvious unit of analysis of operations management is the operations function itself – the collection of resources and processes that produce products and services. But, if managers from other functions are to be included, operations management must also address itself to process

management at a more generic level. Also, no operation can consider itself in isolation from its customers, suppliers, collaborators and competitors. It must see itself as part of the extended supply network. Operations management increasingly needs to work at all three levels of analysis – the individual process, the operation itself and the supply network.

All this has implications for the way operations management is studied, especially at post-experience and postgraduate levels, and the way operations management is practised. It has also very much shaped the way this book has been structured. In addition to covering all the important topics that make the subject so powerful, it places particular emphasis on the following:

- **Principles** – that is, the core ideas that describe how operations behave, how they can be managed and how they can be improved. These are not immutable laws or prescriptions that dictate how operations *should* be managed, nor are they descriptions that simply explain or categorise issues. But they are indications of important underlying ideas.
- **Diagnosis** – an approach that questions and explores the fundamental drivers of operations performance. Aims to uncover or ‘diagnose’ the underlying trade-offs that operations need to overcome and the implications and consequences of the courses of action that could be taken.
- **Practice** – anyone with managerial experience, or who is approaching careers choices, understands the importance of developing practical knowledge and skills that can be applied in practice. This requires an approach, as well as frameworks and techniques, which can be adapted to take account of the complexity and ambiguity of operations, yet give guidance to identifying and implementing potential solutions.

Who should use this book?

This book is intended to provide an introduction to operations and process management for everyone who wishes to understand the nature, principles and practice of the subject. It is aimed primarily at those who have some management experience (although no prior academic knowledge of the area is assumed), or who are about to embark on a career in management. For example:

- *MBA students* should find that its practical discussions of operations management activities enhance their own experience.
- *Postgraduate students* on other specialist masters degrees should find that it provides them with a well-grounded and, at times, critical approach to the subject.
- *Executives* should find its diagnostic structure helpful to provide an understandable route through the subject.

What makes this book distinctive?

It has a clear structure

The book is structured on a model of operations management that distinguishes between activities that contribute to the direction, design, delivery and development of operations and processes.

It uses diagnostic logic chains

Every chapter follows a series of questions that forms a ‘diagnostic logic’ for the topic. These are the questions that anyone can ask to reveal the underlying state of their, or any other,

operations. The questions provide an aid to diagnosing where and how an operation can be improved.

It is illustrations-based

Operations management is a practical subject and cannot be taught satisfactorily in a purely theoretical manner. Because of this, each chapter starts with two real-life examples of how the topic is treated in practice and provides additional examples in relation to specific issues within each chapter.

It identifies key operations principles

Whenever a core idea of operations and process management is described in the text, a brief 'operations principle' summary is included in the margin. This helps to distil those essential points of the topic.

It includes critical commentaries

Not everyone agrees about what is the best approach to the various topics and issues within the subject. This is why we have, at the end of each chapter, included a 'critical commentary'. These are alternative views to the one being expressed in the main flow of the text. They do not necessarily represent our view, but they are worth debating.

Each chapter includes summary checklists

Each chapter is summarised in the form of a list of checklist questions. These cover the essential questions that anyone should ask if they wish to understand the way their own or any other operation works. More importantly, they can also act as prompts for operations and process improvement.

Each chapter finishes with a case study

Every chapter includes a case study, relating real or realistic situations that require analysis, decision, or both. The cases have sufficient content to serve as the basis of case sessions in class, but are short enough to serve as illustrations for the less formal reader.

Each chapter includes an 'applying the principles' section

Selected problems, short exercises and activities are included at the end of each chapter. These provide an opportunity to test out your understanding of the principles covered in the chapter.

Each chapter includes a 'taking it further' section

A short annotated list of further reading and useful websites is provided which takes the topics in the chapter further, or treats some important related issues.

Suggested 'model answers' are available for all the 'applying the principles' exercises

Answers to the first two questions are available on the companion website for students. Answers to all the questions are available to bone fide tutors and lecturers.

Instructor's manual and PowerPoint slides

Visit www.pearsoned.co.uk/slack to find valuable online resources. A dedicated updated web-based instructor's manual is available to lecturers adopting this textbook. It includes teaching notes for all chapters, guided solutions for all case studies in the book, guided solutions for active cases and ideas for teaching them. A set of PowerPoint slides featuring figures and illustrations from the main text is also available.



About the authors

NIGEL SLACK is an Emeritus Professor of Operations Management and Strategy at Warwick University, an Honorary Professor at Bath University and an Associate Fellow of Said Business School, Oxford University. Previously he has been Professor of Service Engineering at Cambridge University, Professor of Manufacturing Strategy at Brunel University, a University Lecturer in Management Studies at Oxford University and Fellow in Operations Management at Templeton College, Oxford. He worked initially as an industrial apprentice in the hand-tool industry and then as a production engineer and production manager in light engineering. He holds a Bachelor's degree in Engineering and Master's and Doctor's degrees in Management, and is a Chartered Engineer. He is the author of many books in Operations Management, including *The Operations Advantage*, published in 2017, *Operations Management* (with Alistair Brandon-Jones and Robert Johnston), the eighth edition published in 2016, *Operations and Process Management* (with Alistair Brandon-Jones), the fifth edition published in 2018, *Operations Strategy* (with Michael Lewis), the fifth edition published in 2017, *The Manufacturing Advantage*, published in 1991, *Making Management Decisions* (with Steve Cooke), published in 1991, *Service Superiority* (with Robert Johnston), published in 1993, *The Blackwell Encyclopedic Dictionary of Operations Management*, published in 1997 and *Perspectives in Operations Management* (with Michael Lewis), published in 2003. Nigel has authored numerous academic papers and chapters in books. He also acts as a consultant to many international companies around the world in many sectors, especially financial services, transport, leisure and manufacturing. His research is in the operations and manufacturing flexibility and operations strategy areas.

ALISTAIR BRANDON-JONES is a Full Chaired Professor in Operations and Supply Management at the University of Bath, and an Adjunct Professor at Hult International Business School. He was formerly a Reader at Manchester Business School, an Assistant and Associate Professor at Bath University and a Teaching Fellow Warwick Business School, where he also completed his PhD. In addition to *Essentials of Operations Management*, his other books include *Operations and Process Management* (with Nigel Slack), the fifth edition published in 2018, *Operations Management* (with Nigel Slack and Robert Johnston), the eighth edition published in 2016 and *Quantitative Analysis in Operations Management* (with Nigel Slack), published in 2008. Alistair is an active empirical researcher focusing on e-enabled operations and supply management, professional services and healthcare operations. He has published this research extensively in world-leading journals including *Journal of Operations Management*, *International Journal of Operations and Production Management*, *International Journal of Production Economics* and *International Journal of Production Research*. He has also disseminated his research through various practitioner publications, conferences, workshops and white papers. Alistair has consulting and executive development experience with organizations around the world, in various sectors including petrochemicals, health, financial services, manufacturing, defence and government. In addition, he has won numerous prizes for teaching excellence and contributions to pedagogy, including from the Times Higher Education, Association of MBAs (AMBA), Production Operations Management Society (POMS), University of Bath, University of Manchester and University of Warwick.

Acknowledgements

In preparing this book, the authors, as usual, unashamedly exploited their friends and colleagues. In particular we had invaluable help from a great and distinguished reviewer team and from colleagues who have provided valuable feedback on various aspects of the project. For their help we are particularly grateful to:

Malcolm Afferson, Sheffield Hallam University, UK
Pär Åhlström, Stockholm School of Economics, Sweden
David Bamford, University of Huddersfield, UK
Vikram Bhakoo, University of Melbourne, Australia
Mattia Bianchi, Stockholm School of Economics, Sweden
Umit Bitici, Strathclyde University, UK
Briony Boydell, Portsmouth University, UK
Raffaella Cagliano, Politecnico di Milano, Italy
Dan Chicksand, Aston University, UK
Ben Clegg, Aston University, UK
Paul Coughlan, Trinity College Dublin, Ireland
Pamela Danese, University of Padova, Italy
Marc Day, Reading University, UK
Stephen Disney, Cardiff University, UK
Des Doran, Kingston University, UK
Joy Field, Boton College, USA
Paul Forrester, Keele University, UK
Gino Franco, Derby University, UK
Abby Ghobadian, Reading University, UK
Janet Godsell, Warwick University, UK
Roger Hall, Huddersfield University, UK
Ingjaldur Hannibalsson, University of Iceland, Iceland
Linda Hendry, Lancaster University, UK
Matthias Holweg, Oxford University, UK
Koos Krabbendam, University of Twente, The Netherlands
Bart MacCarthy, Nottingham University, UK
John Maguire, Sunderland University, UK
Harvey Maylor, Cranfield University, UK
Duncan McFarlane, Cambridge University, UK
Ian McCarthy, Simon Fraser University, Canada
Ronnie Mcmillan, University of Strathclyde, UK
Phil Morgan, Oxford Brookes University, UK
Andy Neely, Cambridge University, UK

Steve New, Oxford University, UK
Carie Queenan, University of South Carolina, USA
Peter Race, Reading University, UK
Pietro Romano, Udine University, Italy
Sarah Schiffling, Lincoln University, UK
Mike Shulver, Birmingham University, UK
Alison Smart, University of Glasgow, UK
Rui Sousa, Universidade Católica Portuguesa, Portugal
Nigel Spinks, Reading University, UK
Martin Spring, Lancaster University, UK
Jan Olhager, Lund University, Sweden
Zoe Radnor, Loughborough University, UK
Venu Venugopal, Nyenrode University, The Netherlands
Ann Vereecke, Vlerick Business School, Belgium
Rohit Verma, Cornell University, USA
Jan de Vries, University of Groningen, The Netherlands
Graham Walder, Wolverhampton University, UK
Helen Walker, Cardiff University, UK
Maggie Zeng, Gloucestershire University, UK

At Warwick, thanks go to, Vikki Abusidualghoul, Haley Beer, Nicola Burgess, Mehmet Chakkol, Max Finne, Emily Jamieson, Mark Johnson, Pietro Micheli, Giovanni Radaelli, Ross Ritchie, Rhian Silvestro and Chris Voss.

At Bath, thanks go to, Maria Battarra, Emma Brandon-Jones, Jie Chen, Günes Erdogan, Emmanuel Fragniere, Vaggelis Gianikas, Andrew Graves, Yufei Huang, Jooyoung Jeon, Adam Joinson, Richard Kamm, Mike Lewis, Sheik Meeran, Ibrahim Muter, Fotios Petropoulos, Lukasz Piwek, Tony Roath, Jens Roehrich, Brian Squire, Kate Sugar, Christos Vasilakis, Xingjie Wei, Emma Williams and Baris Yalabik.

The prerequisite for any book of this type is that it serves a real market need. We were privileged to receive advice from the Pearson team; some of the most insightful people in business education publishing, in particular, Natalia Jaszczuk, Catherine Yates, Carole Drummond, Emma Marchant and Rufus Curnow. Finally, to our families, Angela and Kathy, and Emma and Noah, your ongoing support is invaluable.

Nigel Slack and Alistair Brandon-Jones



Publisher's acknowledgements

We are grateful to the following for permission to reproduce copyright material:

Figures

Figure 2.8 from *The Operations Advantage*, Kogan Page (Slack, N. 2017) reproduced with permission; Figures 3.2, 4.4, 11.7, 15.2 from *Operations Management*, 8e, Pearson Education Ltd, UK (Slack, N.) Copyright © 2016; Figure 4.3 from *Operations Management*, 8e, Pearson Education Ltd, UK (Slack, N.) Copyright © 2016; Figures 4.6, 4.8 from *Operations Management*, 8e, Pearson Education Ltd, UK (Slack, N.) Copyright © 2016; Figure 7.5 adapted from Fisher, M.C. (1997) 'What is the right supply chain for your product?', *Harvard Business Review*, March–April, 105–116; Figure 7.8 after The 50,000 mile journey of Wimbledon's tennis balls, *WBS News* 02/07/2014, Copyright © 2017 Warwick Business School, used with permission; Figure 13.8 from EFQM. Reproduced with permission.

Tables

Table 11.1 adapted from 'Making continual improvement: a competitive strategy for service firms', in Bowen, D.E., Chase, R.B., Cummings, T.G. and Associates (eds) *Service Management Effectiveness*, Jossey-Bass (Fitzsimmons, J.A. 1990).

Photos

Interview 10 from Interview with Joanne Cheung, Steve Deeley and other staff at Godfrey Hall, BMW Dealership, Coventry, used with permission; Interview 11 from Interview with Edward Kay, Tom Dyson and Olly Willans of Torchbox, used with permission; Case Study 11 from Janina Aarts and Mattia Bianchi, Department of Management and Organization, Stockholm School of Economics, used with permission; Interview 13 from Interview with Michael Purtill, General Manager, Four Seasons Canary Wharf Hotel, used with permission.

1

Operations and processes

Introduction

Operations management is about how organisations produce goods and services. Every product you use and every service you experience comes to you courtesy of the operations managers who organised its production. Though not always called operations managers, they are the people who design, run and improve the processes that produce services and products for their customers, so effectively they are operations managers. But operations **and process** management is even wider than this. Managers in other functions, such as marketing, sales and finance, also manage processes. They supply internal 'customers' with services such as marketing plans, sales forecasts, budgets, and so on. In fact, all parts of organisations are made up of processes. That is why operations and process management is of direct relevance to all managers, irrespective of what type of organisation they work for, or which function they work in. And that is what this book is about – the tasks, issues and decisions that are necessary to manage processes effectively, both within the operations function, and in other parts of the business where effective process management is equally important. This is an introductory chapter, so we will examine some of the basic principles of operations and process management. The model developed to explain the subject is shown in Figure 1.1.

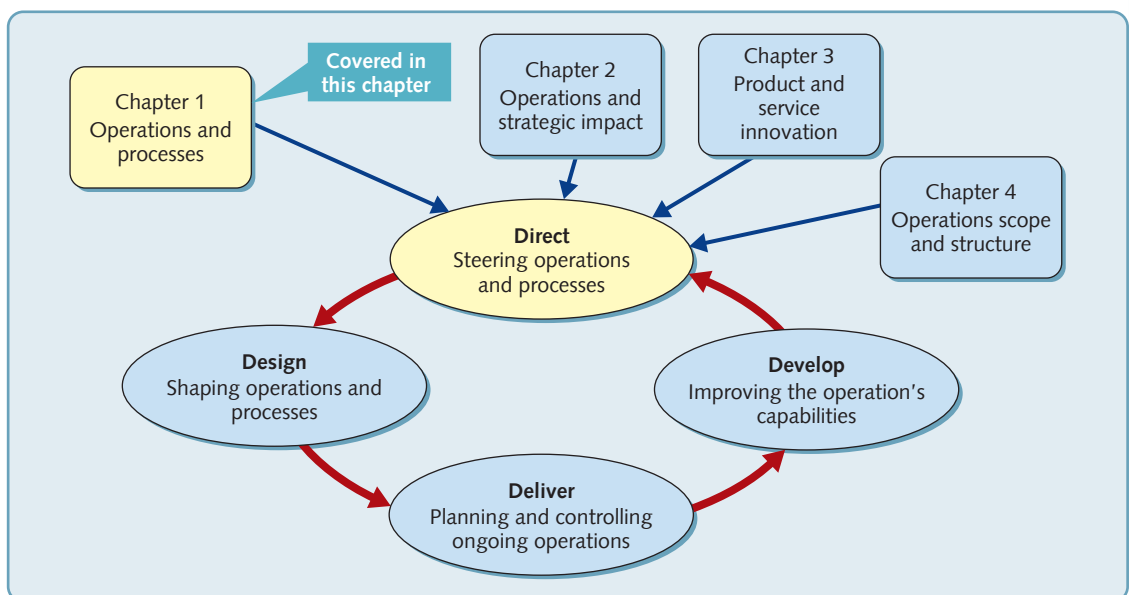


Figure 1.1 Operations and process management is about how organisations produce goods and services

EXECUTIVE SUMMARY



Each chapter has a short executive summary structured around the number of diagnostic questions used in the chapter. These diagnostic questions represent the basic line of enquiry that can reveal the nature and relevance of the topic covered in each chapter.

Does the organisation understand the potential of operations and process management?

The operations function is the part of the organisation that produces products or services. Every organisation has an operations function because every organisation produces some mixture of products and services. It is a central and important activity for *any* organisation. 'Operations' is not always called by that name, but whatever its name, it is always concerned with managing the core purpose of the business – producing some mix of products and services. Processes also produce products and services, but on a smaller scale. They are the component parts of operations. But other functions also have processes that need managing. In fact, *every* part of *any* business is concerned with managing processes. All managers have something to learn from studying operations and process management, because the subject encompasses the management of all types of operation, no matter in what sector or industry, and all processes, no matter in which function.

Does the business take a process perspective?

A 'process perspective' means understanding businesses in terms of all their individual processes. It is only one way of modelling organisations, but it is a particularly useful one. Operations and process management uses the process perspective to analyse businesses at three levels: the operations function of the business; the higher and strategic level of the supply network; and at a lower operational level of individual processes. Within the business, processes are only what they are defined as being. The boundaries of each process can be drawn as thought appropriate. Sometimes this involves radically reshaping the way processes are organised; for example, to form end-to-end processes that fulfil customer needs.

Does operations and process management have a strategic impact?

Operations and process management can make or break a business. Well-managed operations and processes can contribute to the strategic impact of the business in four ways: cost, revenue, investment and capabilities. Because the operations function has responsibility for much of a business's cost base, its first imperative is to keep costs under control. Additionally, it should look to enhance the business's ability to generate revenue through the way it provides service and quality. Furthermore, all failures are ultimately process failures; well-designed processes have less chance of failing and more chance of recovering quickly from failure. Because operations are often the source of much investment, it should aim to get the best possible return on that investment. Finally, the operations function should lay down the capabilities that will form the long-term basis for future competitiveness.

Should all processes be managed in the same way?

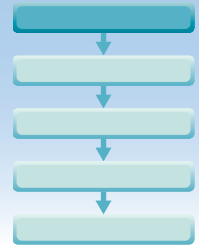
Not necessarily. Processes differ, particularly in what are known as the four Vs: volume, variety, variation and visibility. High-volume processes can exploit economies of scale and be systematised. High-variety processes require enough inbuilt flexibility to cope with the wide variety of activities expected of them. High-variation processes must be able to change their output levels to cope with highly variable and/or unpredictable levels of demand. High-visibility processes add value, while the customer is 'present' in some way and therefore must be able to manage customers' perceptions of their activities. Generally, high volume together with low variety, variation and visibility facilitate low-cost processes, while low volume together with high levels of variety, variation and visibility all increase process costs. Yet in spite of these differences, operations managers use a common set of decisions and activities to manage them. These activities can be clustered under four groupings: directing the overall strategy of the operation; designing the operation's products, services and processes; planning and controlling process delivery; and developing process performance.

Are operations and process decision-making appropriate?

The range of operations decisions are wide-ranging and cover four broad areas that we categorise as follows: '*directing* the overall strategy of the operation'; '*designing* the operation's processes'; '*planning and control process delivery*'; and '*developing* process performance'. However, there are always overlaps and interrelationships between the categories. Yet, no matter what type of decision, operations managers use models (many of which are included in this book) to help them make decisions. Some models are quantitative, some are qualitative but, in practice, a blend of qualitative and quantitative approaches is often the most useful approach. Remember that all models are simplifications of a far more complex reality. This is one reason for the interest in 'behavioural operations management', which attempts to incorporate real (usually non-rational) behaviour into operations decision-making.

DIAGNOSTIC QUESTION

Does the organisation understand the potential of operations and process management?



Operations and process management is the activity of managing the resources and processes that produce products and services, for internal and external customers. It is a central and important activity for *any* organisation. The core body of knowledge for the subject comes from 'operations management', which examines how the 'operations function' of an organisation produces products and services for external customers. Some organisations may call an operations manager by some other name, for example, a 'fleet manager' in a logistics company, an 'administrative manager' in a hospital, or a 'store manager' in a supermarket. Note that we sometimes use the shorter terms 'the operation' or 'operations', interchangeably with the 'operations function'. Note also that we use 'the organisation', 'the business, or 'the enterprise' to describe any kind of human entity with a collective purpose.

All enterprises have 'operations'

All organisations have 'operations', because all organisations produce products, services, or some mixture of both. If you think that you do not have an operations function, you are wrong. If you think that your operations function is not important, you are also wrong. In most enterprises the operations function represents the bulk of its assets and the majority of its people; it is the means by which they serve their customers and provides an economic and/or social return for their stakeholders. An effective operations function has the potential to survive

OPERATIONS PRINCIPLE

All organisations have 'operations' that produce some mix of products and services.

in a turbulent environment and the ability to maintain a steady improvement in its performance. By contrast, a poorly managed operations function, especially if it fails to provide an adequate service to its customers or fails to provide the efficiency to work within its cost constraints, will always prevent an organisation from achieving its objectives, whether social or economic.

But not all operations are the same

Look at the six businesses illustrated in Figure 1.2. There are two financial service companies, two manufacturing companies and two hotels. All of them have *operations functions* that produce the things that their customers are willing to pay for. Hotels produce accommodation services; financial services invest, store, move, or sell us money and investment opportunities; and manufacturing businesses physically change the shape and the nature of materials to produce products. These businesses are from different sectors (banking, hospitality and manufacturing), but it is not that they operate in different sectors of the economy that makes these businesses different from each other. There are often bigger differences *within* economic sectors than *between* them. The main difference between how their operations activities need to be

OPERATIONS PRINCIPLE

The economic sector of an operation is less important in determining how it should be managed than its intrinsic characteristics.

managed is more closely related to the market position that they occupy. For example, all three operations in the left-hand column provide value-for-money products and services and compete largely on cost. The three in the right-hand column provide more 'up-market' products and services that are more expensive to produce and compete on some combination of high specification and customisation. The implication of this is important. It means



Figure 1.2 All types of business have 'operations' because all businesses produce some mix of products and services. The differences in the operations within a category of business are often greater than the differences between business sectors

that the surface appearance of a business and its economic sector are less important to the way its operations are managed than the intrinsic characteristics of what it is trying to achieve, including the volume of its output, the variety of products and services it produces and, above all, how it is trying to compete in its market.

Figure 1.3 illustrates how the scope of this subject has expanded over time. Originally, operations management was almost exclusively associated with the manufacturing sector – and usually called 'production' or 'manufacturing' management. Starting in the 1970s and 1980s, the term *operations management* reflected two trends. First, and most importantly, its use implied that many of the ideas, approaches and techniques traditionally used in the manufacturing sector could be equally applicable in the (much larger) service sector. The second use of the term expanded the scope of 'production' in manufacturing companies to include 'non-core', but important, production-related processes such as purchasing, physical distribution, after sales service, product development, and so on.

Operations and process management

More recently, use of the term *operations and process management* (or sometimes just process management) denotes the shift in the scope of the subject to include the whole organisation. Within any business, the production of products and services is not confined to the operations

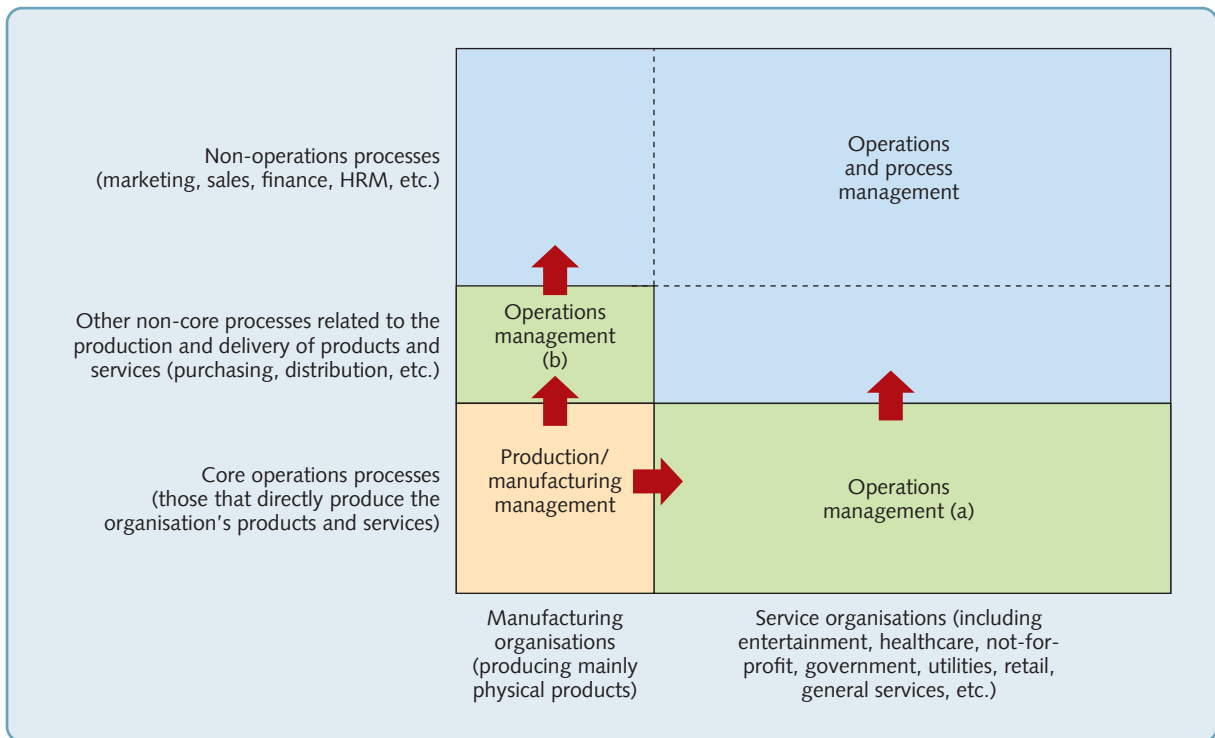


Figure 1.3 Operations management has expanded from treating only the core production processes in manufacturing organisations to include service organisations, non-core operations processes and processes in other functions such as marketing, finance and HRM

function. Every part of any business achieves their objectives by organising their resources such as people, information systems, buildings, and equipment into individual 'processes'. A 'process' is an arrangement of resources and activities that transform inputs into outputs that satisfy (internal or external) customer needs. For example, the marketing function 'produces' marketing plans and sales forecasts, the accounting function 'produces' budgets, the human resources function 'produces' development and recruitment plans, and so on. In fact, every part of any business is concerned with managing processes.

OPERATIONS PRINCIPLE

All operations are composed of processes. A process is an arrangement of resources and activities that transform inputs into outputs that satisfy (internal or external) customer needs.

The difference between *operations* and *processes* is one of scale, and therefore complexity. Both transform inputs into outputs (we shall look at this idea later), but processes are the smaller version. They are the component parts – the building blocks – of an operation. So, 'operations and process management', is the term we use to encompass the management of all types of operation, no matter in what sector or industry, and all processes, no matter in which function of the business. The general truth is that processes are everywhere, and all managers have something to learn from studying operations and process management.

This is very much how we treat the subject in this book and why it is called 'Operations and Process Management'. It includes an examination of the operations function in both manufacturing and service sectors, as well as the management of processes in non-operations functions.

At the beginning of each chapter, we present two examples of individual businesses, or types of business, that illustrate the topic examined in the chapter. Here we look at two businesses, one service company, and one manufacturing company, which have succeeded in large part because of their effective use of operations and process management principles.

EXAMPLE

Lego®¹

Of all businesses, the toy business is one of the world's trickiest. It is difficult to forecast, unfailingly subject to fickle kids' latest fads and subject to constant technological innovation. Yet, in recent

years, The LEGO Group, a privately held, family-owned company with headquarters in Billund, Denmark, has survived in the business, becoming one of the most reputable companies in the world, according to the Reputation Institute, and one of the leading manufacturers of play materials. It is a success founded on a deceptively simple idea. One Lego brick is unremarkable, but put one or two together and possibilities start to emerge. With another few bricks, the number of things you can create rises exponentially. There are more than 915 million possible ways of arranging six standard four-by-two bricks; and, however many bricks you assemble, irrespective of what colour or set they are from, your pieces will always fit together perfectly. All of the basic Lego elements use the same method to stick together. They have studs on top and tubes on the inside. The bricks studs are slightly bigger than the space between the tubes and the walls. Pressing the bricks together produces an 'interference fit' that provides a temporary joint without the use of an additional fastener. However, this principle does depend on very high levels of precision and quality in the manufacture of the elements, which explains the company's motto, 'Only the best is good enough'.

Lego bricks are manufactured at the Group's factories in Denmark, Hungary, The Czech Republic and Mexico, with the location of new factories built in Nyiregyhaza in Hungary and Jiaxing in China chosen to be near their key markets. Products made in these factories serve a global market. The aim, according to Bali Padda, Executive Vice President and Chief Operations Officer of The LEGO Group, is to 'build a stable manufacturing base around the world, ultimately making sure that LEGO products are available to children and their parents when and where they want them'. The company's operations processes are central to maintaining its reputation for quality and its ability to produce millions of elements profitably and sustainably. These processes start at the main warehouse, which contains the silos that hold raw plastic granulates. A complex arrangement of tubes links the silos to the moulding machines. The moulding stage



is particularly important because of the need to make every Lego piece to a demanding level of precision, with tolerances as small as 10 micrometres. At each machine, the plastic is heated and pumped into the mould through a main channel, which divides into a number of narrower channels, each corresponding to a single brick and, when the plastic has solidified (after only a couple of seconds) the machines release the bricks into containers. A sensor detects when a container is full and a robot trolley automatically picks up boxes and leaves empty ones. The robots transport the boxes to conveyors, which move them into the storage area where robotic cranes stack them until needed. The automation means that few people are required for the process.

From there, some pieces go to the 'decoration' stage where they are individually painted. Decoration is the most expensive part of the Lego process. Other pieces go straight to packing, where the Lego sets take their final form. In the packaging process, the pieces go into a machine that separates them individually, counts them using optical sensors and places them in their box. The automatic movement system knows exactly how much a box should weigh at any stage and high-precision scales monitor the weight of the box as the packing process continues. Any deviation, even of a few micrograms, sets off an alarm. At the end of the process, the boxes are sealed shut, automatically weighed to ensure no components are missing, checked by a worker trained to look for errors (e.g. plastic bags sticking out of the box), packed six to a case by a robot and finally sent off for distribution.

Quality assurance staff perform frequent inspections and tests on the various Lego elements, such as drop, torque, tension, compression, bite and impact tests to make sure the toys are robust and safe. Only about eighteen of every million Lego elements produced (0.00002 per cent) fail to pass the tests. In addition, throughout the process, the company tries to achieve high levels of environmental sustainability. Plastic is extensively recycled in the factory. All scrap such as, for example, the plastic that fills the channels that take the hot plastic into moulds and faulty pieces that escape from automated handling, are ground up, and taken back into the production process. Similarly,

the transparent plastic used to clean the channels when the production colour is changed in a moulding machine is also ground up and sold to companies that produce other plastic products.

EXAMPLE

Torchbox: award-winning web designers²

We may take it for granted, yet browsing websites, as part of your studies, your job, or your leisure, is an activity that we all do; probably every day, probably many times each day. It's important. All organisations need to have a web presence if they want to sell products and services, interact with



their customers, or promote their cause. Not surprisingly, there is a whole industry devoted to designing websites so that they have the right type of impact. In fact, taken over the years, web development has been one of the fastest growing industries in the world. But it's also a tough industry. Not every web design company thrives, or even survives beyond a couple of years. To succeed, web designers need technology skills, design capabilities, business awareness and operational professionalism. One that has succeeded is Torchbox, an independently owned web design and development company based in Oxfordshire. Founded in 2000, it now employs 60 people, providing 'high-quality, cost-effective, and ethical solutions for clients who come primarily, but not exclusively, from the charity, non-governmental organisations and public sectors'.

Co-founder and Technical Director Tom Dyson has been responsible for the technical direction of all major developments. 'There are a number of advantages about being a relatively small operation', he said. 'We can be hugely flexible and agile, in what is still a dynamic market. But at the same time we have the resources and skills to provide a creative and professional service. Any senior manager in a firm of our size cannot afford to be too specialised. All of us here have their own specific responsibilities; however, every one of us shares the overall responsibility for the firm's general development. We can also be clear and focused on what type of work we want to do. Our ethos is important to us. We set out to work with clients who share our commitment to environmental sustainability and responsible, ethical business practice; we take our work, and that of our clients, seriously. If you're an arms dealer, you can safely assume that we're not going to be interested.'

Nevertheless, straightforward operational effectiveness is also essential to Torchbox's business. "We know how to make sure that our projects run not only on time and to budget" said Olly Willans, also a co-founder and the firm's Creative Director, 'but we also like to think that we provide an enjoyable and stimulating experience – both for our customers' development teams and for our staff too. High standards of product and service are important to us: our clients want accessibility, usability, performance and security embedded in their web designs and, of course, they want things delivered on-time and on-budget. We are in a creative industry that depends on fast-moving technologies, but that doesn't mean that we can't also be efficient. We back everything we do with a robust feature-driven development process using a kanban project management methodology which helps us manage our obligations to our clients.'

The 'kanban' approach used by the Torchbox web development teams originated from car manufacturers like Toyota (this is fully explained in Chapter 11). 'Using sound operations management techniques helps us constantly to deliver value to our clients', said Tom Dyson, 'we like to think that our measured and controlled approach to handling and controlling work helps ensure that every hour we work produces an hour's worth of value for our clients and for us.'

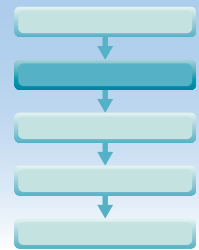
What do they have in common?

These two operations are very different. One is one of the best-known toy manufacturing companies in the world, the other is a small (but successful) company working in an industry that did not exist when Lego was founded. Yet the operations of both companies share the same basic objective

– managing the processes that produce their products and services in a manner that satisfies their customers, while making enough profit to thrive in the long term. Most of the managers in each company, irrespective of their formal title, will be concerned also with managing the processes that contribute to the success of their respective businesses. Of course, there are differences between each company's operations and processes, such as the scale at which they operate, the type of products and services they provide, the resources they use, and so on. But the managers in each company will be making the same *type* of decisions, even if *what* they actually decide is different. The fact that both companies are successful because of their innovative and effective operations and processes also implies further commonality. First, it means that they both understand the importance of taking a 'process perspective' in understanding their supply networks, running their operations, and managing all their individual processes. Without this, they could not have sustained their strategic impact in the face of stiff market competition. Second, both businesses will expect their operations to contribute to their overall competitive strategy. Third, in achieving a strategic impact, they both will have come to understand the importance of managing *all* their individual processes throughout the business so that they too can all contribute to the businesses, success.

DIAGNOSTIC QUESTION

Does the business take a process perspective?



Central to making operations and process management a significant contributor to a business's success is the idea of a 'process perspective'. If a business takes a process perspective, it understands that all parts of the business can be seen as processes, and that all processes can be managed using operations management principles. Yet, although important, a process perspective is not the only way of describing businesses, or any type of organisation. One could represent an organisation as a conventional 'organisational structure' that shows the reporting relationships between various departments or groups of resources. However, even a little experience in any organisation shows that rarely, if ever, does this fully represent the way the organisation actually works. Alternatively, one could describe an organisation through the way it makes decisions: how it balances conflicting criteria, weighs up risks, decides on actions and learns from its mistakes. Or, one could describe an organisation by explaining its culture – its shared values, ideology, pattern of thinking and day-to-day rituals, or its power relationships – how it is governed, seeks consensus (or at least reconciliation), and so on. Or, and this is the significant point, one can represent the organisation as a collection of processes, interconnecting and (hopefully) all contributing to fulfilling its strategic aims. This is the perspective that we emphasise throughout this book. As we define it here, the process perspective analyses businesses as a collection of interrelated processes. Some of these processes will be within the operations function, and will contribute directly to the production of its products and services. Other processes will be in the other functions of the business, but will still need managing using similar principles to those within the operations function.

None of these various perspectives on organisations gives a total picture. Each perspective adds something to our ability to understand, and therefore more effectively manage a business. Nor are these perspectives mutually exclusive. A process perspective does not preclude understanding the influence of power relationships on how processes work, and so on. We use the process perspective here, not because it is the *only* useful and informative way of understanding businesses, but because it is the perspective that directly links the way we manage resources in a business with its strategic impact. Without effective process management, the