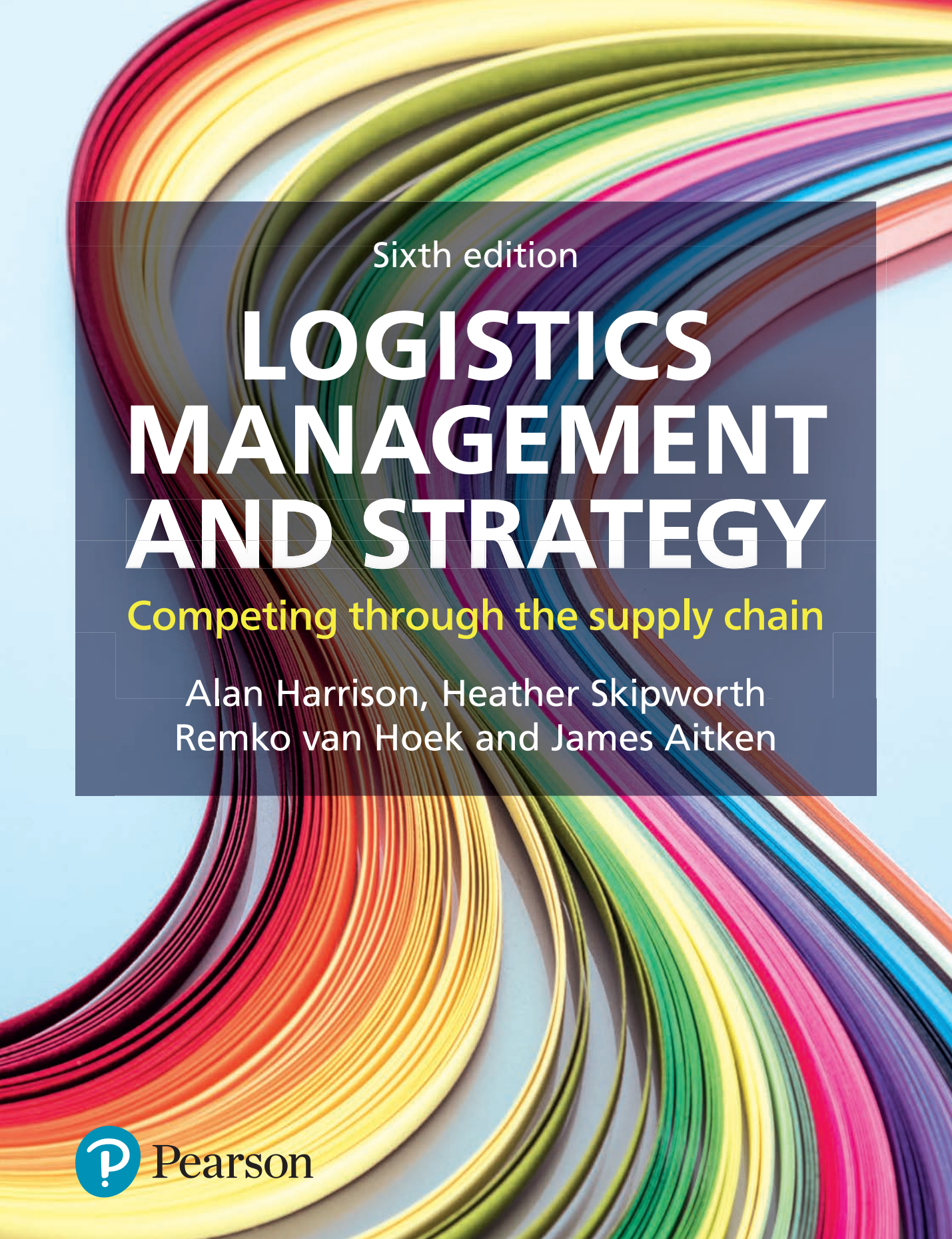
Sixth edition
LOGISTICS MANAGEMENT AND STRATEGY
Competing through the supply chain
Alan Harrison, Heather Skipworth
Remko van Hoek and James Aitken
Pearson

Logistics Management and Strategy

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Logistics Management and Strategy

Competing through the supply chain

Sixth edition

Alan Harrison

Heather Skipworth

Remko van Hoek

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To Cathi, Nick, Katie, Maryl, Ticho, Dylan, Jason, Rade, Luka, Daniel, Jacqueline, Garrie and James, with love.

Contents

Part Two LEVERAGING LOGISTICS OPERATIONS

Personal foreword

I am honoured to be asked to write a personal foreword to the latest edition of *Logistics Management and Strategy*. Alan, my husband until his death in October 2012, was justifiably proud of this book; it epitomises his approach to teaching and training, delivering applied theory and research to satisfy rigorous academic enquiry, in a format attractive and useful to busy practitioners and new recruits to the industry. He would be delighted to see his work reach a sixth edition; he relished the challenge of developing a popular and trusted resource, ever seeking to progress in the light of latest thinking and innovation.

Alan's good friends and close academic colleagues Heather, Remko and now Jim bring their expertise and passion into the authorship of this book, building on the foundation of Alan's achievement and taking his work into the future. I salute all three, and wish them, this book and all its readers every success.

Catherine Maryon,
December 2018

Professional foreword

I am delighted to introduce *Logistics Management and Strategy,* now in its sixth edition, a further aid in our ability to drive our understanding of such a critical part of the business environment. In my 40 years of operational experience in global supply chains, within Bausch & Lomb, Johnson Matthey and, most recently, as an independent consultant in supply chain management currently focused on Brexit, logistics remains a key area of management attention, given its central role in customer service and the opportunities it provides for cost control, two fundamental essentials for any global business today.

Whilst I was at Bausch & Lomb, the focus was committed to producing state-of-the-art optical products, from contact lenses to cataract surgery and the fast-growing optical pharmaceutical markets. These complex supply chains cover five continents and serve varying types of customer including hospitals, opticians and multiple retailers. They involved stock-keeping units (SKUs) requiring temperature control, serial traceability and sterility, and made for a diverse and challenging set of logistics demands.

When you then add these challenges to a range of over 100,000 SKUs – with some products being offered in over 7,000 different refractive powers/pack sizes – then you can understand why utilising the very latest approaches to logistics management and strategy is absolutely crucial.

During my 23 years at Bausch & Lomb we invested heavily in automated warehouses, such as at our site in Amsterdam, recognised as one of the 'top 10' logistics facilities in the Netherlands. We also developed our utilisation of agile logistics. This was addressed by reducing the number of base products produced in our 17 factories, whilst increasing customer responsiveness through postponement of labelling, bundling, promotional artwork and language compliance. In this regard, being a member of the Agile Supply Chain Research Club at Cranfield, originally working with Alan and more recently with Heather, has been a rewarding and beneficial experience. I note that some of our experience has been invested in Chapter 7.

More recently I worked for three years at Johnson Matthey, a FTSE100 company in the automotive sector. Here again the logistics and supply chain management went hand in hand with a global environment, and featured a strong emphasis on a customer-focused supply chain, aggressive cost controls and the use of tools such as sales and operations planning (S&OP), risk analysis and an end-to-end supply chain view from raw materials supply to final customer delivery.

In the last year, I have worked for multiple global organisations in supply chain consultancy, and many of the key areas in this publication have been the focus of the needs of those customers time and time again, proving its relevance and timeliness. Indeed, in my career I have found that across multiple industry sectors – pharmaceuticals, healthcare, FMCG and automotive – that the fundamentals of supply chain and logistics management are consistent, and therefore the value of this publication is accordingly high across all sectors of industry and commerce.

With the addition of many important supply chain aspects in this latest edition, it is with texts such as *Logistics Management and Strategy* in your armoury that you can continue to drive further improvements in your supply chain. The great aspect of this text is its readability; it does not seek to lecture the reader, but imparts its wisdom in a straightforward and practical manner. Fundamentally, I believe that is the essence of the science of logistics. Every element of our complex logistical environment is captured in this book with new sections including integrated supply chain strategy; supply chain risk assessment and mitigation; global perspectives and coverage; the use of big data; approaches to automation; a wide range of agile practices; and planning approaches such as S&OP – all adding to the rich content.

In introducing this collaboration between Alan, Remko, Heather and James, my parentage springs to mind. This was another Anglo-Dutch partnership, albeit with different outcomes! I have spent the last 40 years in logistics, working in both British, American and Dutch environments. The last 25 of these have been in a global role.

It was a personal tragedy when I learned of Alan's illness and eventual passing. As mentioned elsewhere, he was a fantastic contributor to the Agile Supply Chain Research Club and an inspiration to all of us who worked with him. I was fortunate to work with Alan for many years and it was a terrible loss to the world of supply chain when he sadly passed away, but this book is part of a tremendous legacy which he left to us all.

The output of the collaboration between Alan, Remko, Heather and now James rings true in so many areas and offers methods and approaches that will continue to drive our improvements in the coming years.

Paul Mayhew MSc, FCILT
Global Supply Chain Consultant, Wyndham Solutions Ltd

Preface

Logistics has been emerging from Peter Drucker's shadowy description as 'the economy's dark continent' for some years. From its largely military origins, logistics has accelerated into becoming one of the key business issues of the day, presenting formidable challenges for managers and occupying some of the best minds. Its relatively slow route to this exalted position can be attributed to two causes. First, logistics is a cross-functional subject. In the past, it has, rightly, drawn on contributions from marketing, finance, operations and corporate strategy. Within the organisation, a more appropriate description would be a *business process,* cutting across functional boundaries yet with a contribution from each. Second, logistics extends beyond the boundaries of the organisation into the supply chain. Here, it engages with the complexities of synchronising the movement of materials and information between many businesses. The *systems nature* of logistics has proved a particularly difficult lesson to learn, and individual organisations still often think that they can optimise profit conditions for themselves by exploiting their partners in the supply chain. Often they can – in the short term. But winners in one area are matched by losers in another, and the losers are unable to invest or develop the capabilities needed to keep the chain healthy in the long term. Thus the supply chain as whole loses its competitiveness from this short-term exploitative approach. The emergence of logistics has, therefore, been dependent on the development of a cross-functional model of the organisation, and on an understanding of the need to integrate business processes across the supply network.

Whilst its maturity as a discipline in its own right is still not complete, we believe that it is important to further develop logistics management and strategy. Tools and concepts to enable integration of the supply chain are starting to work well. Competitive advantage in tomorrow's world will come from responding to end-customers better than competition and, to this end, understanding how to exploit the latest advances in technology that are developing at an increasing rate. Logistics and supply chain management play a vital role in this response, and it is this role that we seek to describe in this book.

The globalisation of logistics assumes that quality can be duplicated anywhere, that risks are relatively small, and that sustainability does not really matter. Case study 4.2 quotes an environmental activist as saying, 'We are producing food in one corner of the world, packing it in another and then shipping it somewhere else. It's mad.' The reality is that twenty-first-century supply chains are developing very different profiles from those developed by the mindsets of 20 or 30 years ago. Risk is growing in its importance. Plans will need to be in place to prevent or mitigate the impact of financial, operational, natural and political uncertainty. It is both environmentally and economically right to focus on sustainability. Logistics stands at the heart of this debate.

This text has a clear European foundation and an international appeal. In line with the globalisation of logistics, we have included cases from other parts of the

world than Europe – diverse though European logistics solutions are – including South Africa, the United States, Japan, China and Australia.

Accordingly, we start in Part One with the strategic role of logistics in the supply chain. We continue by developing the marketing perspective by explaining our view of 'putting the end-customer first'. Part One finishes by exploring the concept of value and logistics costs. In Part Two, we review leveraging logistics operations in terms of their global dimensions, and of the lead-time frontier. Part Two continues by examining the challenges of coordinating manufacturing and retail processes, and the impact on logistics of just-in-time and the agile supply chain. Part Three reviews working together, first in terms of integrating the supply chain and second in terms of sourcing and supply management. Our book ends with Part Four, in which we outline the logistics future challenge.

This text is intended for MSc students on logistics courses, and as an accompanying text for open learning courses such as global MSc degrees and virtual universities. It will also be attractive as a management textbook and as recommended reading on MBA options in logistics and supply chain management.

In the second edition, we listened carefully to students and to reviewers alike and set out to build on the foundation of our initial offering. We updated much of the material whilst keeping the clear structure and presentation of the first edition. There were lots of new cases and we updated others. We attempted to touch on many of the exciting developments in this rapidly expanding body of knowledge, such as governance councils, the prospects for a radio frequency identification device (RFID) and the future of exchanges.

The third edition retained the clarity and up-to-date content that had become hallmarks of the previous editions. It continued to provide further new and updated cases to illustrate developments in the subject. Chapters 6, 7 and 10 were largely reconstructed, but we also made many improvements to other chapters resulting from our research and work with industrial partners.

The fourth edition built on the foundations we had developed so far, whilst continuing to update the content and keep it abreast of the rapidly developing logistics body of knowledge. Many of the cases were updated too and new ones introduced. Chapters 6 and 7 were again largely reconstructed, and we refocused Chapter 9 around sourcing and supply management. We continued to develop the theme of sustainable logistics, which we classify as a competitive priority right from the start.

We worked with Alan on the fifth edition before his death, after which we continued without his direct intervention, but very much within his guidance. That edition carried forward the healthy tradition established for this book by further developing areas on the basis of the latest research and providing cases to illustrate practice. In response to reviewers we further developed the alignment between marketing and supply chain, culminating in a new expanded section on segmented supply chain strategy in Chapter 2. We also took the opportunity to reconstruct and expand Chapter 3 on value and logistics costs, equipping the reader with the latest thinking on improving liquidity through supply chain management and approaches to making capital investment decisions. Risk readiness in Chapter 4 was also updated in the light of food scares such as the horsemeat scandal. Related

to this, a new section was also added to Chapter 4 to address the global governance of supply chains.

Agility is not new but the concept has developed across organisational and relational practices. Chapter 7 was therefore reconstructed and expanded to reflect the body of knowledge now available on supply chains able to respond to unpredictable demand. Chapter 10 was revised to reflect the changing future and revisited corporate social responsibility from the perspective of supply chain trade-offs. Humanitarian logistics was also a new section, created in response to the growing number of humanitarian crises – both political and natural – and the need for existing supply chain strategies to be applied to save lives. As with all previous editions, many of the cases were updated and new ones introduced. In response to reviewers, we introduced more global cases, such as the Li & Fung case and also food supply chain cases.

For the sixth edition we were fortunate to welcome Professor James Aitken as a third active author. He brings with him a wealth of experience both in industry and academia and has greatly contributed to this edition. We felt it important to ensure that technological advances under the banner of Industry 4.0 were covered, so you will find such additions as big data and the Internet of Things covered in Chapters 2 and 10; the use of industrial robots and augmented reality in Chapter 5; 3D printing, adaptable distribution networks and drones in Chapter 7; an updated review of the use of radio frequency identification devices (RFID) and an entirely new section on blockchain in Chapter 8.

In response to reviewers' comments we have improved and expanded the explanations of the balanced scorecard and the SCOR model in Chapter 3; covered in depth the changing role of logistics service providers, expanded risk management and added a section on tax efficient supply chains in Chapter 4; created a new section on the transaction cost economics (TCE) perspective of relationships in Chapter 8; and expanded the existing section on corporate social responsibility (CSR) in Chapter 10.

We also took the opportunity to improve Chapter 5 to focus more clearly on the various speed trade-offs and how they can be overcome, such as cost versus speed and variety versus speed. We also raise an interesting debate about managing time in a high process variety environment by being mindful of how that time is used. Finally, the section on strategies and practices for the situation where total logistics time (cycle time) is greater than the time the customer is willing to wait has been expanded. Chapter 6 also underwent significant improvement, including a new section on sales and operations planning, incorporating a new case study with a basic simulation tool, and an improved section on efficient consumer response (ECR). Finally Chapter 8 has been expanded to reflect its increasing importance; we have further developed the sections on external integration between companies and electronic integration.

As with all previous editions, many of the cases have been updated and new ones introduced, such as the use of collaborative robots at GKN Driveline, demand profiling at Tilda, supplier relationship management at Mars and many more. In response to reviewers' comments, all but one of the 14 new cases relate to sectors other than retailing in order to improve the cross-sector balance of cases.

We are grateful to Paul Mayhew, formerly of Bausch & Lomb and later Johnson Matthey and now a Global Supply Chain Consultant at Wyndham Solutions Ltd.,

who has once again written the foreword. We are also indebted to Catherine Maryon, who has provided a personal foreword for this book to pay tribute to our beloved colleague and friend Professor Alan Harrison, who passed away in 2012. We will always miss Alan, and we are proud to take the book to a 6th edition as if he were still by our side.

We hope that our book will offer support to further professional development in logistics and supply chain management, which is needed today more than ever before. In particular, we hope that it encourages you to challenge existing thinking, and to break old mindsets by creating a new and more innovative future. Transformation of supply chains is a focus for everyone in the 21st century. Since we first launched this textbook in 2001, it has become a European bestseller and is popular in Australia, Singapore and South Africa. It is also developing an important following in the United States. Our book has also been published in local language formats in Japan, Brazil, Russia, China, Poland, Mongolia and Ukraine.

Authors' acknowledgements

We should like to acknowledge our many friends and colleagues who have contributed to our thinking and to our book. Cranfield colleagues deserve a special mention: Prof Janet Godsell (now at Warwick Manufacturing Group), Prof Carlos Mena (now at Portland State University), Dr Simon Templar, Dr Silvia Rossi, Dr Paul Chapman (now at Saïd Business School), Prof Paul Baines and Professor Richard Wilding have all made important contributions. Sri Srikanthan helped us with the financial concepts in Chapter 3. Members of the Agile Supply Chain Research Club at Cranfield also deserve special mention, notably Stuart Bailey of Brakes Group (formerly of Kimberley-Clark), Simon Marshall and Paul Horton of Travis Perkins, Paul Mayhew (formerly of Johnson Matthey), who provides the foreword for the new edition, Ian Shellard and David Evans of Rolls-Royce, Mark Baker of Pentland Brands (who updated Case study 4.4 and Case study 8.6), Joe Thomas of Tesco (who updated Case study 1.1), Martyn Walker of Agility Science and Jody Cleworth of Marine Transport International (who provided Case study 8.8 on blockchains), Jon Hinton and Shane Artiss of DHL (who supported Case study 5.4 on vision picking) and Nicky McGroarty of O2 (for supporting development of Case study 8.4). Other individuals who have provided information for cases include Jeremy Roberts of Tilda Limited (Case study 2.3), Chris Guacci of DW Windsor Lighting Limited (Case study 7.5), Stephane Guelat of Eaton Corporation who supported Case study 9.6, Mohammed Zameer of GKN Driveline who provided material for Case study 5.3 and Richard Renshaw of KPMG (also a Cranfield Visiting Fellow), who created an excellent teaching case on Sales and Operations Planning (Case study 6.2) . We have picked the brains of several who have recently retired from the industry, including David Aldridge (formerly of Cussons UK) and Philip Matthews (formerly of Boots the Chemist). A number of professors from other universities have contributed ideas and cases, including Corrado Ceruti (University of Roma), Tor Vergata, Marie Koulikoff-Souviron (SKEMA Business School, Nice), Jacques Colin (CretLog, Aix-en-Provence), Konstantinos Zographos (Athens University of Economics and Business), Huo Yanfang (University of Tianjin), Thomas Choi (Arizona State University) and David Bennett (Newcastle Business School). Many of our MSc graduates, such as Steve Walker and Alexander Oliveira, also made important contributions. Professor Yemisi Bolumole (Michigan State University) helped us to redraft earlier versions of the first edition. Also, we thank the reviewers who made many valuable comments on earlier editions of this book. We are very grateful to all of these, and to the many others who made smaller contributions to making this book possible. Cathi Maryon helped to research several of the cases. Finally, we thank Lynne Wall for helping wherever she could – in addition to helping to run our Centre for Logistics and Supply Chain Management at Cranfield!

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Photographs

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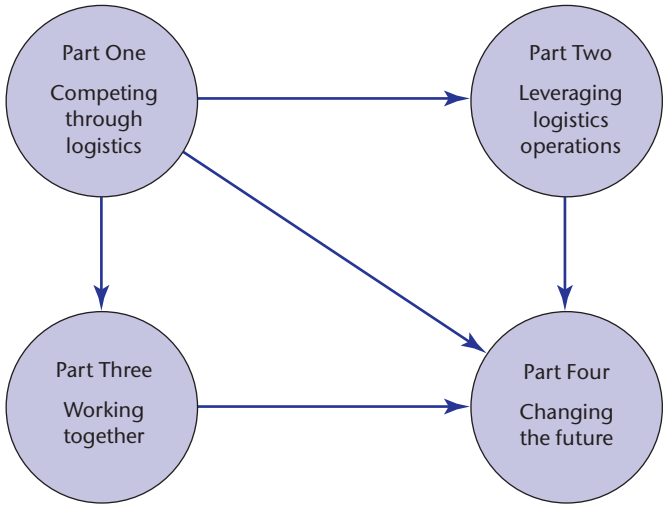
How to use this book

This book is divided into four parts, centred on a model for logistics. The model for logistics is introduced in the first chapter of Part One, which places logistics in terms of its contribution to competitiveness, customer service and the creation of value. Part Two of the book focuses on leveraging logistics operations within the context of quality of service and cost performance objectives. Part Three focuses on working together, and Part Four pulls together four elements of leading-edge thinking in logistics, homing in on future challenges for the subject.



The book has been arranged to take you through the subject in logical stages. The limitation of a text presentation is that the subjects are then arranged in sequence, and links between stages have to be made by the reader. We have set out to facilitate cross-linkages by including:

- *activities* at the end of many of the sections, which are aimed at helping you to think about the issues raised and how they could be applied;
- *discussion questions* at the end of each chapter to help you assess your understanding of the issues raised, and give you practice in using them;
- *case studies,* which draw together a number of issues and help you to think about how those issues are linked together in a practical setting. Use the study questions at the end of each case to guide your thinking.

We have sought to break up the text with figures, tables, activities and case studies, so rarely will you find two successive pages of continuous text. You should, therefore, regard the activities and case studies as an integral part of the method used in this book to help you to learn.

Where possible, discuss the activities and case study questions in groups after you have prepared them individually. Discussion helps to broaden the agenda and create confidence in handling the issues. Whilst you are studying this book, think about the logistics issues it raises – in your own firm or ones that you know well, and in articles in newspapers such as the *Financial Times* and magazines such as *Business Week*. Follow up the website addresses we have included in the text and again link them with the issues raised in the book.

A few words on terminology are appropriate here. We have taken the view that logistics and supply chain management (SCM) are sufficiently different for separate definitions to be needed. We have included these definitions in Chapter 1: logistics is a subset of SCM. 'Supply chain' and 'supply network' are used interchangeably, although we favour 'chain' for a few organisations linked in series and 'network' to describe the more complex inter-linkages found in most situations. Again, our position is explained in Chapter 1.

A summary is provided at the end of each chapter to help you to check that you have understood and absorbed the main points in that chapter. If you do not follow the summary points, go back and read the relevant section again. If need be, follow up on references or suggested further reading. Summaries are also there to help you with revision.

We have designed this book to help you to start out on the logistics journey and feel confident with its issues. We hope that it will help you to improve supply chains of the future.

Plan of the book

Part One COMPETING THROUGH LOGISTICS

Chapter 1
Logistics and the supply chain

Chapter 2
Putting the end-customer first

Chapter 3
Value and logistics costs

Part Two LEVERAGING LOGISTICS OPERATIONS

Chapter 4
Managing logistics internationally

Chapter 5
Managing the lead-time frontier

Chapter 6
Supply chain planning and control

Chapter 7
Lean thinking and agile supply chains

Part Three WORKING TOGETHER

Chapter 8
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Chapter 9
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Part Four CHANGING THE FUTURE

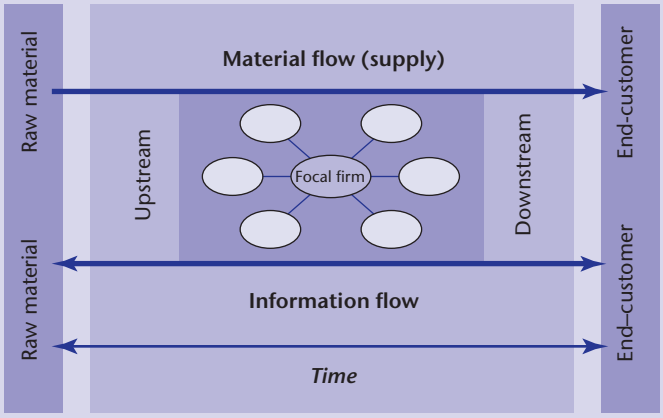
Chapter 10
Logistics future challenges and opportunities

Part One

COMPETING THROUGH LOGISTICS

Our model of logistics structures the supply network around three main factors: the flow of materials, the flow of information and the time taken to respond to demand from source of supply. The scope of the network extends from the 'focal firm' at the centre across supplier and customer interfaces, and therefore typically stretches across functions, organisations and their borders. The network is best seen as a system of interdependent processes, where actions in one part affect those of all others. The key 'initiator' of the network is end-customer demand on the right: only the end-customers are free to make up their mind when to place an order. After that, the system takes over.

Chapter 1 explains how networks are structured, the different ways in which they may choose to compete and how their capabilities have to be aligned with the needs of the end-customer. Chapter 2 places the end-customer first in logistics thinking, and develops the theme of aligning logistics strategy with marketing strategy. Chapter 3 considers how value is created in a supply network, how logistics costs can be managed and how a balanced measurement portfolio can be designed.



CHAPTER 1

Logistics and the supply chain

Objectives

The intended objectives of this chapter are to:

- **identify and explain logistics definitions and concepts that are relevant to managing the supply chain;**
- **identify how supply chains compete in terms of time, cost, quality and sustainability, and that there are supportive capabilities and soft objectives;**
- **show how different supply chains may adopt different and distinctive strategies for competing in the marketplace.**

By the end of this chapter you should be able to understand:

- **how supply chains are structured;**
- **different ways in which supply chains may choose to compete in the marketplace;**
- **the need to align supply chain capabilities with competitive priorities.**

Introduction

It takes only 17 hours or so to assemble a car, and a couple more days are needed to ship it to the customer via the dealer. So why does it take more than a month for a manufacturer to make and deliver the car I want? And why are the products I want to buy so often unavailable on the shelf at the local supermarket? These are questions that go to the heart of logistics management and strategy. Supply chains today are slow and costly in relation to what they will be like in the future. But let us start at the beginning, by thinking about logistics and the supply chain in terms of what they are trying to do. It is easy to get bogged down in the complexities of how a supply chain actually works (and very few people actually know how a whole supply chain works!). We shall address many of these details later in this book. First, let us focus on how a supply chain competes, and on what the implications are for logistics management and strategy.

The overall aim of this chapter is to provide an introduction to logistics and to set the scene for the book as a whole. The need is to look outside the individual organisation and to consider how it aligns with other organisations in a given supply chain. This is both a strategic and a managerial task: strategic, because it requires

long-term decisions about how logistics will be structured and the systems it will use; managerial, because it encompasses decisions about sourcing, making and delivering products and services within an overall 'game plan'.

Key issues

This chapter addresses four key issues:

1 **Logistics and the supply chain:** definitions, structure, tiering.
2 **Material flow and information flow:** the supply chain and the demand chain.
3 **Competing through logistics:** competitive criteria in the marketplace.
4 **Logistics strategies:** aligning capabilities across the supply chain.

1.1 Logistics and the supply chain

***Key issues:* What is the supply chain, and how is it structured? What is the purpose of a supply chain?**

Logistics is a big word for a big challenge. Let us begin by giving an example of that challenge in practice, because that is where logistics starts and ends.

CASE STUDY 1.1

Tesco PLC

Tesco PLC is the UK's largest food retailer, with a revenue of about £51 billion for the financial year 2016–17. Across 11 countries in Central Europe and Asia, Tesco employs about 440,000 people making it a truly global business and now it has approximately 6,800 stores (including franchises). Tesco continues to see growth in most countries, however, whilst about half of the Tesco stores are outside the UK, the UK business still dominates, accounting for over two thirds of the revenue. With this in mind, the remainder of this case focuses on Tesco UK.

Between 2010 and 2013 the number of stores in the UK rose quickly from 2,300 to 3,146, and this was partially due to the opening of further Tesco Express stores (smaller convenience stores, which are now by far the most numerous), 54 of which opened over a 6-month period in 2013. Since 2013 the rate of increase in the number of stores has slowed, reaching 3,433 in 2017 (see Table 1.1 for a breakdown of the different store formats). The slowing rate of new store openings is mainly due to the increase in online sales in common with many other retailers. Consistent with the multi-channel approach (discussed in Section 2.1.3), Tesco UK operates an online Tesco store (Tesco.com), where its full range of products, estimated at around 75,000, is available. This channel offers delivery of products can direct to the customer's home or, by using 'Click and Collect', the customer can choose a convenient Tesco store (or other location) from which to pick up their order.

When Tesco.com was first opened, Tesco online orders were 'picked' from stores open to the public (rather than distribution centres). However, since 2009 Tesco UK has operated a number of 'dark' stores dedicated to the fulfilment of online orders.

Table 1.1 Tesco's UK stores as of 2017

Format	Number	Total area (m^2)	Mean area (m^2)	Percentage of space	'Changes in number of stores through 2016
Tesco Extra	252	1,648,842	6,543	44.53%	
Tesco Superstore	479	1,307,610	2,730	35.32%	+1
Tesco Express	1,740	376,629	216	10.17%	+8
Tesco Metro	176	185,156	1,052	5.00%	−1
One Stop	780	117,894	151	3.18%	+1
Tesco.com only (dark stores)	6	66,519	11,086	1.80%	
Dobbies	0	0	0	0.00%	−36
Total	3,433	3,702,649	1,079	100.00%	−27

As shown in Table 1.1 there are now six Tesco.com dark stores. Dark stores, otherwise known as dotcom stores, are distribution centres (DC) that exclusively process online orders and are not open to consumers from the general public. They may be similar to conventional supermarkets laid out with aisles of shelves but, dissimilar to retail stores, there are no shop assistants or check-outs. Online orders are processed and optimised picking routes are created, which take into account the store layout. The online orders are then picked 24 hours a day, 7 days a week, by DC employees, known as 'personal shoppers', who normally are processing multiple orders at the same time.

I recent years the product range offered by Tesco has expanded quickly, establishing a presence in the non-food market for such items as entertainment, toys, electrical goods, clothing, gardening and the like. This extensive range is supplied by thousands of suppliers, who are contracted to meet specified service levels (in terms of both timing and quantities) by delivering to Tesco within specific time 'windows'. Considering just England 270 suppliers are each supplying more than 1,250 products. The annual quantities delivered to Tesco stores by suppliers are staggering at around 2 billion cases of product. This is part of a virtuous circle where Tesco develops economies of scale with its suppliers, allowing it to provide attractive offers for consumers, which results in Tesco selling more, and increased economies of scale and this the cycle continues. This is an important element of the Tesco business model.

Material flow from suppliers to stores

An early improvement for supermarket operation was to ensure suppliers delivered to depots rather than to every store. During the 1980s, 26 depots distributed to retail stores and these depots were small and not so efficient with just a single-temperature operation - no chiller or freezer areas. It was not economically viable to deliver to each store every day, because delivery volumes were relatively low. Any products that needed temperature-controlled conditions were transported on special separate vehicles.

Ordering system were not common across product groups but instead differed leading to further inefficiencies and complexities. This depot network was unable to process the volume growth and the more demanding standards for temperature control, therefore an improved distribution strategy was required.

Fresh food depots, which provided a number of different storage temperature environments, replaced many of the existing small depots which had insufficient temperature control facilities. The opportunity was to provide a cost-effective daily delivery service of fresh product to all stores, based on the idea that commonly, a fresh food depot can process over 80 million cases per year with a 40-acre site. The depot building provides three temperature zones: −25°C (frozen), 1°C (chilled) and 12°C (semi-ambient). Each depot serves a group of between 50 and 500 retail stores. To enable fresh food delivery vehicles to, not only operate at different temperatures, but be able to vary the space available at each temperature, insulated trailers were used which were divided into chambers by means of movable bulkheads. Using both in-house and outsourced logistics, deliveries to stores are made within scheduled time windows. Long shelf life food and non-food products, such as dried food and electrical items, are delivered separately.

Tesco has introduced different retail store formats (as shown in Table 1.1) – Extra, Superstore, Metro, Express and One Stop – which vary considerably in size from 6,500 square metres (Extra) to 150 square metres (One Stop). They also stock different product ranges and are strategically positioned in different locations from out of town (Extra) to city centre (Express). The resulting variety in terms of both product ranges, location and size and design of store presents major challenges to supply chain management. For instance, delivering to a Tesco Express in the middle of London will require frequent small deliveries using small vans facing strict restrictions in delivery times. On the other hand, a Tesco Extra will require lorry load deliveries of a much wider product range (Tsinopoulos and Mena, 2010).

In September 2018 Tesco announced its plans to launch a chain of discount stores. Chief executive Dave Lewis claimed that Jack's – named after Tesco founder Sir Jack Cohen – would be cheaper than Aldi or Lidl. Jack's stores will sell 2,600 products – far fewer than the 35,000 carried by a Tesco Superstore – with 1,800 branded 'Jack's'. This compares to the reduced variety offered by Lidl and Aldi. It is a strategy to drive lower prices through aggregating demand onto fewer suppliers and improving distribution and retailing efficiencies through the simplicity, and reduced volatility in demand, enabled by lower variety.

Information flow

So much for the method of transporting goods from supplier through to the stores, but how much should be sent to each store? With such a huge product range today, it is impossible for the individual store to reorder across the whole range (store-based ordering). Instead, sales of each product line are tracked continuously through the till by means of electronic point of sale (EPOS) systems. As a customer's purchases are scanned through the barcode reader at the till, the sale is recorded automatically for each stock-keeping unit (SKU). Cumulative sales by store are updated frequently on Tesco Information Exchange (TIE), a system based on Internet technology. TIE enables Tesco and its suppliers to more effectively communicate trading information to reduce leadtimes from manufacturer to stores and to maintain high product availability on

Tesco's shelves. TIE enables many improvement initiatives, such as improving the introduction of new products, running promotions, and monitoring service levels.

Using sales information on TIE Tesco places orders with its suppliers by means of electronic data interchange (EDI). During the 1990's, volumes and product ranges increased and food retailers such as Tesco reduced stock in their depots by ordering only what was required to meet the next day's forecast sales. For fast-moving products such as washing powders and certain types of cheese, the aim is *day 1 for day 2*: that is, to order today what is needed for tomorrow. The target is to *pick to zero* in the depot so no stock is left after the store orders have been fulfilled. This way the same space in the depot can be used many times over. To improve product availability at stores during a given day, and meet fluctuations in demand through the day, deliveries to stores are made in two *waves*, at specific times and within defined windows.

(Source: Updated by Joe Thomas (Tesco), 2010, through access to the Tesco PLC website (www.tescoplc.com), October 2013, and from the Tesco Annual Report 2018)

Questions

1 Describe the key logistics processes at Tesco UK.

2 What do you think are the main logistics challenges in running the Tesco UK operation?

So why has Tesco grown in an intensely competitive market? Tesco has to understand customer needs and how they can be served. Its products must be recognised by its customers as representing outstanding value for money. To support such goals, it must ensure that the products that its customers want are available on the shelf at each of its stores, and online, at all times, day and night. Logistics is the task of planning and controlling the purchase and distribution of Tesco's massive product range from suppliers to stores. Logistics is concerned with managing two key flows:

- *material flow* of the physical goods from suppliers through the distribution centres to stores and for the online business through to the end-customer;
- *information flow* of demand data from the end-customer back to purchasing and to suppliers, and supply data from suppliers to the retailer, so that material flow can be planned and controlled accurately.

The logistics task of managing material flow and information flow is a key part of the overall task of *supply chain management*. Supply chain management is concerned with managing the entire chain of processes, including raw material supply, manufacture, packaging and distribution to the end-customer. The Tesco UK supply chain comprises three main functions:

- *distribution*: the operations and support task of managing Tesco's distribution centres (DCs), the distribution of products from the DCs to the associated stores and, in the case of the online offering, delivery to the end-customer;
- *network and capacity planning*: the task of planning and implementing sufficient capacity in the supply chain to ensure that the right products can be procured in the right quantities now and in the future;

- *supply chain development*: the task of improving Tesco's supply chain so that its processes are stable and in control, that it is efficient, and that it is correctly structured to meet the logistics needs of material flow and information flow.

Thus logistics can be seen as part of the overall supply chain challenge. Whilst the terms 'logistics' and 'supply chain management' are often used interchangeably, logistics is actually a subset of supply chain management. It is time for some definitions.

1.1.1 Definitions and concepts

A supply chain as a whole ranges from basic commodities (what is in the ground, sea or air) to selling the final product to the end-customer, to recycling the used product. Material flows from raw materials (such as a bauxite mine as a source of aluminium ore) to the finished product (such as a can of cola). The can is recycled after use. The analogy to the flow of water in a river is often used to describe organisations near the source as *upstream,* and those near the end-customer as *downstream.* We refer to firms that are involved in supply chains as *partners,* because that is what they are. There is a collective as well as an individual role to play in the conversion of basic commodity into finished product. At each stage of the conversion, there may be *returns,* which could be reject material from the preceding firm, or waste such as the finished can that needs to be recycled. Sometimes, the whole product is wasted because the consumer throws it away.

A supply chain is a network of partners who collectively convert a basic commodity (upstream) into a finished product (downstream) that is valued by end-customers, and who manage returns at each stage.

Each partner in a supply chain is responsible directly for a process that *adds value* to a product.

A process transforms *inputs* in the form of materials and information into *outputs* in the form of goods and services.

In the case of the cola can, partners carry out processes such as mining, transportation, refining and hot rolling. The cola can has *greater value* than the bauxite (per kilogram of aluminium).

Supply chain management (SCM) involves *planning and controlling* all of the processes from raw material production to purchase by the end-user to recycling of the used cans. Planning refers to making a plan that defines how much of each product should be bought, made, distributed and sold each day, week or month. Controlling means keeping to plan – in spite of the many problems that may get in the way. The aim is to coordinate planning and control of each process so that the needs of the end-customer are met correctly. The definition of SCM used in this book is adapted from the Council of SCM Professionals (CSCMP, 2010):

SCM encompasses the planning and controlling of all processes involved in procurement, conversion, transportation and distribution across a supply chain. SCM includes coordination and collaboration between partners, which can be suppliers,

intermediaries, third-party service providers or customers. In essence, SCM integrates supply and demand management within and between companies in order to serve the needs of the end-customer.

'Serve the needs of the end-customer' has different implications in different contexts. In not-for-profit environments, such as public health and local government, serving implies 'continuously improving', 'better than other regions/countries', 'best value', and the like. In the commercial sector, serving implies 'better than competition', 'better value for money', and so on. In either situation, the focus of managing the supply chain as a whole is on *integrating* the processes of supply chain partners, of which the end-customer is the key one. In effect, the end-customer starts the whole process by buying finished products. It is the buying behaviour of the end-customer that causes materials to flow through the supply chain. This shall be explored later in Chapter 2.

The degree to which the end-customer is satisfied with the finished product depends crucially on the management of material flow and information flow along the supply chain. If delivery is late, or the product has bits missing, the whole supply chain is at risk from competitors who can perform the logistics task better. Logistics is a vital enabler for supply chain management. We use the following definition of logistics in this book:

Logistics is the task of coordinating material flow and information flow across the supply chain to meet end-customer needs.

Logistics has both *strategic* (long-term planning) and *managerial* (short- and medium-term planning and control) aspects. A breakdown of costs in a supermarket's supply chain is as follows:

- Supplier delivery to supermarket's distribution centre (DC) 18%
- DC operations and deliver to store 28%
- Store replenishment 46%
- Supplier replenishment systems 8%

Nearly half of the supply chain costs were incurred in in-store replenishment. In order to reduce these in-store costs, the supermarket realised that the solution is 'to spend more upstream and downstream to secure viable trade-offs for in-store replenishment'. If a product is not available on the shelf, the sale is potentially lost. By integrating external manufacturing and distribution processes with its own, the supermarket seeks to serve the needs of its customers better than its competitors. This might include, for instance, ensuring all products are supplied in retail-ready packaging (RRP) and merchandisable units (MUs) to simplify and improve the speed of shelf replenishment and reduce costs.

1.1.2 Supply chain: structure and tiering

The concept of a supply chain suggests a series of processes linked together to form a chain. In Figure 1.1 milk is produced by a dairy cooperative and shipped to a cheese factory. Once made, the cheese is shipped to the manufacturer's national distribution centre (NDC), where it is stored and matured for nine months. It can