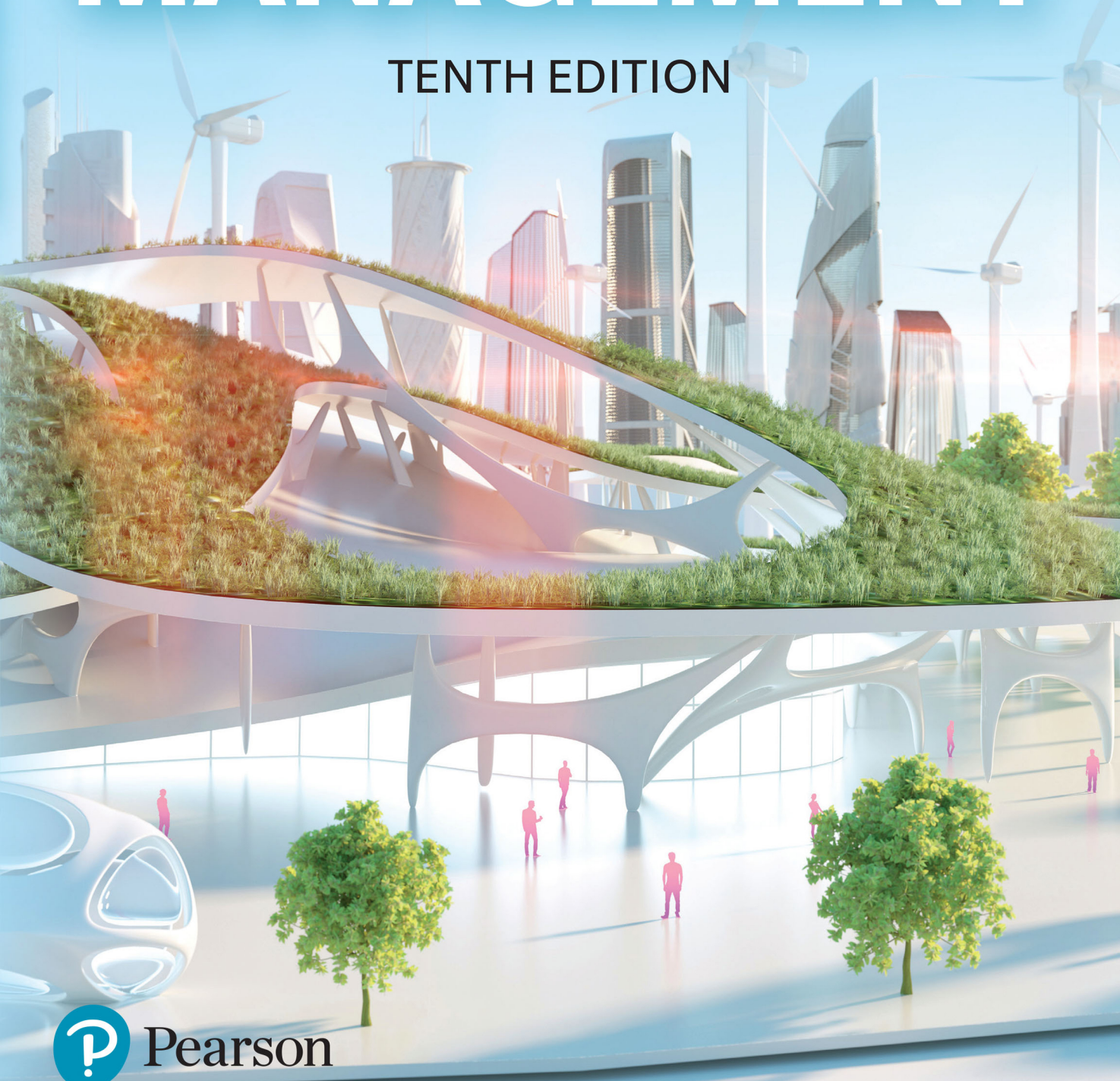


Nigel Slack • Alistair Brandon-Jones • Nicola Burgess

OPERATIONS MANAGEMENT

TENTH EDITION



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Alistair Brandon-Jones
Nicola Burgess



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KAO Two
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Guide to 'Operations in practice' examples and case studies

<i>Chapter</i>	<i>Company example</i>	<i>Region</i>	<i>Sector/activity</i>	<i>Company size</i>
1 Operations management	LEGOLAND and LEGO both rely on their operations managers	Global	Manufacturing/Leisure	Large
	MSF operations provide medical aid to people in danger	Global	Charity	Large
	Marina Bay Sands Hotel	Singapore	Hospitality	Large
	Servitisation and circular design at Philips Lighting	Europe	Lighting services	Large
	Two very different hospitality operations	Switzerland/Global	Hospitality	Small/Medium/Large
	Fjällräven products are voted the most sustainable in their field	Sweden	Manufacturing	Large
	Case study: Kaston-Trenton Service (KTS)	UK	Service	Small
2 Operations performance	Danone's path to B Corporation	Europe	Food manufacturing	Large
	Nutella shuts factory to preserve quality	France	Food manufacturing	Large
	Speeding response to save lives	UK	Emergency services	Various
	What does dependability mean when travelling by rail?	Global	Transport	Large
	566 quadrillion individual muesli mixes – now that's flexible	Germany	Internet retail	Small/Medium
	Everyday low prices at Aldi	Europe	Retail	Large
	Case study: IKEA looks to the future	Global	Retail	Large
3 Operations strategy	Operations is the basis of Ocado's strategy	Global	Retail	Large
	Dow Silicones' operations strategy	Global	Manufacturing	Large
	Tesco learns the hard way	UK	Retail	Large
	The rise of intangibles	All regions	Technology	Various
	Sustainability is high on Google's operations agenda	Global	Technology	Large
	Case study: McDonald's: half a century of growth	Global	Restaurants	Large

<i>Chapter</i>	<i>Company example</i>	<i>Region</i>	<i>Sector/activity</i>	<i>Company size</i>
4 Managing product and service innovation	The slow innovation progress of the Zip fastener	US/Sweden/ Japan	Garment manufacturing	Various
	Gorilla Glass	USA	Technology	Medium/Large
	BT's open innovation ecosystem	UK/Global	Telecoms	Large
	Toyota's approach to organising innovation	Japan	Vehicle manufacturing	Large
	Product innovation for the circular economy	UK	Manufacturing	Small
	Case study: Widescale studios and the Fiery-bryde development	UK	Video game development	Small
5 The structure and scope of supply	Virtually like Hollywood	USA	Entertainment	Large
	Aalsmeer: a flower auction hub	Netherlands	Flower supply	Medium
	Adidas shuts its 'near market' factories	Germany/ USA	Manufacturing	Large
	Aerospace in Singapore	Singapore	Aircraft servicing	
	Compass and Vodaphone – two ends of the outsourcing phenomenon	Global	Catering/ Telecoms	Large
	Bangladesh disaster prompts reform – but is it enough? Case study: Aarens Electronic	Bangladesh Netherlands	Manufacturing Manufacturing	Various Medium
6 Process design	Changi airport	Singapore	Transport	Large
	Fast (but not too fast) food drive-throughs	All regions	Restaurants	Various
	Legal & General's modular housing process	UK	Construction	Medium
	Ecover's ethical operation design	France and Belgium	Manufacturing	Large
	Dishang and Sands Film Studios – at opposite ends of the volume-variety spectrum	China/UK	Manufacturing	Small/Large
	London's underground tackles a bottleneck Case study: The Action Response Applications Processing Unit (ARAPU)	UK UK	Transport Charity	Large Small
7 The layout and look of facilities	Ducati factory or Google office, they both have to look good	Italy/USA	Manufacturing/ Technology	Large
	Reconciling quiet and interaction in laboratory layout	UK	Research	Small
	Supermarket layout	All regions	Retail	All
	Office layout and design	All regions	General	All
	Virtual reality brings layout to life	Switzerland	General	All
	Rolls-Royce factory is designed on environmental principles Case study: Misenwings SA	UK Switzerland	Manufacturing Catering	Medium Small/Medium
8 Process technology	Go figure, or not	All regions	Technology	All
	Technology or people? The future of jobs	All regions	All	All
	Love it or hate it, Marmite's energy recycling technology	UK	Food manufacturing	Large
	Bionic duckweed	UK	Transport	Large
	'Wrong-shaped' parcels post a problem for UK Mail	UK	Delivery	Large
	Rampaging robots Case study: Logaltel Logistics	USA Europe	Entertainment Logistics	Large Large

Chapter	Company example	Region	Sector/activity	Company size
9 People in operations	Do you want to own the company you work for?	UK	Software	Small
	Exoskeleton devices take the strain	USA	Manufacturing	Large
	Michelin calls it 'responsabilisation'	France	Manufacturing	Large
	Hybrid working divides opinions	Europe/USA	Several	Various
	The stress of high customer contact jobs	All regions	Service	Various
	Music while you work?	All regions	All	Various
	Technology and surveillance at work	All regions	All	Various
Case study: Grace faces (three) problems	UK	Legal services	Small	
10 Planning and control	Operations control at Air France	Global	Air transport	Large
	Can airline passengers be sequenced?	All regions	Air transport	Various
	The trials of triage	All regions	Healthcare	Various
	Sequencing and scheduling at London's Heathrow airport	UK	Air transport	Large
	Ryanair cancels flights after 'staff scheduling' errors	Europe	Air transport	Large
	Case study: Audall Auto Servicing	UK	Car servicing	Small
11 Capacity management	3M's COVID-19 surge capacity	Global	Manufacturing	Large
	How artificial intelligence helps with demand forecasting	All regions	Technology	Various
	Next-generation signal technology expands railway capacity	Global	Transport	Large
	Mass transport systems have limited options in coping with demand fluctuation	UK/Singapore	Transport	Large
	Surge pricing helps manage demand for taxis and art galleries	UK	Service	Various
	Case study: FreshLunch	UK	Restaurants	Small
12 Supply chain Management	Zipline's drone-enabled supply network	Africa	Transport	Large
	Supply chain excellence at JD.com – the rise of an e-commerce titan	China	Retail	Large
	Twice around the world for Wimbledon's tennis balls	UK	Entertainment	Medium
	Considering the longer-term effects of COVID-19 on managing supply networks	Global	All	N/A
	Donkeys - the unsung heroes of supply networks	Global	Transport	Small
	TradeLens – blockchain revolutionises shipping	Denmark/Global	Transport	Large
	Case study: Big or small? EDF's sourcing dilemma	UK	Energy	Large
13 Inventory management	An inventory of energy	All regions	Energy	Large
	Safety stocks for coffee and COVID	Switzerland/ All regions	Retail/ Healthcare	Large
	Mr Ruben's bakery	USA	Retail	Small
	Amazon's 'anticipatory inventory'	Global	Retail	Large
	France bans the dumping of unsold stock	France	Retail	Various
	Case study: supplies4medics.com	Europe	Healthcare	Medium

<i>Chapter</i>	<i>Company example</i>	<i>Region</i>	<i>Sector/activity</i>	<i>Company size</i>
14 Planning and control systems	Butcher's Pet Care coordinates its ERP	UK	Manufacturing	Large
	The computer never lies – really?	UK	Retail	Large
	The ERP for a chicken salad sandwich	UK	Manufacturing	Medium
	It's not that easy	Germany/ Australia/ Finland/USA	Various	Various
	Case study: Psycho Sports Ltd	N/A	Manufacturing	Small
15 Operations improvement	Kaizen at Amazon	Global	Retail	Large
	Disco balls and rice leads to Innovative Improvement	UK	Healthcare	Medium
	The checklist manifesto	USA	Healthcare	Various
	Six Sigma at Wipro	Global	Consultancy	Large
	Triumph motorcycles resurrected through benchmarking	UK	Manufacturing	Large
	Learning from Formula 1	UK	Retail	Large
	Schlumberger's InTouch technology for knowledge management	Global	Energy	Large
Case study: Sales slump at Splendid Soup Co.	UK	Manufacturing	Large	
16 Lean operations	Toyota: the lean pioneer	Global	Manufacturing	Large
	A very simple kanban	UK	Healthcare	Medium
	The rise of the personal kanban	All regions	N/A	Small
	Waste reduction in airline maintenance	All regions	Transport	Various
	Rapid changeover for Boeing and Airbus	Europe/USA	Transport	Large
	Jamie's 'lean' cooking	UK	Entertainment	Medium
	Autonomy at Amazon	All regions	Retail	Large
	Visual management at KONKEPT	Singapore	Retail	Medium
	Respect!	USA	Healthcare	Medium
Case study: St Bridget's Hospital: seven years of lean	Sweden	Healthcare	Medium	
17 Quality management	Quality at two operations: Victorinox and Four Seasons	Switzerland/ UK	Manufacturing/ Hospitality	Large
	Augmented reality technology adds to IKEA's service quality	Sweden	Retail	Large
	Virgin Atlantic offers a service guarantee for aviophobes	UK	Transport	Large
	Testing cars (close) to destruction	UK	Service	Medium
	Coin counting calculations	UK	Financial services	Various
	Keyboard errors – autofill and 'fat fingers'	UK/Germany	Government/ financial services	Large
	Quality systems only work if you stick to them	Japan	Manufacturing	Large
Case study: Rapposcience Labs	Belgium	Mining	Small	

<i>Chapter</i>	<i>Company example</i>	<i>Region</i>	<i>Sector/activity</i>	<i>Company size</i>
18 Managing risk and recovery	Time since last fatal crash. . . 12 years	USA	Transport	Various
	Volkswagen and the 'dieselgate' scandal	Germany	Manufacturing	Large
	Darktrace uses AI to guard against cyberattacks	UK	Technology	Large
	Pressing the passenger panic button	Global	Transport	Large
	Case study: Slagelse Industrial Services (SIS)	Denmark	Manufacturing	Medium
19 Project management	'For the benefit of all' – NASA's highs and lows	USA	Government	Large
	When every minute counts in a project – unblocking the Suez Canal	Egypt	Transport	Large
	McCormick's AI spice project	USA	Food	Large
	Berlin Brandenburg Airport opens at last	Germany	Transport	Large
	The risk of changing project scope – sinking the <i>Vasa</i>	Sweden	Military	Medium
	Ocado's robotics projects	UK	Retail	Large
	Case study: Kloud BV and Sakura Bank K.K.	Netherlands/ Japan	Financial services	Large

PREFACE

Operations may not run the world, but it makes the world run

This is our 10th edition

It's the 10th edition of this text, which means it's been around a long time! Since the first edition was published, a lot has happened to the subject of operations management. Supply networks, technologies, how people work and, above all, how the social responsibility of operations is viewed, have all changed radically. And so has this text. Over the years, we have changed the treatment and content to reflect key developments as (and often before) they fully emerge. Our philosophy has always been that we should keep pace with what is happening in the real world of operations management *as it is practised*.

One of the things that has affected the real world of operations management, is the COVID-19 pandemic. This edition was prepared as the Global pandemic was profoundly disrupting many established operations practices. Some pandemic-related changes will undoubtedly endure, others will not. Some changes were simply accelerated versions of what was happening before the pandemic – for example, working from home. Others were relatively novel – workplace barriers, travel restrictions and socially distanced working. At the time of writing, it is not at all clear how widespread or long-lasting some of these changes will be. We have tried to use the COVID-19 pandemic to illustrate underlying principles of operations management and explain some of its effects, but without letting pandemic issues dominate the text.

It is adapting the content and coverage of the subject that has allowed us to maintain our market-leading position over the 10 editions. In 2021, this text was listed in the top 10 most highly cited business, marketing, accounting and economics textbooks worldwide, according to the *Financial Times* Teaching Power Rankings. It is our ambition to continue to include the many exciting developments in the subject well into the future. To help achieve this ambition, we are delighted to welcome a third author to the team. Our friend and colleague, Dr Nicola Burgess is a Reader at Warwick Business School. She has considerable teaching, research and administrative experience, and brings significant

expertise to the team, particularly in the fields of 'lean' operations, operations improvement and healthcare management.

Why you need to study operations management

Because operations management is *everywhere*. Every time you experience a service and every time you buy a product, you are benefiting from the accomplishments of the operations managers who created them. Operations management is concerned with creating the services and products upon which we all depend. And all organisations produce some mixture of services and products, whether that organisation is large or small, manufacturing or service, for profit or not for profit, public or private. And, if you are a manager, remember that operations management 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'.

Because operations management is *important*. Thankfully, most companies have now come to understand the importance of operations. This is because they have realised that, in the short-term, effective operations management gives the potential to improve both efficiency and customer service simultaneously. Even more important, operations management can provide the capabilities that ensure the survival and success of an enterprise in the long term.

Because operations management is *exciting*. It is at the centre of so many of the changes affecting the business world – changes in customer preference, changes in supply networks, changes in how we see the environmental and social responsibilities of enterprises, profound changes in 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.

Because operations management is *challenging*. Promoting the creativity that will allow organisations 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 globalisation of markets and the difficult-to-define areas of knowledge management.

The aim of this text

This text provides a clear, authoritative, well-structured and interesting treatment of operations management as it applies to a variety of businesses and organisations. 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 that 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’ boxes throughout each chapter and the case studies at the end of each chapter, all explore the approaches taken by operations managers in practice.
- ▶ *International* in the examples that are used. There are over 100 descriptions of operations practice from all over the world, over half of which are new for this edition.
- ▶ *Balanced* in its treatment. This means we reflect the balance of economic activity between service and manufacturing operations. Around 75 per cent of examples are from organisations that deal primarily in services and 25 per cent from those that are primarily manufacturing.

Who should use this text?

This text is for anyone who is interested in how services and products are created:

- ▶ *Undergraduate students* 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 text uses the ‘4Ds’ model of operations management that distinguishes between the strategic decisions that govern the *direction* of the operation, the *design* of the processes and operations that create products and services, planning and control of the *delivery* of products and services, and the *development*, or improvement, of operations.

Illustrations-based

Operations management is a practical subject and cannot be taught satisfactorily in a purely theoretical manner. Because of this we have used short ‘Operations in practice’ examples that explain some of the 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 ones being expressed in the main flow of the text.

Responsible operations

In every chapter, under the heading of ‘Responsible operations’, we summarise how the topic covered in the chapter touches upon important social, ethical and environmental issues.

Summary answers to key questions

Each chapter is summarised in the form of a list of bullet points. These extract the essential points that answer the key questions 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 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 that takes the topics covered in the chapter further, or treats some important related issues. The nature of each piece of further reading is also explained.

TO THE INSTRUCTOR...

Teaching and learning resources for the 10th edition

New for the 10th edition

In the 10th edition we have retained the extensive set of changes that we made in the 9th edition. In addition, with slight modification, we have retained the '4Ds' structure (direct, design, deliver and develop) that has proved to be exceptionally popular. Needless to say, as usual, we have tried to keep up to date with the (increasingly) rapid changes taking place in the wonderful world of operations.

Specifically, the 10th edition includes the following key changes:

- ▶ The coverage of 'lean operations', which was included in the 'Deliver' part in previous editions, has been moved to the 'Develop' part. This reflects the change in how 'lean' is seen in the subject. Its emphasis has shifted more towards a holistic approach to operations and improvement. And, while its role in planning and control remains relevant, lean is increasingly seen as an improvement approach.
- ▶ The 'Problems and applications' questions have been extended. Each chapter now has up to 10 questions that will help to practise analysing operations. They can be answered by reading the chapter. Model answers for the first two questions can be found on the companion website for this text. Answers to all questions are available to tutors adopting the text.
- ▶ Many totally new end-of-chapter case studies have been included. Of the 19 chapters, 10 cases are new to this text. We believe that these cases will add significantly to students' learning experience. However, several of the most popular cases have been retained.
- ▶ In every chapter we have included a new section called 'Responsible operations'. This summarises how the topic covered in the chapter touches upon important social, ethical and environmental issues. We have found that using this feature to develop the important issues of social, ethical and environmental responsibility through each session provides a useful learning thread that students respond to.
- ▶ We have extended and refreshed the popular 'Operations in practice' examples throughout the text. Of more than 100 examples, around 50 per cent are new to this text.
- ▶ We have further strengthened the emphasis on the idea that 'operations management' is relevant to every type of business and all functional areas of the organisation.
- ▶ We have placed greater stress on the worked examples in each chapter, so as to give students more help in analysing operations issues.
- ▶ Many new ideas in operations management have been incorporated. However, we have retained the emphasis on the foundations of the subject.
- ▶ A completely new instructor's manual is available to lecturers adopting this textbook, together with PowerPoint presentations for each chapter.

TO THE STUDENT. . .

Making the most of this text

All academic texts in business management are, to some extent, simplifications of the messy reality that is actual organisational life. Any text has to separate topics, in order to study them, which in reality are closely related. For example, technology choice impacts on job design that in turn impacts on quality management; yet, for simplicity, we are obliged to treat these topics individually. The first hint, therefore, in using this text 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, 6, 10 and 15 and the chapter summaries of selected chapters. The same applies to revision – study the introductory chapters and summary answers to key questions.

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

management decisions and activities in newsfeeds, social media and magazines. There are also examples that you can observe every day. Whenever you use a shop, eat a meal in a restaurant, download music, access online resources or ride on public transport, consider the operations management issues of all the operations of which you are a customer.

The end-of-chapter cases and problems are there to provide an opportunity for you to think further about the ideas discussed in the chapters. The problems 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 cases at the end of each chapter will require some more thought. Use the questions at the end of each case study 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 studies (or any other case or example in operations management) start off your analysis with the two fundamental questions:

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

Ten steps to getting a better grade in operations management

We 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 the grade we really deserve. So, if you are studying operations management, and you want a really good grade, try following these simple steps:

Step 1 Practise, practise, practise. Use the 'Key questions' and the 'Problems and applications' to check your understanding.

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.

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. Each chapter incorporates 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 'Operations in practice' examples in the text.

Step 5 Research widely around the topic. Use websites that you trust – don't automatically believe what you read. 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 in the kitchen of your favourite restaurant?

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 to find out where you need to improve.
- (b) Second, show that you know how to illustrate and apply the topic. The case studies and 'Operations in practice' sections provide many 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!** Try to 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. Read on, and GOOD LUCK!

Nigel Slack, Alistair Brandon-Jones and Nicola Burgess

ABOUT THE AUTHORS

Nigel Slack is an Emeritus Professor of Operations Management and Strategy at Warwick University, and an Honorary Professor at Bath 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), *Making Management Decisions* (1991) published by Prentice Hall, *Service Superiority* (with Robert Johnston, 1993), published by EUROMA, *The Blackwell Encyclopedic Dictionary of Operations Management* (with Michael Lewis) published by Blackwell, *Operations Strategy*, now in its 6th edition (with Michael Lewis, 2020) published by Pearson, *Perspectives in Operations Management (Volumes I to IV with Michael Lewis, 2003)* published by Routledge, *Operations and Process Management*, now in its 6th edition (with Alistair Brandon-Jones, 2021) published by Pearson, *Essentials of Operations Management*, now in its 2nd edition (with Alistair Brandon-Jones, 2018) also published by Pearson, and *The Operations Advantage*, published by Kogan Page (2017). He has authored numerous academic papers and chapters in books. He has also acted as a consultant to many international companies around the world in many sectors, especially financial services, transport, leisure, energy and manufacturing. His research is in the operations and manufacturing flexibility and operations strategy areas.

Alistair Brandon-Jones is a Full Chaired Professor of Operations and Supply Chain Management, and Head of the Information, Decisions and Operations Division in Bath University's School of Management. He is a Visiting Professor for Hult International Business School and Danish Technical University, and a non-executive director at Brevio (www.brevio.org) focused on smarter grant-making in the Third Sector. Between

2014 and 2017, he was Associate Dean for Post-Experience Education, responsible for the MBA, EMBA, DBA and EngDoc programmes. He was formerly a Reader at Manchester Business School, an Assistant and Associate Professor at Bath University, and a Teaching Fellow at Warwick Business School, where he also completed his PhD. His other books include *Operations and Process Management* (6th edition, 2021), *Essentials of Operations Management* (2nd edition, 2018) and *Quantitative Analysis in Operations Management* (2008). Alistair is an active empirical researcher focusing on digitisation of operations and supply chain management, professional service operations and healthcare operations. This research has been published extensively in world-elite journals including *Journal of Operations Management*, *International Journal of Operations & Production Management*, *International Journal of Production Economics* and *International Journal of Production Research*. Alistair has led Operations Management, Operations Strategy, Supply Chain Management, Project Management and Service Operations courses at all levels and has been invited to lecture at various international institutions, including the University of Cambridge, Hult International Business School, SDA Bocconi, Warwick Business School, NOVA University, Danish Technical University, Edinburgh Napier, Warwick Medical School and University College Dublin. In addition, he has extensive consulting and executive development experience with a range of organisations, including Maersk, Schroders Bank, Royal Bank of Scotland, Baker Tilly, Rowmarsh, QinetiQ Defence, Eni Oil and Gas, Crompton Greaves, Bahrain Olympic Committee, Qatar Leadership Centre, National Health Service and the Singapore Logistics Association. He has won a number of prizes for teaching excellence and contributions to pedagogy, including from *Times Higher Education*, Association of MBAs (AMBA), Production Operations Management Society (POMS), University of Bath, University of Manchester, University of Warwick and Hult International Business School.

Nicola Burgess is Reader in Operations Management at Warwick Business School. She has worked extensively with public sector organisations to understand operations management and improvement in a public

sector context. Nicola's research has enabled her to work closely with policy makers as well as practitioners and she serves in an advisory capacity on healthcare programme boards. She also works closely with social enterprise in an advisory, research and teaching capacity. Her research has been published in world-leading journals including *Journal of Operations Management*, *European Journal of Operations Research*, *Human Resource Management* and the *British Medical Journal*. Nicola has taught operations management, operations

strategy and supply chain management at all levels from undergraduate to postgraduate and contributes to the world-leading Distance Learning MBA at Warwick Business School. She is also Course Director for the innovative Foundation Year at Warwick Business School. Her teaching has been recognised by students as being 'passionate' and 'innovative', reflecting a desire to foster student engagement, enthusiasm and understanding of operations management, both inside and outside of the classroom.

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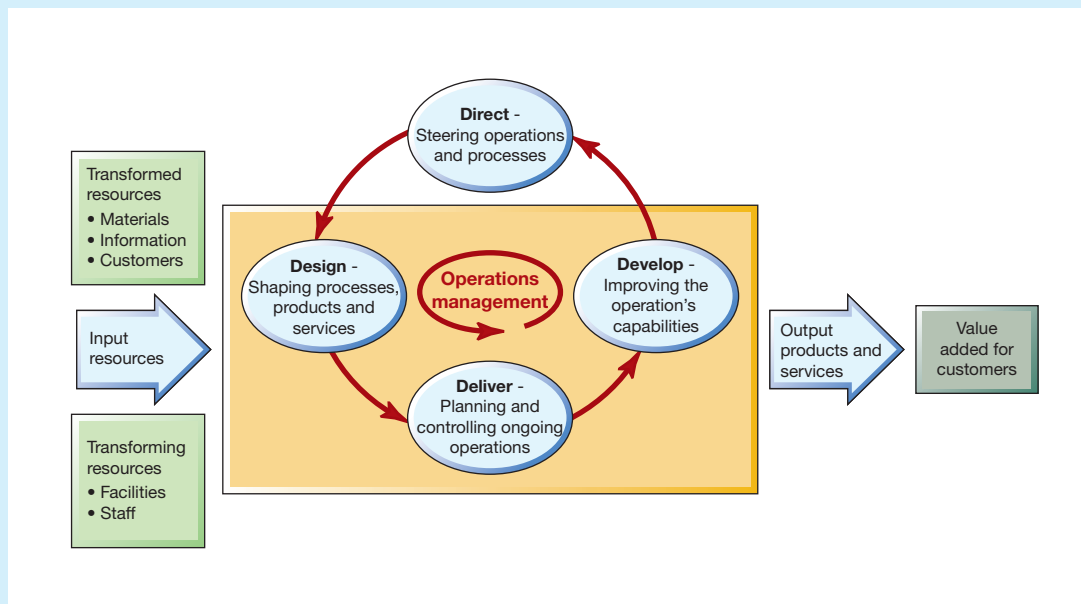
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Nigel Slack, Alistair Brandon-Jones and Nicola Burgess

PART ONE

Directing the operation



This part of the text introduces the idea of ‘operations’ and the operations function. It also examines the fundamental activities and decisions that shape the overall direction and strategy of the operations function. The chapters in this part are:

▶ **Chapter 1 Operations management**

This introduces the common ideas that describe the nature and role of operations and processes in all types of organisation.

▶ **Chapter 2 Operations performance**

This identifies how the performance of the operations function can be judged.

▶ **Chapter 3 Operations strategy**

This examines how the activities of the operations function can have an important strategic impact.

▶ **Chapter 4 Managing product and service innovation**

This looks at how innovation can be built into the product and service design process.

▶ **Chapter 5 The structure and scope of supply**

This describes the major decisions that determine how, and the extent to which, an operation adds value through its own activities.

1

Operations management

KEY QUESTIONS

- 1.1 What is operations management?
- 1.2 Why is operations management important in all types of organisations?
- 1.3 What is the input–transformation–output process?
- 1.4 What is the process hierarchy?
- 1.5 How do operations (and processes) differ?
- 1.6 What do operations managers do?

INTRODUCTION

Operations management is about how organisations create and deliver services and products. Everything you wear, eat, sit on, use, read or knock about on the sports field comes to you courtesy of the operations managers who organised its creation and delivery. Everything you look up on a search engine, every treatment you receive at the hospital, every service you expect in the shops and every lecture you attend at university – all have been created by operations managers. While the people who supervised their creation and delivery may not always be called ‘operations managers’, that is what they really are. And that is what this text is concerned with – the tasks, issues and decisions of those operations managers who have made the services and products on which we all depend. This is an introductory chapter, so we will examine what we mean by ‘operations management’, how operations processes can be found everywhere, how they are all similar yet different, and what it is that operations managers do (see Figure 1.1).

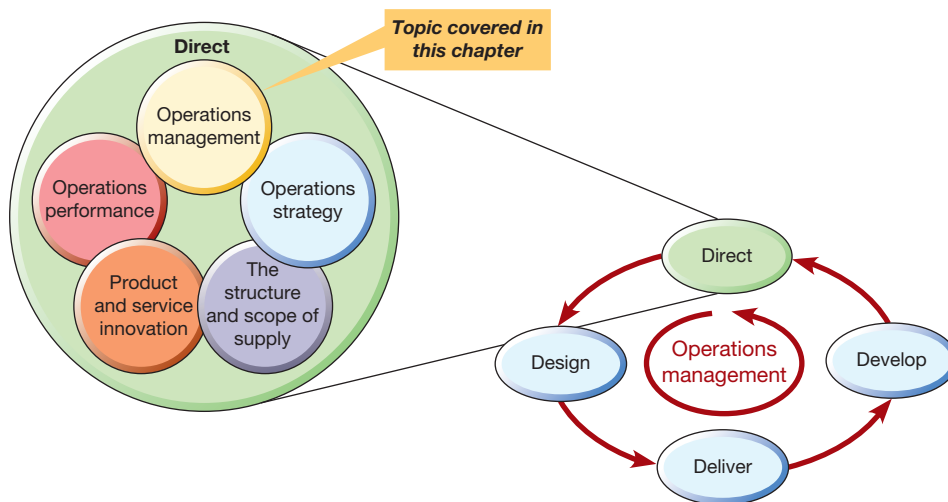


Figure 1.1 This chapter examines operations management

1.1 What is operations management?

Operations management is the activity of managing the resources that create and deliver services and products. The operations function is the part of the organisation that is responsible for this activity. Every organisation has an **operations function** because every organisation creates some type of service and/or product. However, not all types of organisation will necessarily call the operations function by this name. (Note in addition that we also use the shorter terms ‘the operation’ or ‘operations’ interchangeably with the ‘operations function’.) **Operations managers** are the people who have particular responsibility for managing some, or all, of the resources that comprise the operations function. Again, in some organisations, the operations manager could be called by some other name. For example, they might be called the ‘fleet manager’ in a distribution company, the ‘administrative manager’ in a hospital, or the ‘store manager’ in a supermarket.



Operations principle

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

OPERATIONS IN PRACTICE

LEGOLAND® and LEGO® both rely on their operations managers



They may seem to be very different businesses, even though they partly share the same name. LEGOLAND is a world-renowned chain of location-based family leisure theme parks, and LEGO is one of the best-known makers of learning toys. But look in more detail and they share many common operations management activities. It is by looking at these activities that we can understand some of the similarities and difference between operations.

LEGOLAND¹

Theme parks are a multi-billion-dollar industry. And one of the best-known brands in the industry is LEGOLAND®, whose LEGO-themed attractions hotels and accommodation are aimed primarily at families with children aged 3 to 12. LEGOLAND has parks in seven countries and across three continents. The first park opened over 60 years ago, near the LEGO factory in Billund, Denmark. Location is important. For example, LEGOLAND Deutschland is located in Bavaria close to Switzerland and Austria, all markets with a significant Lego following. All LEGOLAND parks are operated by the UK-based Merlin Entertainments, which also operates other branded attractions in the United Kingdom, Italy and Germany, such as Madame Tussauds, The London Eye, Warwick Castle and Alton Towers. What all of these have in common is that they provide their visitors with an ‘experience’. Every stage of each attraction that customers (usually referred to as ‘guests’) move through has to be designed to create an intense or immersive experience centred on theming around movie or television characters, or in the case of LEGOLAND, LEGO intellectual property. The individual attractions in theme parks require considerable investment, often using sophisticated technology. Maintaining the utilisation of these attractions means trying to manage the flow of guests around the park so that they are queuing for as little time as possible. However, public holidays, seasons and weather will all impact on the number of guests wanting to visit each park. But however busy a park is, the quality of its guests’ satisfaction with the experience is an important part of LEGOLAND’S operations management. What it calls its ‘Guest Obsession’ with creating smooth and memorable experiences for its guests includes regularly monitoring guest satisfaction scores and using ‘net promoter’ measurement (see Chapter 2 for a discussion of net promoter scores).

LEGO²

The LEGO Group, a privately held, family-owned company, with headquarters in Billund, Denmark, is one of the leading manufacturers of play materials. Lego bricks are manufactured at the Group's factories, located to be near its key markets in Europe and the United States. The company's success is founded on a deceptively simple idea. One LEGO brick is unremarkable but put one or two or more together and possibilities start to emerge. For example, there are more than 915 million possible ways of arranging six standard four-by-two bricks.³ With all the elements, colours and decorations in the LEGO range, the total number of combinations becomes very large indeed. Yet however many bricks you assemble, and irrespective of what colour or set they are from, they will always fit together perfectly because they are made to very high levels of precision and quality. The company's motto is 'Only the best is good enough'. At the Billund operation, 60 tons of plastic is processed every 24 hours, with its moulding machines supplied by a complex arrangement of tubes. This stage is particularly important, because every LEGO piece must be made with tolerances as small as 10 micrometres. The moulds used by these machines are expensive, and each element requires its own mould. Robot trolleys travel between the machines, picking up boxes and leaving empty ones, an investment in automation that means that few people are required. In the packaging process the LEGO sets take their final form. The system knows exactly how much each packed box should weigh

at any stage and any deviation sets off an alarm. Quality assurance staff perform frequent inspections and tests to make sure the toys are robust and safe. For every 1 million LEGO elements, only about 18 (that's 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.

Operations management is central to both businesses

Both LEGOLAND, which provides an entertainment service, and LEGO, which manufactures the famous LEGO bricks, depend on their operations managers to survive and prosper. It is they who design the stages that add value to the guests or the plastic that flows through the operation. They manage the activities that create services and products, they support the people whose skill and efforts contribute to adding value for both customers and the business itself. They attempt to match the operation's capacity with the demand placed upon it. They control quality throughout all the operation's processes. And they make whatever strategy each organisation has into practical reality. Without effective operations management, neither business would be as successful. Of course, there are differences between the two operations. One 'transforms' their guests, the other 'transforms' plastic. Yet they share a common set of operations management tasks and activities, even if the methods used to accomplish the tasks are different.

Table 1.1 Some activities of the operations function in various organisations

Internet service provider	Fast-food chain	International aid charity	Furniture manufacturer
<ul style="list-style-type: none"> ▶ Maintain and update hardware ▶ Update software and content ▶ Respond to customer queries ▶ Implement new services ▶ Ensure security of customer data 	<ul style="list-style-type: none"> ▶ Locate potential sites for restaurants ▶ Provide processes and equipment to produce burgers, etc. ▶ Maintain service quality ▶ Develop, install and maintain equipment ▶ Reduce impact on local area ▶ Reduce packaging waste 	<ul style="list-style-type: none"> ▶ Provide aid and development projects for recipients ▶ Provide fast emergency response when needed ▶ Procure and store emergency supplies ▶ Be sensitive to local cultural norms 	<ul style="list-style-type: none"> ▶ Procure appropriate raw materials and components ▶ Make sub-assemblies ▶ Assemble finished products ▶ Deliver products to customers ▶ Reduce environmental impact of products and processes

If you want a flavour of some of the issues involved in managing a modern successful operation, look at the 'Operations in practice' example, 'LEGOLAND® and LEGO® both rely on their operations managers'. It illustrates how important the operations function is for any company whose reputation depends on creating high-quality, sustainable and profitable products and services. Their operations and their offerings are innovative, they focus very much on customer satisfaction, they invest in the development of their staff, and they play a positive role in fulfilling their social and environmental responsibilities. All of these issues are (or should be) high on the agenda of any operations manager in any operation. Continuing this idea, Table 1.1 shows just some of the activities of the operations function for various types of organisations.

Operations in the organisation

The operations function is central to the organisation because it creates and delivers services and products, which is its reason for existing. The operations function is one of the three **core functions** of any organisation. These are:

- ▶ the marketing (including sales) function – which is responsible for positioning and communicating the organisation’s services and products to its markets in order to generate customer demand;
- ▶ the product/service development function – which is responsible for developing new and modified services and products in order to generate future customer demand;
- ▶ the operations function – which is responsible for the creation and delivery of services and products based on customer demand.

In addition, there are the support functions that enable the core functions to operate effectively. These include, for example, the accounting and finance function, the technical function, the human resources function and the information systems function. Remember that although different organisations may call their support functions by different names, almost all organisations will have the three core functions.

However, there is not always a clear division between functions. This leads to some confusion over where the boundaries of the operations function should be drawn. In this text, we use a relatively **broad definition of operations**. We treat much of the product/service development, technical and information systems activities and some of the human resource, marketing, and accounting and finance activities as coming within the sphere of operations management. We view the operations function as comprising all the activities necessary for the day-to-day fulfilment of customer requests within the constraints of social and environmental sustainability. This includes sourcing services and products from suppliers and delivering services and products to customers.

Figure 1.2 illustrates some of the relationships between operations and other functions in terms of the flow of information between them. Although not comprehensive, it gives an idea of the nature of each relationship. Note that the support functions have a different relationship with operations to the core functions. Operations management’s responsibility to support functions is primarily to make sure that they understand operations’ needs and help them to satisfy these needs. The relationship with the other two core functions is more equal – less of ‘this is what we want’ and more ‘this is what we can do currently – how do we reconcile this with broader business needs?’

Operations principle

Operations managers need to cooperate with other functions to ensure effective organisational performance.

1.2 Why is operations management important in all types of organisations?

In some types of organisation, it is relatively easy to visualise the operations function and what it does, even if we have never seen it. For example, most people have seen images of a vehicle assembly line. But what about an advertising agency? We know vaguely what they do – they create the advertisements that we see online, in magazines and on television – but what is their operations function? The clue lies in the word ‘create’. Any business that creates something must use resources to do so, and so must have an operations activity. Also, the vehicle plant and the advertising agency do have one important element in common; both have a higher objective – to make a profit from creating and delivering their products or services. Yet not-for-profit organisations also use their resources to create and deliver services, not to make a profit, but to serve society in some way. Look at the examples of what operations management does in five very different organisations in Figure 1.3 and some common themes emerge.

Start with the statement from the ‘easy-to-visualise’ vehicle plant. Its summary of what operations management does is: ‘Operations management uses machines to efficiently assemble products that satisfy current customer demands’. The statements from the other organisations are similar but use slightly different language. Operations management uses not just machines but also ‘knowledge’, ‘people’, ‘our and our partners’ resources’ and ‘our staff’s knowledge and experience’, to efficiently (or effectively or creatively) assemble (or produce, change, sell, move, cure, shape, etc.)

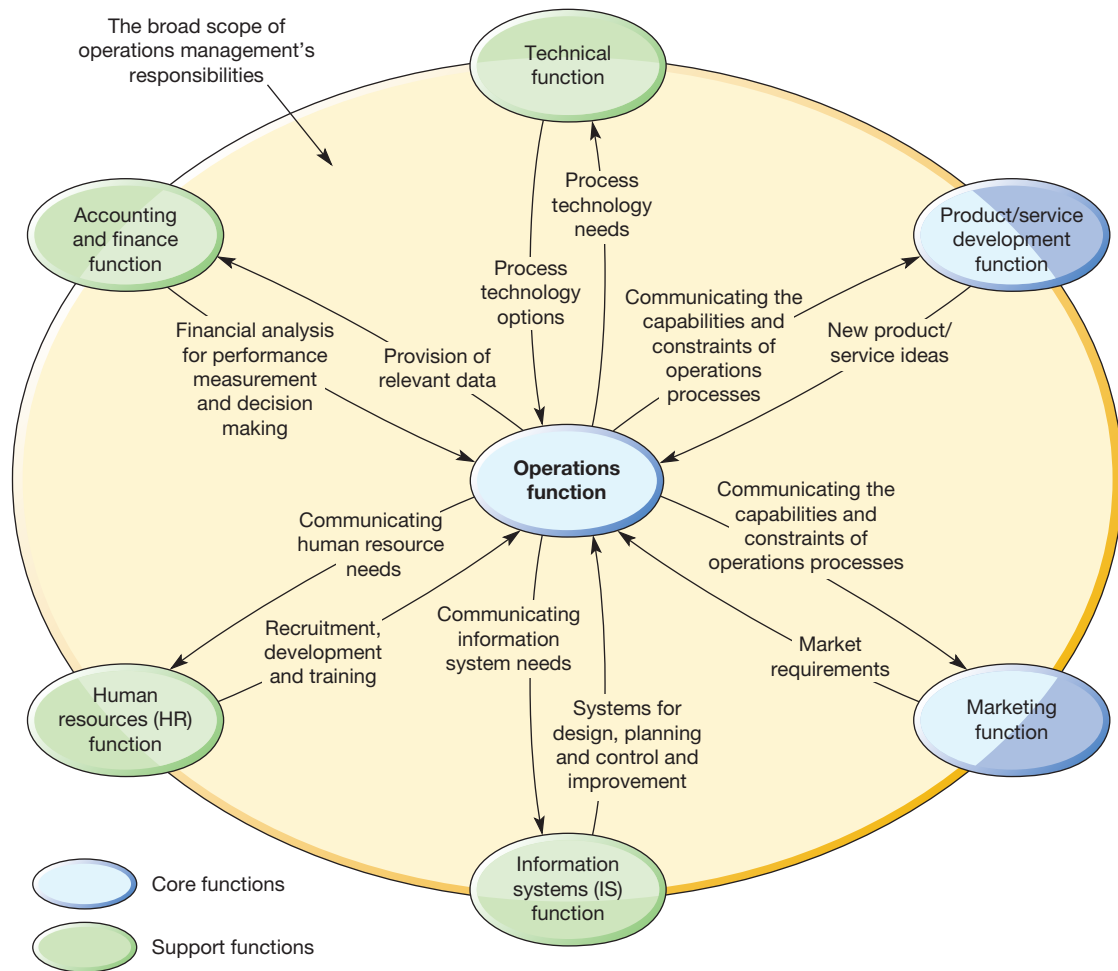


Figure 1.2 The relationship between the operations function and other core and support functions of the organisation



Operations principle

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

products (or services or ideas) that satisfy (or match or exceed or delight) customer (or clients' or citizens' or society's) demands (or needs or concerns or even dreams).

Whatever terminology is used there is a common theme and a common purpose to how we can visualise the operations activity in any type of organisation; small or large, service or manufactur-

ing, public or private, profit or not-for-profit. Operations management uses 'resources to appropriately create outputs that fulfil defined market requirements' (see Figure 1.4). However, although the essential nature and purpose of operations management is the same in any type of organisation, there are some special issues to consider, particularly in smaller organisations and those whose purpose is to maximise something other than profit.

Operations management in the smaller organisation

Operations management is just as important in small organisations as it is in large ones. Irrespective of their size, all companies need to create and deliver their services and products efficiently and effectively. However, in practice, managing operations in a small or medium-size organisation has its own set of problems. Large companies may have the resources to dedicate individuals to specialised tasks, but smaller companies often cannot, so people may have to do different jobs as the need arises. Such an informal structure can allow the company to respond quickly as opportunities or problems present themselves. But decision making can also become confused as individuals' roles overlap. Small

Physician's surgery – Operations management uses knowledge to effectively diagnose conditions in order to treat real and perceived patient concerns



Automobile assembly factory – Operations management uses machines to efficiently assemble products that satisfy current customer demands



Management consultancy – Operations management uses people to effectively create the services that will address current and potential client needs



Advertising agency – Operations management uses our staff's knowledge and experience to creatively present ideas that delight clients and address their real needs



Disaster relief charity – Operations management uses our and our partners' resources to speedily provide the supplies and services that relieve community suffering

All of these are operations

Figure 1.3 All of these are operations that produce some mix of products and services

Operations management uses...

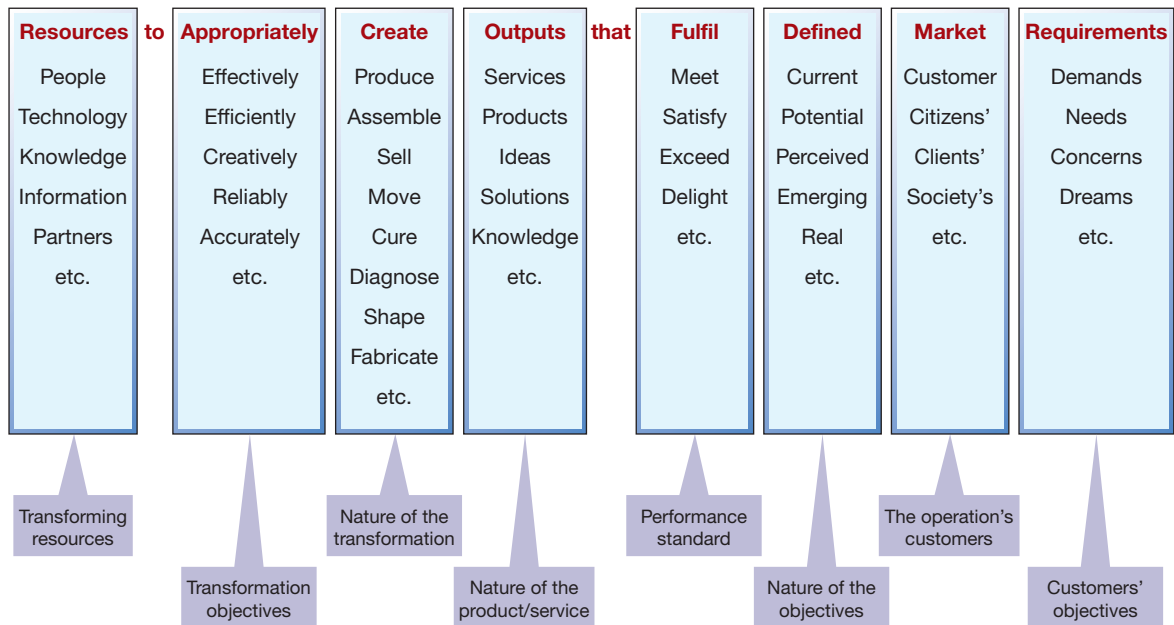


Figure 1.4 Operations management uses resources to appropriately create outputs that fulfil defined market requirements