

# Welcome to **OPERATIONS MANAGEMENT**

**Operations Management** is important, exciting, challenging, and everywhere your look!

Important, because it's concerned with creating all of the products and services upon which we depend. Exciting, because it's at the centre of so many of the changes affecting the world of business. Challenging, because the solutions that we find need to work globally and responsibly within society and the environment. And everywhere, because every service and product that you use – the cereal you eat at breakfast, the chair you sit on, and the radio station you listen to while you eat – is the result of an operation or process.

**Our aim** in writing *Operations Management* is to give you a **comprehensive understanding** of the issues and techniques of operations management, and to **help you get a great final result** in your course. Here's how you might make the most of the text:

- Get ahead with the latest developments – from the up-to-the-minute *Operations in practice* features in every chapter to the focus on corporate social responsibility in the final chapter – these **put you at the cutting edge**.
- Use the *Worked examples* and *Problems and applications* to improve your use of key quantitative and qualitative techniques, and work your way to **better grades in your assignments and exams**.
- Follow up on the recommended readings at the end of each chapter. They're specially selected to enhance your learning and **give you an edge** in your course work.

And in particular, look out for the references to **MyOMLab** in the text, and log on to [www.myomlab.com](http://www.myomlab.com)\* where you can



- check and reinforce your understanding of key concepts using self-assessment questions, audio summaries, animations video clips and more;
- practice your problem-solving with feedback, guided solutions and a limitless supply of questions!

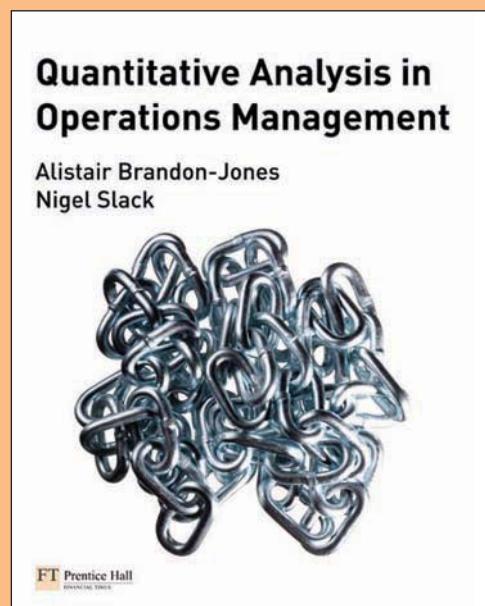
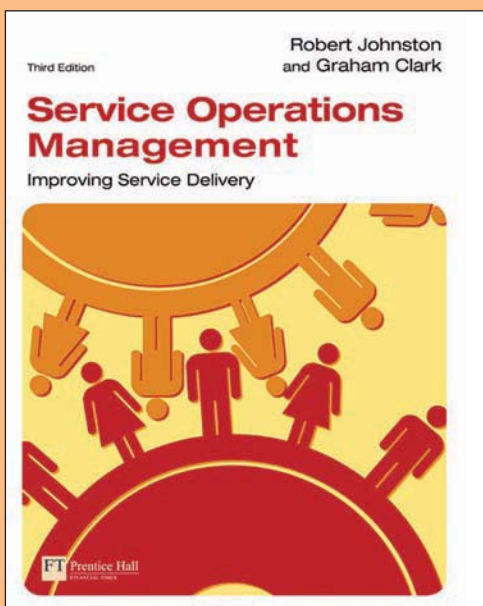
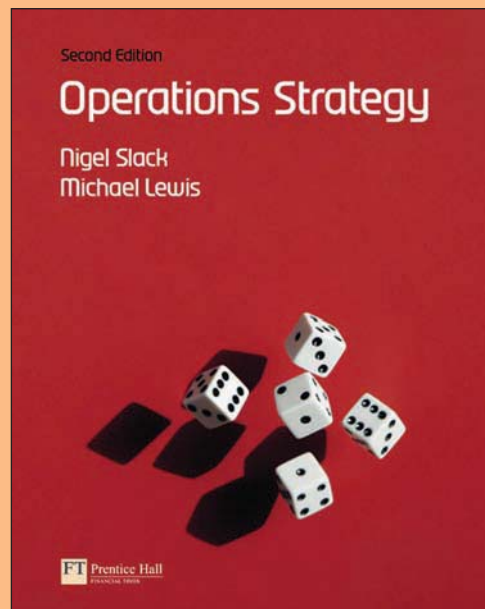
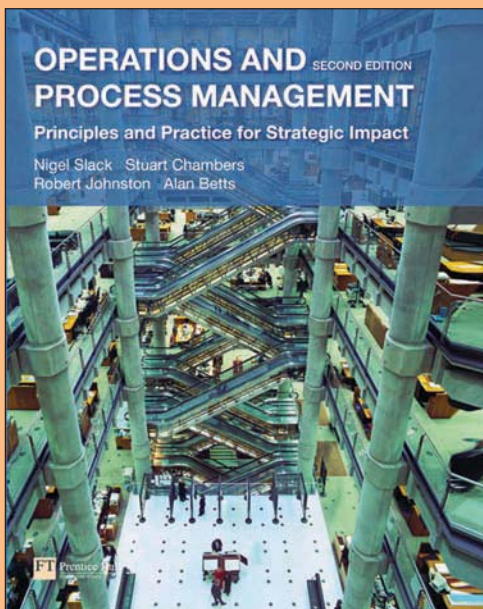
We want *Operations Management* to give you what you need: a comprehensive view of the subject, an ambition to put that into practice, and – of course – success in your studies. So, read on and good luck!

*Nigel Slack  
Stuart Chambers  
Robert Johnston*

\* P.S. In order to **log in to MyOMLab**, you'll need to **register with the access code** included with all new copies of the book.

## Further reading in Operations Management

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# OPERATIONS MANAGEMENT

Sixth Edition

Nigel Slack

Stuart Chambers

Robert Johnston

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First published under the Pitman Publishing imprint 1995  
Second edition (Pitman Publishing) 1998  
Third edition 2001  
Fourth edition 2004  
Fifth edition 2007  
**Sixth edition 2010**

© Nigel Slack, Stuart Chambers, Christine Harland, Alan Harrison, Robert Johnston 1995, 1998  
© Nigel Slack, Stuart Chambers, and Robert Johnston 2001, 2004, 2007, 2010

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ISBN: 978-0-273-73046-0

**British Library Cataloguing-in-Publication Data**

A catalogue record for this book is available from the British Library

**Library of Congress Cataloging-in-Publication Data**

Slack, Nigel.

Operations management / Nigel Slack, Stuart Chambers, Robert Johnston. – 6th ed.  
p. cm.

ISBN 978-0-273-73046-0 (pbk.)

1. Production management. I. Chambers, Stuart. II. Johnston, Robert, 1953– III. Title.  
TS155.S562 2010  
658.5–dc22

10 9 8 7 6 5 4 3 2 1  
14 13 12 11 10

Typeset in 10/12pt Minion by 35  
Printed and bound by Rotolito Lombarda, Italy

*The publisher's policy is to use paper manufactured from sustainable forests.*

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	p. 9	Oxfam	Global	Charity	Large
	p. 14	Prêt A Manger	Europe/USA	Retail	Medium
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	p. 21 p. 27	Mwagusi Safari Lodge Concept Design Services	Tanzania UK	Hospitality Design/manufacturing/ distribution	Small Medium
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	p. 398	Seven-Eleven Japan	Japan	Retail	Large
	p. 401	H&M, Benetton and Zara	Global	Design/manufacturing/distribution/retail	Large

<i>Chapter</i>	<i>Location</i>	<i>Company/example</i>	<i>Region</i>	<i>Sector/activity</i>	<i>Company size</i>
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	p. 417 p. 418	What a waste Psycho Sports Ltd	US All	Waste management Manufacturing	Large Small
<b>Chapter 15</b> <b>Lean</b> <b>synchronization</b>	p. 430	Toyota Motor Company	Global	Auto manufacturing	Large
	p. 440	Hospitals	UK	Healthcare	Medium/large
<b>Chapter 16</b> <b>Project</b> <b>planning</b> <b>and control</b>	p. 458	The Millau Bridge	France	Construction	Large
	p. 465	The National Trust	UK	Heritage	Various
	p. 47	Access HK	Hong Kong	Charity	Small
	p. 488	United Photonics Malaysia Sdn Bhd	Malaysia	Research and development	Medium
<b>Chapter 17</b> <b>Quality</b> <b>management</b>	p. 496	Four Seasons Hotel	Global/UK	Hospitality	Large
	p. 499	Tea and Sympathy	USA	Hospitality	Small
	p. 500	Magic Moments	UK	Photography services	Small
	p. 505	Vitacress	Europe	Agriculture	Large
	p. 507	Surgical Statistics	US	Healthcare	Various
	p. 512	IBM	Canada	IT services	Large
	p. 516	Rendall Graphics	Canada	Manufacturing	Medium
<b>Chapter 18</b> <b>Improvement</b>	p. 541	Heineken International (Part I)	Netherlands	Brewery	Large
	p. 548	Erdington	UK	Beverage	Large
	p. 556	Xchanging	Europe	Process outsourcing	Large
	p. 565	Geneva Construction and Risk (GCR)	Europe	Insurance	Large
<b>Chapter 19</b> <b>Risk</b> <b>management</b>	p. 572	Cadburys Salmonella outbreak	Global	Confectionary	Large
	p. 575	Not what you want to hear	USA	Airline	Large
	p. 577	Viruses, threats and 30 years of spam	Global	Internet	Various
	p. 592	Otis Elevators	Global	Facilities services	Large
	p. 597	Chernobyl	Ukraine	Power generation	Large
<b>Chapter 20</b> <b>Organizing for</b> <b>improvement</b>	p. 602	Taxing Quality	Denmark	Public service	Large
	p. 620	Heineken International (Part II)	Netherlands	Brewery	Large
	p. 622	Work-Out at GE	Global	Various	?Large
	p. 626	Singapore Libraries	Singapore	?	?
<b>Chapter 21</b> <b>Corporate</b> <b>social</b> <b>responsibility</b> <b>(CSR)</b>	p. 635	Ecological footprints	All	All	All
	p. 638	HP Recycling Program	Global	Manufacturing	Large
	p. 642	The Gap between perception, reality and intention	Global	Retail	Large
	p. 649	CSR as it is presented	Various	Various	Various

# Making the most of this book and MyOMLab

## Check your understanding

Each chapter opens with a set of **Key questions** to identify major topics. **Summary answers** conclude the chapter. You can check your understanding of each chapter by taking the **Sample tests of self-assessment questions** on MyOMLab at [www.myomlab.com](http://www.myomlab.com).

**Chapter 2**  
**Operations performance**

**Key questions**

- Why is operations performance important in any organization?
- How does the operations function incorporate all stakeholders' objectives?
- What does top management expect from the operations function?
- What are the performance objectives of operations and what are the internal and external benefits which derive from excelling in each of them?
- How do operations performance objectives trade off against each other?

**Introduction**

Operations are judged by the way they perform. There are many individuals and groups doing the judging and there are many different aspects of performance on which the assessment is being made. The people doing the judging are called 'stakeholders' and the aspects of performance they are using are called 'performance objectives'. And if we want to understand the strategic contribution of the operations function, it is important to understand how we can measure its performance. So this chapter starts by illustrating how operations performance can impact on the success of the whole organization. Second, we look at various perspectives on, and aspects of performance. Finally, we examine how performance objectives trade off against each other. On our general model of operations management the topics covered in this chapter are represented by the area marked on Figure 2.1.

**Figure 2.1** This chapter examines operations performance

Check and improve your understanding of this chapter using self assessment questions and a personalised study plan, audio and video downloads, and an eBook - all at [www.myomlab.com](http://www.myomlab.com).

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**Summary answers to key questions**

Check and improve your understanding of this chapter using self assessment questions and a personalised study plan, audio and video downloads, and an eBook - all at [www.myomlab.com](http://www.myomlab.com).

► Why is operations performance important in any organization?

- Operations management can either 'make or break' any business. It is large and, in most businesses, represents the bulk of its assets, but also because the operations function gives the ability to compete by providing the ability to respond to customers and by developing the capabilities that will keep it ahead of its competitors in the future.

► How does the operations function incorporate all stakeholders objectives?

- At a strategic level, performance objectives relate to the interests of the operation's stakeholders. They relate to the company's responsibility to customers, suppliers, shareholders, employees, and society in general.

► What does top management expect from the operations function?

- Operations can contribute to the organization as a whole by:
  - reducing the costs
  - achieving customer satisfaction
  - reducing the risk of operational failure
  - reducing the amount of investment
  - providing the basis for future innovation.

► What are the performance objectives of operations and what are the internal and external benefits which derive from excelling in each of them?

- By 'doing things right', operations seek to influence the quality of the company's goods and services. Externally, quality is an important aspect of customer satisfaction or dissatisfaction. Internally, quality operations both reduce costs and increase dependability.
- By 'doing things fast', operations seek to influence the speed with which goods and services are delivered. Externally, speed is an important aspect of customer service. Internally, speed both reduces inventories by decreasing internal throughput time and reduces risks by delaying the commitment of resources.
- By 'doing things on time', operations seek to influence the dependability of the delivery of goods and services. Externally, dependability is an important aspect of customer service. Internally, dependability within operations increases operational reliability, thus saving the time and money that would otherwise be taken up in solving reliability problems and also giving stability to the operation.
- By 'changing what they do', operations seek to influence the flexibility with which the company produces goods and services. Externally, flexibility can:
  - produce new products and services (product/service flexibility);
  - produce a wide range or mix of products and services (mix flexibility);
  - produce different quantities or volumes of products and services (volume flexibility);
  - produce products and services at different times (delivery flexibility).

◀ ◁ 1 2 3 4 5 6 7 8 9 10 ▷ ▶ ▶▶

This Question: 1 pt      This Test: 12 pts      8 of 12 complete

Using PERT, Harold Benson was able to determine that the expected project completion time for the construction of a pleasure yacht is 22 months, and the project variance is 4.

The probability that the project will be completed in 18 months =  (round your response to four decimal places).

The probability that the project will be completed in 21 months =  (round your response to four decimal places).

The probability that the project will be completed in 24 months =  (round your response to four decimal places).

The probability that the project will be completed in 26 months =  (round your response to four decimal places).

The due date that yields a 95% chance of completion =  months (round your response to two decimal places).

Enter any number or expression in each of the edit fields, then click Next or Previous.

Previous      Next      Submit

## Practice makes perfect

**Worked examples** show how quantitative and qualitative techniques can be used in operations management. **Problems and applications** at the end of the chapter allow you to apply these techniques, and you can get more practice as well as guided solutions from the **Study plan** on MyOMLab at [www.myomlab.com](http://www.myomlab.com).

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run continuously at its maximum rate. Different products will have different coating requirements, so the line will need to be stopped while it is changed over. Maintenance will need to be performed on the line, which will take out further productive time. Technical scheduling difficulties might mean further lost time. Not all of these losses are the operations manager's fault; they have occurred because of the market and technical demands on the operation. The actual capacity which remains, after such losses are accounted for, is called the **effective capacity** of operation. These causes of reduction in capacity will not be the only losses in the operation. Such factors as quality problems, machine breakdowns, absenteeism and other avoidable problems will all take their toll. This means that the actual output of the line will be even lower than the effective capacity. The ratio of the output actually achieved by an operation to its design capacity, and the ratio of output to effective capacity are called, respectively, the **utilization** and the **efficiency** of the plant:

$$\text{Utilization} = \frac{\text{actual output}}{\text{design capacity}}$$

$$\text{Efficiency} = \frac{\text{actual output}}{\text{effective capacity}}$$

**Worked example**

Suppose the photographic paper manufacturer has a coating line with a design capacity of 200 square metres per minute, and the line is operated on a 24-hour day, 7 days per week (168 hours per week) basis.

Design capacity is  $200 \times 60 \times 24 \times 7 = 2,016$  million square metres per week. The records for a week's production show the following lost production time:

1 Product changovers (set-up)	20 hrs
2 Regular preventative maintenance	16 hrs
3 No work scheduled	8 hrs
4 Quality sampling checks	8 hrs
8 Shift change times	8 hrs
6 Maintenance breakdown	18 hrs
7 Quality failure investigation	20 hrs
8 Coating material stockouts	8 hrs
9 Labour shortages	6 hrs
10 Waiting for paper rolls	6 hrs

During this week the actual output was only 582,000 square metres. The first five categories of lost production occur as a consequence of reasonably unavoidable, planned occurrences and amount to a total of 59 hours. The last five categories are unplanned, and avoidable, losses and amount to 58 hours.

Measured in hours of production.

Design capacity = 168 hours per week  
 Effective capacity =  $168 - 59 = 109$  hrs  
 Actual output =  $168 - 58 = 51$  hrs

$$\text{Utilization} = \frac{\text{actual output}}{\text{design capacity}} = \frac{51 \text{ hrs}}{168 \text{ hrs}} = 0.304(30\%)$$

$$\text{Efficiency} = \frac{\text{actual output}}{\text{effective capacity}} = \frac{51 \text{ hrs}}{109 \text{ hrs}} = 0.468(47\%)$$

Chapter 11 Capacity planning and control 331

**Problems and applications**

These problems and applications will help to improve your analysis of operations. You can find more practice problems as well as worked examples and guided solutions on MyOMLab at [www.myomlab.com](http://www.myomlab.com).

- A local government office issues hunting licences. Demand for these licences is relatively slow in the first part of the year but then increases after the middle of the year before slowing down again towards the end of the year. The department works a 220-day year on a 5-day-a-week basis. Between working days 0 and 100, demand is 25 per cent of demand during the peak period which lasts between day 100 and day 150. After 150 demand reduces to about 12 per cent of the demand during the peak period. In total, the department processes 10,000 applications per year. The department has 2 permanent members of staff who are capable of processing 15 licence applications per day. If an untrained temporary member of staff can only process 10 licences per day, how many temporary staff should the department recruit between days 100 and 150?
- In the example above, if a new computer system is installed that allows experienced staff to increase their work rate to 20 applications per day, and untrained staff to 15 applications per day, (a) does the department still need 2 permanent staff, and (b) how many temporary members of staff will be needed between days 100 and 150?
- A field service organization repairs and maintains printing equipment for a large number of customers. It offers one level of service to all its customers and employs 30 staff. The operation's marketing vice-president has decided that in future the company will offer 3 standards of service, platinum, gold and silver. It is estimated that platinum-service customers will require 50 per cent more time from the company's field service engineers than the current service. The current service is to be called 'the gold service'. The silver service is likely to require about 80 per cent of the time of the gold service. If future demand is estimated to be 20 per cent platinum, 70 per cent gold and 10 per cent silver service, how many staff will be needed to fulfil demand?
- Look again at the principles which govern customers' perceptions of the queuing experience. For the following operations, apply the principles to minimize the perceived negative effects of queuing.
  - A cinema
  - A doctor's surgery
  - Waiting to board an aircraft.
- Consider how airlines cope with balancing capacity and demand. In particular, consider the role of yield management. Do this by visiting the web site of a low-cost airline, and for a number of flights price the fare that is being charged by the airline from tomorrow onwards. In other words, how much would it cost if you needed to fly tomorrow, how much if you needed to fly next week, how much if you needed to fly in 2 weeks, etc. Plot the results for different flights and debate the findings.
- Calculate the overall equipment efficiency (OEE) of the following facilities by investigating their use.
  - A lecture theatre
  - A cinema
  - A coffee machine
 Discuss whether it is worth trying to increase the OEE of these facilities and, if it is, how you would go about it.

Chapter 16 Project Planning and Control

Problem 3.2b

In the following table the activities with their precedence sequence and expected time (days) are listed for a project on which Dave Cartwright's consulting company is working:

Activity	Immediate Predecessor(s)	Time (days)
A	-	5
B	A	4
C	A	6
D	B	6
E	B	4
F	C	4
G	D	6
H	E, F	8

Dave's team should be able to complete the project in  days. **Standard Solution**

Enter any number or expression in the edit field, then click Check Answer.

2 parts remaining

---

In the following table the activities with their precedence sequence and expected time (days) are listed for a project on which Dave Cartwright's consulting company is working:

Activity	Immediate Predecessor(s)	Time (days)
A	-	4
B	A	6
C	A	6
D	B	4
E	B	4
F	C	6
G	D	6
H	E, F	7

The time it would take to finish all activities along the path A-B-D-G is  days.

Enter any number or expression in the edit field, then click Check Answer.

4 parts remaining

# Making the most of this book and MyOMLab (continued)

## Analyse operations in action

The **Operations in practice** and **Case study** features in each chapter illustrate and encourage you to analyse operations management in action. You can see and hear more about how theory is applied in practice in the animations and video clips in the **Multimedia library** in MyOMLab at [www.myomlab.com](http://www.myomlab.com).

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### Operations in practice Britvic – delivering drinks to demand<sup>1</sup>

Britvic is amongst Europe's leading soft-drink manufacturers, a major player in a market consuming nearly ten billion litres a year. Annually, Britvic bottles, distributes and sells over 1 billion litres of ready-to-drink soft drinks in around 400 different flavours, shapes and sizes, including brands such as Pepsi, Targa, Robinsons, Aqua Libra, Purdy's and J2O. Every year, Britvic produce enough cans of soft drinks to stretch three times around the world, so it has to be a high-volume and high-speed business. Its six UK factories contain factory lines producing up to 1,000 cans a minute, with distribution organized on a grand scale. At the centre of its distribution network is a National Distribution Centre (NDC) located at Luttworham, UK. It is designed to operate 24 hours a day throughout the year, handling up to 620 truckloads of soft drinks daily and, together with a national network of 12 depots, it has to ensure that 200,000 outlets in the UK receive their orders on time. Designed and built in collaboration with Wincanton, a specialist supply chain solutions company, which now manages Britvic's NDC, it is capable of holding up to 140 million cans in its 50,000-pallet 'High Bay' warehouse. All information, from initial order to final delivery, is held electronically. Loads are scanned at Britvic factories and fed into the 'Business Planning and Control System' that creates a schedule of receipts. This information is then fed to the Warehouse Management System and when hauliers arrive at the NDC, data are passed over to the Movement Control System that controls the retrieval of pallets from the High Bay.

Over the year Britvic distribute over 100 million cases. However, the demand pattern for soft drinks is seasonal, with short-term changes caused by both weather and marketing campaigns. Furthermore, Britvic's service policy of responding whenever customers want them to deliver has a dramatic impact on the NDC and its capacity planning. 'Our busiest periods are during the summer and in the run-up to Christmas, where we expect over 200 trailers in and out each day – that equates to about 3 million cases per week. In the quiet periods, especially after Christmas, we have less than a million cases per week' (Distribution Manager).

Not only is demand on the NDC seasonal in a general sense, it can vary from 2,000 pallets one day, to 6,000 the next, as a result of short-term weather patterns and variable order patterns from large customers (supermarkets). Given the lack of space in the High Bay, it is not possible to simply stock up for the busy periods, so flexibility and efficiency are the keys to success.

The NDC uses a number of methods to cope with demand fluctuations. Most importantly is the use and development of technology both within the NDC and out in Britvic's supply chain. High levels of throughput and the ability to respond quickly to demand fluctuations depend on the use of integrated information technology linked to automated 'High Bay' handling technology. 'Without the automation this just simply couldn't function. You realize how much you need this system when it breaks down! The other day, multiple errors in the system meant that in the space of 6 hours we went from being ahead to having 50 loads waiting to be processed. That equates to 1,350 pallets or nearly 4 million cans.'

Human resource management is also key in managing capacity. Every morning the shift manager receives orders for the day, although further orders can be placed at any time during the day. The order information allows the multi-skilled workforce to be allocated effectively. The daily meetings also allow any problems to be addressed and dealt with before they become critical. Finally, by outsourcing the NDC management to Wincanton, the site is able to second employees from other Wincanton-owned sites when demand is high. 'Our other sites around the country have different peaks and troughs throughout the year which helps us utilize employee numbers.'



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### Case study Design house partnerships at Concept Design Services<sup>2</sup>

'I can't believe how much we have changed in a relatively short time. From being an inward-looking manufacturer, we became a customer-focused 'design and make' operation. Now we are an integrated service provider. Most of our new business comes from the partnerships we have formed with design houses. In effect, we design products jointly with specialist design houses that have a well-known brand, and offer them a complete service of manufacturing and distribution. In many ways we are now a "business-to-business" company rather than a "business-to-consumer" company.' (Jim Thompson, CEO, Concept Design Services (CDS))

CDS had become one of Europe's most profitable home-ware businesses. Originally founded in the 1980s, the company had moved from making industrial mouldings, mainly in the aerospace sector, and some cheap 'homeware' items such as buckets and dustpans, sold under the 'Focus' brand name, to making very high-quality (expensive) stylish homewares with a high 'design value'.

**The move into 'Concept' products**

The move into higher-margin homeware had been masterminded by Lewis Fleet, CDS's Marketing Director, who had previously worked for a large retail chain of paint and wallpaper retailers. Experience in the decorative products industry had taught him the importance of *brand and product development, even in mundane products such as paint. Premium-priced colours and new textures would become popular for one or two years, supported by appropriate promotion and features in lifestyle magazines. The manufacturers and retailers who created and supported these products were dramatically more profitable than those who simply provided standard ranges. Instinctively, I felt that this must also apply to homeware. We decided to develop a whole coordinated range of such items, and to open up a new distribution network for them to serve up-market stores, kitchen equipment and specialty retailers. Within a year of launching our first new range of kitchen homeware under the "Concept" brand name, we had over 3000 retail outlets signed up, provided with point-of-sale display facilities. Press coverage generated an enormous interest which was reinforced by the product placement on several TV cookery and "lifestyle" programmes. We soon developed an entirely new market and within two years "Concept" products were providing over 75 per cent of our revenue and 80 per cent of our profits. The price realisation of Concept products is many times higher than for the Focus range. To keep ahead we launched new ranges at regular intervals.'*

**The move to the design house partnerships**

Over the last four years, we have been designing, manufacturing and distributing products for some of the most prestigious design houses. This sort of business is likely to grow, especially in Europe where the design houses appreciate our ability to offer a full service. We can design products in conjunction with their own design staff and offer them a level of manufacturing expertise they can't get elsewhere. More significantly, we can offer a distribution service which is tailored to their needs. From the customer's point of view the distribution arrangements appear to belong to the design house itself. In fact they are based exclusively on our own call centre, warehouse and distribution resources.'

The most successful collaboration was with Vitessis, the Italian designers. Generally it was CDS's design expertise which was attractive to 'design house' partners. Not only did CDS employ professionally respected designers, they had also acquired a reputation for being able to translate difficult technical designs into manufacturable and saleable



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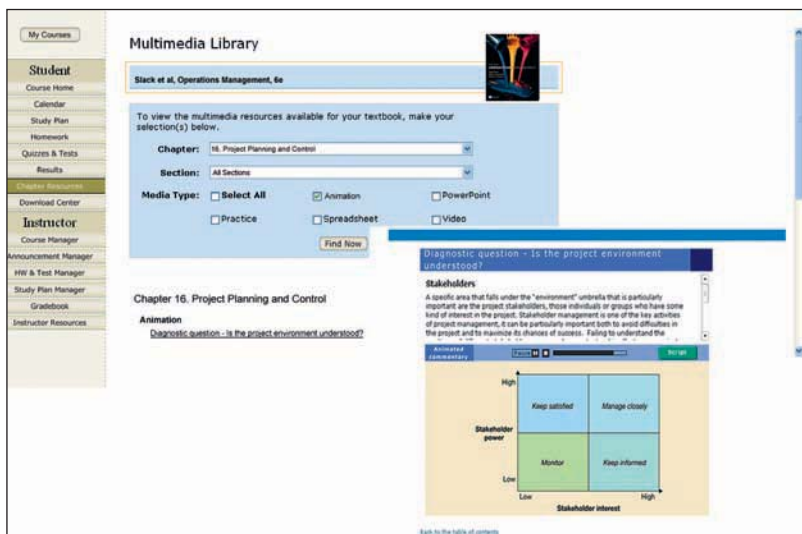
Chapter 16. Project Planning and Control

**Animation**

Diagnostic question – is the project environment understood?

Stakeholders

A specific area that falls under the "environment" umbrella that is particularly important are the project stakeholders, those individuals or groups who have some kind of interest in the project. Stakeholder management is one of the key activities of project management, it can be particularly important both to avoid difficulties in the project and to maximize the chances of success. Failing to understand the



High	Keep satisfied	Manage closely
Low	Monitor	Keep informed
	Low	High
	Stakeholder interest	

Back to the table of contents



## Take a different view

**Critical commentaries**, together with **Further reading** and **Useful websites** at the end of each chapter, show a diversity of viewpoint and encourage you to think critically about operations management. You can find the **Useful websites** in the **Multimedia library** of MyOMLab at [www.myomlab.com](http://www.myomlab.com).

Chapter 10 The nature of planning and control 291

**Figure 10.16** The drum, buffer, rope concept

Therefore, some form of communication between the bottleneck and the input to the process is needed to make sure that activities before the bottleneck do not overproduce. This is called the rope (see Figure 10.16).

**Critical commentary**

Most of the perspectives on control taken in this chapter are simplifications of a far more messy reality. They are based on models used to understand mechanical systems such as car engines. But anyone who has worked in real organizations knows that organizations are not machines. They are social systems, full of complex and ambiguous interactions. Simple models such as these assume that operations objectives are always clear and agreed, yet organizations are political entities where different and often conflicting objectives compete. Local government operations, for example, are overtly political. Furthermore, the outputs from operations are not always easily measured. A university may be able to measure the number and qualifications of its students, for example, but it cannot measure the full impact of its education on their future happiness. Also, even if it is possible to work out an appropriate intervention to bring an operation back into 'control', most operations cannot perfectly predict what effect the intervention will have. Even the largest of burger bar chains does not know exactly how a new shift allocation system will affect performance. Also, some operations never do the same thing more than once anyway. Most of the work done by construction operations is one-offs. If every output is different, how can 'controllers' ever know what is supposed to happen? Their plans themselves are mere speculation.

**The degree of difficulty in controlling operations**

The simple monitoring control model in Figure 10.15 helps us to understand the basic functions of the monitoring and control activity. But, as the critical commentary box says, it is a simplification. Some simple technology-dominated processes may approximate to it, but many other operations do not. In fact, the specific criticisms cited in the critical commentary box provide a useful set of questions which can be used to assess the degree of difficulty associated with control of any operation:

- Is there consensus over what the operation's objectives should be?
- How well can the output from the operation be measured?
- Are the effects of interventions into the operation predictable?
- Are the operation's activities largely repetitive?

Figure 10.17 illustrates how these four questions can form dimensions of 'controllability'. It shows three different operations. The food processing operation is relatively straightforward to control, while the child care service is particularly difficult. The tax advice service is somewhere in between.

Chapter 6 Supply network design 167

- 4 A private health-care clinic has been offered a leasing deal where it could lease a CAT scanner at a fixed charge of €4,000 per month and a charge per patient of €6 per patient scanned. The clinic currently charges €10 per patient for taking a scan. (a) At what level of demand (in number of patients per week) will the clinic break even on the cost of leasing the CAT scanner? (b) Would a revised lease that stipulated a fixed cost of €3,000 per week and a variable cost of €0.2 per patient be a better deal?
- 5 Visit sites on the Internet that offer (legal) downloadable music using MP3 or other compression formats. Consider the music business supply chain, (a) for the recordings of a well-known popular music artist, and (b) for a less well-known (or even largely unknown) artist struggling to gain recognition. How might the transmission of music over the Internet affect each of these artists' sales? What implications does electronic music transmission have for record shops?
- 6 Visit the web sites of companies that are in the paper manufacturing/pulp production/packaging industries. Assess the extent to which the companies you have investigated are vertically integrated in the paper supply chain that stretches from foresting through to the production of packaging materials.

**Selected further reading**

Carnel, E. and Tjia, P. (2006) *Offshoring Information Technology: Sourcing and Outsourcing to a Global Workforce*, Cambridge University Press, Cambridge. An academic book on outsourcing.

Chopra, S. and Meindl, P. (2001) *Supply Chain Management: Strategy, Planning and Operations*, Prentice Hall, Upper Saddle River, NJ. A good textbook that covers both strategic and operations issues.

Dell, M. (with Catherine Friedman) (1999) *Direct from Dell: Strategies that Revolutionized an Industry*, Harper Business.

London, Michael Dell explains how his supply network strategy (and other decisions) had such an impact on the industry. Interesting and readable, but not a critical analysis! Schoderstrom, M.L. (1998) *International Facility Location and Acquisition Analysis*, Quorum Books, New York. Very much one for the technically minded.

Vaishishia, A. and Vaishishia, A. (2006) *The Offshore Nation: Strategies for Success in Global Outsourcing and Offshoring*, McGraw-Hill Higher Education. Another topical book on outsourcing.

**Useful web sites**

[www.locationstrategies.com](http://www.locationstrategies.com) Exactly what the title implies. Good industry discussion.

[www.opanway.com](http://www.opanway.com) American location selection site. You can get a flavour of how location decisions are made.

[www.transparency.org](http://www.transparency.org) A leading site for international business (including location) that fights corruption.

[www.itsd.com](http://www.itsd.com) More details on Intel's 'Copy Exactly' strategy and other capacity strategy issues.

[www.opman.com](http://www.opman.com) Lots of useful stuff.

[www.outsourcing.com](http://www.outsourcing.com) Site of the Institute of Outsourcing. Some good case studies and some interesting reports, news items, etc.

[www.hahs.ac.uk/clips](http://www.hahs.ac.uk/clips) A centre for research in strategic purchasing and supply with some interesting papers.

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**The Channel Tunnel**  
[The Channel Tunnel - Relevance Rating: 5/5 Rating](#)  
 This website provides information on the Channel Tunnel, including details on the tunnel's construction, operation, and future plans.

**Virtual project management**  
[Virtual project management - Relevance Rating: 5/5 Rating](#)  
 This website provides information on virtual project management, including details on the benefits, challenges, and best practices.

# Preface

## Introduction

Operations management is *important*. It is concerned with creating the services and products upon which we all depend. And all organizations produce some mixture of services and products, whether that organization is large or small, manufacturing or service, for profit or not for profit, public or private. Thankfully, most companies have now come to understand the importance of operations. This is because they have realized that effective operations management gives the potential to improve both efficiency and customer service simultaneously. But more than this, operations management is *everywhere*, it is not confined to the operations function. All managers, whether they are called Operations or Marketing or Human Resources or Finance, or whatever, manage processes and serve customers (internal or external). This makes, at least part of their activities ‘operations’.

Operations management is also *exciting*. It is at the centre of so many of the changes affecting the business world – changes in customer preference, changes in supply networks brought about by internet-based technologies, changes in what we want to do at work, how we want to work, where we want to work, and so on. There has rarely been a time when operations management was more topical or more at the heart of business and cultural shifts.

Operations management is also *challenging*. Promoting the creativity which will allow organizations to respond to so many changes is becoming the prime task of operations managers. It is they who must find the solutions to technological and environmental challenges, the pressures to be socially responsible, the increasing globalization of markets and the difficult-to-define areas of knowledge management.

## The aim of this book

This book provides a clear, authoritative, well structured and interesting treatment of operations management as it applies to a variety of businesses and organizations. The text provides both a logical path through the activities of operations management and an understanding of their strategic context.

More specifically, this text is:

- *Strategic* in its perspective. It is unambiguous in treating the operations function as being central to competitiveness.
- *Conceptual* in the way it explains the reasons why operations managers need to take decisions.
- *Comprehensive* in its coverage of the significant ideas and issues which are relevant to most types of operation.
- *Practical* in that the issues and challenges of making operations management decisions *in practice* are discussed. The ‘Operations in practice’ feature, which starts every chapter, the short cases that appear through the chapters, and the case studies at the end of each chapter, all explore the approaches taken by operations managers in practice.
- *International* in the examples which are used. There are over 120 descriptions of operations practice from all over the world.
- *Balanced* in its treatment. This means we reflect the balance of economic activity between service and manufacturing operations. Around seventy-five per cent of examples are from service organizations and twenty-five per cent from manufacturing.

## Who should use this book?

Anyone who is interested in how services and products are created.

- *Undergraduates* on business studies, technical or joint degrees should find it sufficiently structured to provide an understandable route through the subject (no prior knowledge of the area is assumed).
- *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.

## Distinctive features

### Clear structure

The structure of the book uses a model of operations management which distinguishes between design, planning and control, and improvement.

### **Illustrations-based**

Operations management is a practical subject and cannot be taught satisfactorily in a purely theoretical manner. Because of this we have used examples and 'boxed' short cases which explain some issues faced by real operations.

### **Worked examples**

Operations management is a subject that blends qualitative and quantitative perspectives; 'worked examples' are used to demonstrate how both types of technique can be used.

### **Critical commentaries**

Not everyone agrees about what is the best approach to the various topics and issues with operations management. This is why we have included 'critical commentaries' that pose alternative views to the one being expressed in the main flow of the text.

### **Summary answers to key questions**

Each chapter is summarized in the form of a list of bullet points. These extract the essential points which answer the key question posed at the beginning of each chapter.

### **Case studies**

Every chapter includes a case study suitable for class discussion. The cases are usually short enough to serve as illustrations, but have sufficient content also to serve as the basis of case sessions.

### **Problems and applications**

Every chapter includes a set of problem type exercises. These can be used to check out your understanding of the concepts illustrated in the worked examples. There are also activities that support the learning objectives of the chapter that can be done individually or in groups.

### **Selected further reading**

Every chapter ends with a short list of further reading which takes the topics covered in the chapter further, or treats some important related issues. The nature of each further reading is also explained.

### **Useful websites**

A short list of web addresses is included in each chapter for those who wish to take their studies further.

# To the Instructor ...

## Teaching and learning resources for the 6th edition

### New for the sixth edition

We have a regular opportunity to listen to the views of users of the book and are always keen to receive feedback. Our research for the 6th edition resulted in maintaining the successful structure of previous editions and incorporating the following key changes:

- An even greater emphasis has been placed on the idea of 'process management', making the subject more relevant to every functional areas of the organization.
- A whole new chapter on Corporate Social Responsibility (CSR) has been added, and reflects a greater emphasis on this issue throughout the book.
- The 'Operations in Practice' sections that are used to introduce the topic at the beginning of each chapter have been refreshed.
- The Worked examples have been extended to provide a better balance between qualitative and quantitative-based techniques.
- Many of the cases at the end of the chapter and short cases are new (but the old ones are still available on the web site), and provide an up-to-date selection of operations issues.

- The 'Problems' and 'Study activities' sections have been merged. This makes each chapter more compact.
- The book has been visually redesigned to aid learning.

### Instructor's resources

A completely new instructor's manual is available to lecturers adopting this textbook, together with PowerPoint presentations for each chapter and a Testbank of assessment questions. Visit [www.pearsoned.co.uk/slack](http://www.pearsoned.co.uk/slack) to access these.

In addition a new Operations in Practice DVD is now available. Please contact your local Pearson Education Sales Consultant ([www.pearsoned.co.uk/relocator](http://www.pearsoned.co.uk/relocator)) for further details and to request a copy.

Finally, and most importantly, a new set of online resources to enable students to check their understanding, practice key techniques and improve their problem-solving skills now accompanies the book. Please see below for details of MyOMLab.



### The key to greater understanding and better grades in Operations Management!

#### MyOMLab for instructors

MyOMLab is designed to save you time in preparing and delivering assignments and assessments for your course, and to enable your students to study independently and at their own pace. Using MyOMLab, you can take advantage of:

- A wide range of engaging resources, including video, powerpoint slides and animated models with audio commentary.
- Hundreds of self-assessment questions, including algorithmically-generated quantitative values which make for a different problem every time.
- A Homework feature, allowing you to assign work for your students to prepare for your next class or seminar.
- A Gradebook which tracks students' performance on sample tests as well as assessments of your own design.

If you'd like to learn more or find out how MyOMLab could help you, please contact your local Pearson sales consultant at [www.pearsoned.co.uk/relocator](http://www.pearsoned.co.uk/relocator) or visit [www.myomlab.com](http://www.myomlab.com).

# To the Student . . .

## Making the most of this book

All academic textbooks in business management are, to some extent, simplifications of the messy reality which is actual organizational life. Any book has to separate topics, in order to study them, which in reality are closely related. For example, technology choice impacts on job design which in turn impacts on quality control; yet we have treated these topics individually. The first hint therefore in using this book effectively is to look out for all the links between the individual topics. Similarly with the sequence of topics, although the chapters follow a logical structure, they need not be studied in this order. Every chapter is, more or less, self-contained. Therefore study the chapters in whatever sequence is appropriate to your course or your individual interests. But because each part has an introductory chapter, those students who wish to start with a brief 'overview' of the subject may wish first to study Chapters 1, 4, 10 and 18 and the chapter summaries of selected chapters. The same applies to revision – study the introductory chapters and summary answers to key questions.

The book makes full use of the many practical examples and illustrations which can be found in all operations. Many of these were provided by our contacts in companies, but many also come from journals, magazines and newspapers. So if you want to understand the importance of operations management in everyday business life look for examples and illustrations of oper-

ations management decisions and activities in newspapers and magazines. There are also examples which you can observe every day. Whenever you use a shop, eat a meal in a restaurant, borrow a book from the library or ride on public transport, consider the operations management issues of all the operations for which you are a customer.

The case exercises and study activities are there to provide an opportunity for you to think further about the ideas discussed in the chapters. Study activities can be used to test out your understanding of the specific points and issues discussed in the chapter and discuss them as a group, if you choose. If you cannot answer these you should revisit the relevant parts of the chapter. The case exercises at the end of each chapter will require some more thought. Use the questions at the end of each case exercise to guide you through the logic of analysing the issue treated in the case. When you have done this individually try to discuss your analysis with other course members. Most important of all, every time you analyse one of the case exercises (or any other case or example in operations management) start off your analysis with the two fundamental questions:

- How is this organization trying to compete (or satisfy its strategic objectives if a not-for-profit organization)?,
- What can the operation do to help the organization compete more effectively?



**The key to greater understanding and better grades in Operations Management!**

### **MyOMLab for students**

MyOMLab has been developed to help students make the most of their studies in operations management. Visit the MyOMLab at [www.myomlab.com](http://www.myomlab.com) to find valuable teaching and learning material including:

- Self-assessment questions and a personalized Study Plan to diagnose areas of strength and weakness, direct students' learning, and improve results.
- Unlimited practice on quantitative techniques and solving problems.
- Audio downloads, animated models and electronic flashcards to aid exam revision.
- Video clips and short cases to illustrate operations management in action.

# Ten steps to getting a better grade in operations management

I could say that the best rule for getting a better grade is to be good. I mean really, really good! But, there are plenty of us who, while fairly good, don't get as good a grade as we really deserve. So, if you are studying operations management, and you want a really good grade, try following these simple steps:

**Step 1 Practice, practice, practice.** Use the Key questions and the Problems and applications to check your understanding. Use the Study plan feature in MyOMLab and practice to master the topics which you find difficult.

**Step 2 Remember a few key models,** and apply them wherever you can. Use the diagrams and models to describe some of the examples that are contained within the chapter. You can also use the revision pod casts on MyOMLab.

**Step 3 Remember to use both quantitative and qualitative analysis.** You'll get more credit for appropriately mixing your methods: use a quantitative model to answer a quantitative question and vice versa, but qualify this with a few well chosen sentences. Both the chapters of the book, and the exercises on MyOMLab, incorporate qualitative and quantitative material.

**Step 4 There's always a *strategic objective*** behind any operational issue. Ask yourself, 'Would a similar operation with a different strategy do things differently?' Look at the Short cases, Case studies, and Operations in practice pieces in the book.

**Step 5 Research** widely around the topic. Use websites that you trust – we've listed some good websites at the end of each chapter and on MyOMLab. You'll get more credit for using references that come from genuine academic sources.

**Step 6 Use your own experience.** Every day, you're experiencing an opportunity to apply the principles of operations management. Why is the queue at the airport check-in desk so long? What goes on behind the 'hole in the wall' of your bank's ATM machines?

Use the videos on MyOMLab to look further at operations in practice.

**Step 7 Always answer the question.** Think 'What is really being asked here? What topic or topics does this question cover?' Find the relevant chapter or chapters, and search the Key questions at the beginning of each chapter and the Summary at the end of each chapter to get you started.

**Step 8 Take account of the three tiers of accumulating marks** for your answers.

- (a) First, demonstrate your knowledge and understanding. Make full use of the text and MyOMLab to find out where you need to improve.
- (b) Second, show that you know how to illustrate and apply the topic. The Short cases, Case studies and 'Operations in practice' sections, combined with those on MyOMLab, give you hundreds of different examples.
- (c) Third, show that you can discuss and analyse the issues critically. Use the Critical commentaries within the text to understand some of the alternative viewpoints.

Generally, if you can do (a) you will pass; if you can do (a) and (b) you will pass well, and if you can do all three, you will pass with flying colours!

**Step 9 Remember not only what the issue is about, but also understand why!** Read the text and apply your knowledge on MyOMLab until you really understand why the concepts and techniques of operations management are important, and what they contribute to an organisation's success. Your new-found knowledge will stick in your memory, allow you to develop ideas, and enable you to get better grades.

**Step 10 Start now!** Don't wait until two weeks before an assignment is due. Log on ([www.myomlab.com](http://www.myomlab.com)), read on, and GOOD LUCK!

*Nigel Slack*

## About the authors

**Nigel Slack** is the Professor of Operations Management and Strategy at Warwick 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 and papers in the operations management area, including *The Manufacturing Advantage*, published by Mercury Business Books, 1991, and *Making Management Decisions* (with Steve Cooke), 1991, published by Prentice Hall, *Service Superiority* (with Robert Johnston), published in 1993 by EUROMA and *Cases in Operations Management* (with Robert Johnston, Alan Harrison, Stuart Chambers and Christine Harland) third edition published by Financial Times Prentice Hall in 2003, *The Blackwell Encyclopedic Dictionary of Operations Management* (with Michael Lewis) published by Blackwell in 2005, *Operations Strategy* together with Michael Lewis, the second edition published by Financial Times Prentice Hall in 2008 and *Perspectives in Operations Management (Volumes I to IV)* also with Michael Lewis, published by Routledge in 2003. He 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.

**Stuart Chambers** is a Principle Teaching Fellow at Warwick Business School, where he has been since 1988. He began his career as an undergraduate apprentice at

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**Robert Johnston** is Professor of Operations Management at Warwick Business School and its Deputy Dean. He is the founding editor of the *International Journal of Service Industry Management* and he also serves on the editorial board of the *Journal of Operations Management* and the *International Journal of Tourism and Hospitality Research*. He is the author of the market leading text, *Service Operations Management* (with Graham Clark), now in its 3rd edition (2008), published by Financial Times Prentice Hall. Before moving to academia Dr Johnston held several line management and senior management posts in a number of service organizations in both the public and private sectors. He continues to maintain close and active links with many large and small organizations through his research, management training and consultancy activities. As a specialist in service operations, his research interests include service design, service recovery, performance measurement and service quality. He is the author or co-author of many books, as well as chapters in other texts, numerous papers and case studies.

# Acknowledgements

During the preparation of the fifth edition of this book, the authors conducted a number of ‘faculty workshops’ and the many useful comments from these sessions have influenced this and the other books for the ‘Warwick group’. Our thanks go to everyone who attended these sessions and other colleagues. We thank Pär Åhlström of Stockholm School of Economics and Alistair Brandon-Jones of Bath University for assistance well beyond the call of duty, Alan Betts of ht2.org for case writing help and support, and Shirley Johnston for case writing help and support. Also, Professor Sven Åke Hörte of Lulea University of Technology, Eamonn Ambrose of University College, Dublin, Colin Armistead of Bournemouth University, Ran Bhamra, Loughbrough University, Ruth Boaden of Manchester Business School, Peter Burcher of Aston University, John K Christiansen of Copenhagen Business School, Philippa Collins of Heriot-Watt University, Henrique Correa of Rollins College, Florida, Paul Coughlan, Trinity College Dublin, Simon Croom, University of San Diego, Stephen Disney, Cardiff University, Doug Davies of University of Technology, Sydney, Tony Dromgoole of the Irish Management Institute, Dr J.A.C. de Haan of Tilburg University, Carsten Dittrich, University of Southern Denmark, David Evans of Middlesex University, Paul Forrester of Keele University, Keith Goffin, Cranfield University, Ian Graham of Edinburgh University, Alan Harle of Sunderland University, Norma Harrison of Macquarie University, Catherine Hart of Loughborough Business School, Chris Hillam of Sunderland University, Ian Holden of Bristol Business School, Matthias Holweg, Cambridge University, Mickey Howard, Bath University, Brian Jefferies of West Herts College, Tom Kegan of Bell College of Technology, Hamilton, Denis Kehoe, Liverpool University, Mike Lewis, Bath University, Peter Long of Sheffield Hallam University, John Maguire of the University of Sunderland, Charles Marais of the University of Pretoria, Roger Maull, Exeter University, Bart McCarthy, Nottingham University, Harvey Maylor of Cranfield University, John Meredith Smith of EAP, Oxford, Michael Milgate of Macquarie University, Keith Moreton of Staffordshire University, Chris Morgan, Cranfield University, Adrian Morris of Sunderland University, Steve New, Oxford University, John Pal of Manchester Metropolitan University, Peter Race of Henley College, Reading University, Ian Sadler of Victoria University, Richard Small, Supply Network Solutions, Andi Smart, Exeter University, Amrik

Sohal of Monash University, Alex Skedd of Northumbria Business School, Martin Spring of Lancaster University, Dr Ebrahim Soltani of the University of Kent, R. Stratton of Nottingham Trent University, Dr Nelson Tang of the University of Leicester, David Twigg of Sussex University, Helen Valentine of the University of the West of England, Professor Roland van Dierdonck of the University of Ghent, Dirk Pieter van Donk of the University of Groningen and Peter Worthington.

Our academic colleagues in the Operations Management Group at Warwick Business School also helped, both by contributing ideas and by creating a lively and stimulating work environment. Our thanks go to Jannis Angelis, Nicola Burgess, Dan Chicksand, Michaelis Giannakis, Zoe Radnor, Michael Shulver, Rhian Silvestro, Nick Wake, Dick Wheeler, Helen Walker, and Paul Walley. We are also grateful to many friends, colleagues and company contacts. In particular thanks for help with this edition goes to Philip Godfrey and Cormac Campbell and their expert colleagues at OEE, David Garman and Carol Burnett of The Oakwood Partnership, Clive Buesnel of Xchanging, Hans Mayer and Tyko Persson of Nestlé, Peter Norris and Mark Fisher of the Royal Bank of Scotland, John Tyley of Lloyds TSB, Joanne Chung of Synter BMW, Michael Purtill of Four Seasons Hotel Group, Catherine Pyke and Nick Fudge of Lower Hurst Farm, Johan Linden of SVT, John Matthew of HSPG, Dan McHugh of Credit Swiss First Boston, David Nichol of Morgan Stanley, Leigh Rix of The National Trust, and Simon Topman of Acme Whistles. Mary Walton is coordinator to our group at Warwick Business School. Her continued efforts at keeping us organized (or as organized as we are capable of being) are always appreciated, but never more so than when we were engaged on ‘the book’.

We were lucky to receive continuing professional and friendly assistance from a great publishing team. Especial thanks to Matthew Walker, Elizabeth Wright and Colin Reed.

Finally, all six editions were organized, and largely word processed by Angela Slack. It was, yet again, an heroic effort. To Angela – our thanks.

*Nigel Slack  
Stuart Chambers  
Robert Johnston*



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### Tables

Table 8.1 after E-commerce and its impact on operations management, *International Journal of Production Economics*, 75, pp. 185–97 (Gunasekaran, A., Marri, H.B., McGaughey, R.E. and Nebhwani, M.D. 2002), Elsevier; Table S9.2 adapted from Adapted from Barnes, Frank C. (1983) 'Principles of Motion Economy: Revisited, Reviewed, and Restored', Proceedings of the Southern Management Association Annual Meeting (Atlanta, G.A. 1983), p. 298.

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