

# Logistics Management and Strategy

Competing through the supply chain

3rd edition

Alan Harrison and  
Remko van Hoek



Prentice Hall  
FINANCIAL TIMES

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Third Edition

**Alan Harrison**

**Remko van Hoek**

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To Nick, Katie, Maryl and Ticho, with love.



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# Foreword

It is a real pleasure to introduce such a quality text as *Logistics Management and Strategy*, now in its third edition, which helps to enhance our understanding of this important area of business today. It is a field that is rapidly gaining importance and focus as businesses like Reckitt Benckiser address the challenge of meeting increasingly demanding customer expectations in all five continents.

Reckitt Benckiser is rightly famous for the excellence of its products – but product excellence must be supported by logistics excellence so that a broad range is always available for the end-consumer to buy. One challenge is obviously to ensure this availability to the consumer while complying with the requirements of trade customers. Another challenge is to achieve all of this at a low cost in order to be able to offer products to the consumer at reasonable prices. Answering these challenges is the aim of the Reckitt Benckiser network and, more specifically, of our logistics organisation.

At Reckitt Benckiser we describe ourselves as a ‘truly global company passionately delivering better solutions to consumers, with operations in 60 countries, sales in 180 countries and net revenues in excess of £5 billion’.

The logistics task in fulfilling our objective, with such a business scope, is immense. We have 44 factories around the world and produce several hundreds of different products from food to home and personal care.

We have grown by over 70% over the last five years, which poses further challenges for our logistics systems and people to meet. On the one hand, we need to optimise our systems and minimise costs; on the other hand, we must support the growth of the business and ensure product and process innovation. For us to succeed, it is becoming increasingly important to excel in the management of logistics, which becomes a strategic function and a source of differentiation and of competitive advantage. This means that managers in all parts of the business must understand their impact on, and role in, the logistics task.

*Logistics Management and Strategy* is an excellent text that supports the need to disseminate knowledge and understanding of logistics in an easy-to-read way. While explaining with great clarity the theoretical concepts, it remains very pragmatic and close to business life through the use of concrete examples and well-chosen case studies. It manages to examine logistics knowledge and understanding in depth while at the same time remaining not only very accessible but really pleasant to read.

Finally, its international perspective reflects the nature of logistics today in businesses like Reckitt Benckiser. As another Anglo-Dutch collaboration, Alan and Remko have succeeded in helping to increase our understanding of a rapidly evolving and increasingly crucial area of doing business in the twenty-first century.

Alain Le Goff  
Executive Vice President, Global Supply  
Member of the Executive Committee  
Reckitt Benckiser





# Preface

Logistics has been emerging from Peter Drucker's shadowy description as 'the economy's dark continent' for some years.<sup>1</sup> 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 business processes. 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 to develop the capabilities needed to keep the chain healthy in the long term. 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.

While its maturity as a discipline in its own right is still far from complete, we believe that it is time to take a current and fresh look at 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 the competition. Logistics plays a vital role in this response, and it is this role that we seek to describe in this book. This text has a clear European appeal. Its currency is the Euro. But in line with the globalisation of logistics, we have included cases from other parts of the world, including South Africa, the United States, Japan, China and Australia.

Accordingly, we start in Part One with the competitive 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 impact on logistics of lean thinking and the agile supply chain. Part Three reviews working together, first in terms of integrating the supply chain and second in terms of partnerships. 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 the global MSc degrees and virtual

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1 Drucker, P. (1962) 'The economy's dark continent', *Fortune*, April, pp. 103–270.

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 while keeping the clear structure and presentation of the first edition. We included lots of new cases and 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 RFID and the future of exchanges.

Since we launched this textbook in 2001, it has become a European best-seller – and is popular in Australia, Singapore and South Africa. It has also been launched in Japan, Brazil, China and the Ukraine. The third edition retains the clarity and up-to-date content which have become hallmarks of the previous editions. This edition continues to provide further new and updated cases to illustrate developments in the subject. This time, chapters 6, 7 and 10 have been largely reconstructed, but you will also find many improvements to other chapters resulting from our research and our work with industrial partners. To formalise the connection between logistics and the supply chain, we have added the subtitle ‘Competing through the supply chain’.

We hope that our book will offer support to further professional development in logistics and supply chain management, which is much needed. 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.

## Author's 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: Dr Paul Chapman, Janet Godsell, Dr Carlos Mena, Simon Templar and Professor Richard Wilding have been particularly helpful. Sri Srikanthan helped us with the financial concepts used in section 3.2. Members of the Agile Supply Chain Research Club at Cranfield also deserve special mention, especially Chris Poole of Procter & Gamble (now of PA Management Consultants), Paul Mayhew of Bausch & Lomb Europe, Ian Shellard and David Evans of Rolls-Royce, Peter Duggan of Telefonica and Colin Peacock of Procter & Gamble. We have picked the brains of several who have recently retired from the industry, including David Aldridge (formerly of Cussons UK), Philip Matthews (formerly of Boots the Chemists) and Graham Sweet of Xerox, Europe. A number of professors from other European universities have contributed ideas and cases, including Marie Koulikoff-Souviron (CERAM, Nice), Jacques Colin (CretLog, Aix-en-Provence), Konstantinos Zographos (Athens University of Economics and Business), and Corrado Ceruti (University of Roma). Many of our MSc graduates, such as Steve Walker and Alexander Oliveira, also made important contributions. Professor Yemisi Bolumole (University of North Florida) helped us to re-draft earlier versions of the first edition, and Professor Martin Christopher contributed to our earlier thinking on agile supply chains. Dr Jim Aitken contributed to our supply chain segmentation thinking in Chapter 2, and we have used his work on supplier associations in Chapter 9. We also acknowledge the encouragement of Amanda McPartlin at Pearson Education in the preparation of this text and the encouragement to write it faster! 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. Finally, we thank Lynne Hudston for helping to sort out our rather convoluted manuscripts in addition to helping to run our Supply Chain Research Centre at Cranfield.

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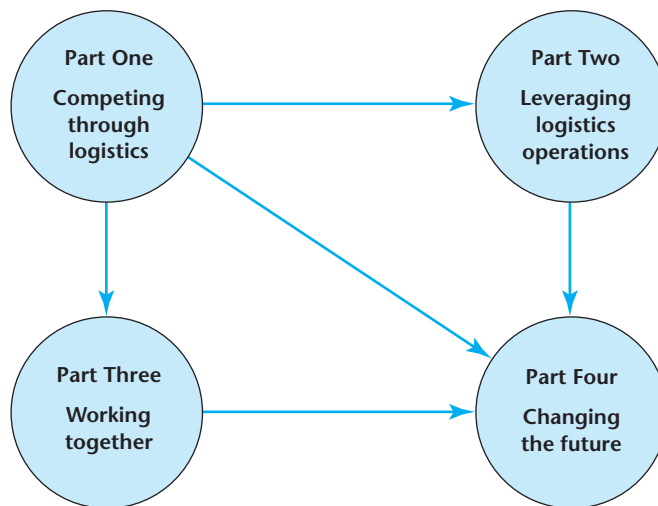
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# How to use this book

This book is divided into four parts, centred around 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 to assess your understanding of the issues raised, and to 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 continually to break up the text with figures, tables, activities and case studies, so you will rarely 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. While 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 web site addresses we have included in the text and again link them with the issues raised in the book.

Chapter 1 begins with a retail case study and examples, because of the obviously close engagement of the end-customer. You will soon appreciate that we have balanced consumer supply chains with many industrial examples and case studies. We compare the issues in Table 2.2, page 40. Thus, we have presented logistics management and strategy by using examples from a broad range of sectors.

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 to feel confident with its issues. We hope that it will help you to improve supply chains of the future.

# Plan of the book

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**Chapter 1**  
Logistics and the supply chain

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## Part Two LEVERAGING LOGISTICS OPERATIONS

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**Chapter 10**  
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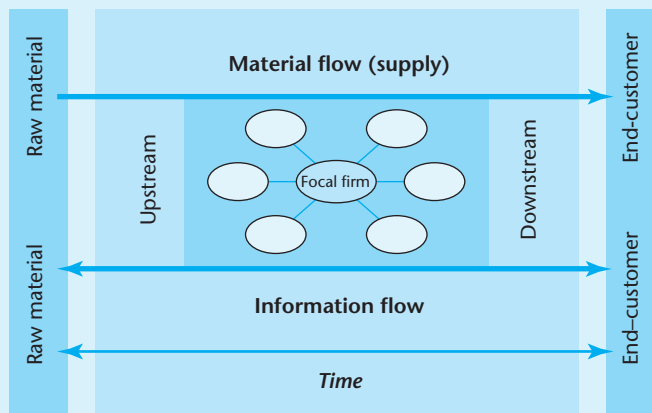


# Part One

## 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' in darker red at the centre across supplier and customer interfaces, and therefore typically stretches across functions, organisations and 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-customer is 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 and quality;
- 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 the needs of the end-customer.

### Introduction

A car takes only 20 hours or so to assemble, and a couple more days are needed to ship it to the customer via the dealers. 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 compared with what they will be like in a few years' time. 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 those 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 brings in long-term decisions about how logistics will be structured and the sys-

tems 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

Tesco is the UK's largest food retailer, with a sales turnover of more than €67.5 billion. While it has some 638 stores in central Europe, and some 636 in the Far East, most are in the United Kingdom and Northern Ireland, where it has nearly 1,800. This number has increased rapidly as Tesco entered the convenience store market with deals such as the Tesco Express alliance with Esso to run grocery shops at petrol stations. The product range held by the stores has grown rapidly in recent years, and currently stands at 65,000 stock-keeping units (skus) depending on the size of the store as Tesco broadens its presence in the 'non-food' market for electrical goods, stationery, clothing and the like. This massive range is supported by 3,000 suppliers, who are expected to provide service levels (correct time and quantities) of at least 98.5 per cent by delivering to Tesco within half-hour time 'windows'. Volumes are equally impressive. In a year, some 2.5 billion cases of product are shipped from suppliers to the stores.

Tesco states that its core purpose is 'to create value for customers to earn their lifetime loyalty'. Wide product range and high on-shelf availability across that range are key enablers of that core purpose. So how do you maintain high availability of so many skus in so many stores? This question goes to the heart of logistics management for such a vast organisation. Logistics is about material flow, and about information flow. Let us look at how Tesco deals with each of these in turn.

An early reform for supermarket operation was to have suppliers deliver to a distribution centre rather than to every store. During the 1980s, distribution to retail stores was handled by 26 depots. These operated on a single-temperature basis, and were small and relatively inefficient. Delivery volumes to each store were also relatively low, and it was not economic to deliver to all stores each day. Goods that required temperature-controlled environments had to be carried on separate vehicles. Each product group had different ordering systems. The network of depots simply could not handle

the growth in volume and the increasingly high standards of temperature control. A new distribution strategy was needed.

Under the 'composite' distribution system, many small depots with limited temperature control facilities were replaced by composite distribution centres (called regional distribution centres, RDCs), which can handle many products at several temperature ranges. The opportunity is to provide a cost-effective daily delivery service to all stores. Typically, a composite distribution centre can handle over 60 million cases per year on a 15-acre site. The warehouse building comprises 25,000 square metres divided into three temperature zones: frozen ( $-25^{\circ}\text{C}$ ),  $+2^{\circ}\text{C}$  (chilled) and  $+12^{\circ}\text{C}$  (semi-ambient). Each distribution centre (DC) serves a group of between 100 and 140 retail stores. Delivery vehicles for composite depots can use insulated trailers divided into chambers by means of movable bulkheads so they can operate at different temperatures. Deliveries are made at agreed, scheduled times. Ambient goods such as cans and clothing are delivered through a separate grocery distribution network which relies on a stocked environment where orders are picked by store. This operation is complemented by a strategically located trunking station which operates a *pick to zero* operation for fast-moving grocery on merchandise units that can be placed directly on the shop floor.

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 bar code reader at the till, the sale is automatically recorded for each sku. Cumulative sales are updated every four hours on Tesco Information Exchange (TIE). This is a system based on Internet Protocol that allows Tesco and its suppliers to communicate trading information. The aim of improved communication is to reduce response times from manufacturer to stores and to ensure product availability on the shelf. Among other things, TIE aims to improve processes for introducing new products and promotions, and to monitor service levels.

Based on the cumulative sales, Tesco places orders with its suppliers by means of electronic data interchange (EDI). As volumes and product ranges increased during the 1990s, food retailers such as Tesco aimed to destock their distribution centres by ordering only what was needed to meet tomorrow's forecast sales. For fast-moving products such as types of cheese and washing powders, the aim is *day 1 for day 2*: that is, to order today what is needed for tomorrow. For fast-moving products, the aim is to *pick to zero* in the distribution centre: no stock is left after store orders have been fulfilled and deliveries to stores are made as soon as the product is picked, which increases the stock availability for the customer. The flow of the product into the distribution centre is broken into four waves and specific products are delivered in different cycles through the day. This means that the same space in the distribution centre can be used several times over.

### Questions

- 1 Describe the key logistics processes at Tesco.
- 2 What do you think are the main logistics challenges in running the Tesco operation?



So why is Tesco growing in an intensely competitive market? It describes its core purpose as being ‘to create value for customers to earn their lifetime loyalty’. *Loyalty* is an important term that we return to in the next chapter. In order to achieve loyalty, 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 at all times, day and night. Planning and controlling the purchase and distribution of Tesco’s massive product range from suppliers to stores is one of logistics. Logistics is the task of managing two key flows:

- *material flow* of the physical goods from suppliers through the distribution centres to stores;
- *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 accurately planned and controlled.

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 structure comprises three main functions:

- *distribution*: the operations and support task of managing Tesco’s distribution centres, and the distribution of products from the DCs to the associated stores;
- *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. While 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 a basic commodity (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 each firm in a supply chain as a partner, 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 like the finished can that needs to be recycled.

**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 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 supply chain management used in this book is as follows:

**Planning and controlling all of the business processes – from end-customer to raw material suppliers – that link together partners in a supply chain 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 this behaviour that causes materials to flow through the supply chain (Gattorna, 1998: 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:

**The task of coordinating material flow and information flow across the supply chain.**

Logistics has both *strategic* (long-term planning) and *managerial* (short- and medium-term planning and control) aspects. Tesco has a clear view about the

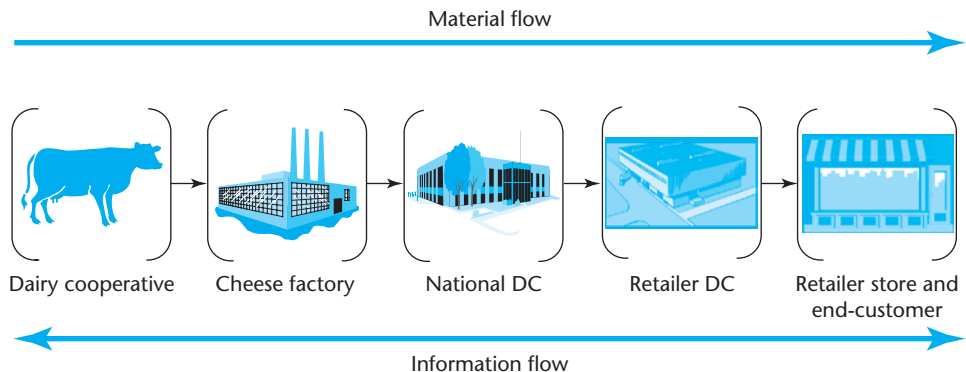
opportunities here. A breakdown of costs in Tesco's part of the UK supply chain is as follows:

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

Nearly half of supply chain costs are incurred in-store. In order to reduce these in-store costs, Tesco realises 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, Tesco seeks to serve the needs of its customers better than its competitors.

### 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. A typical Tesco supply chain is formed from five such links.

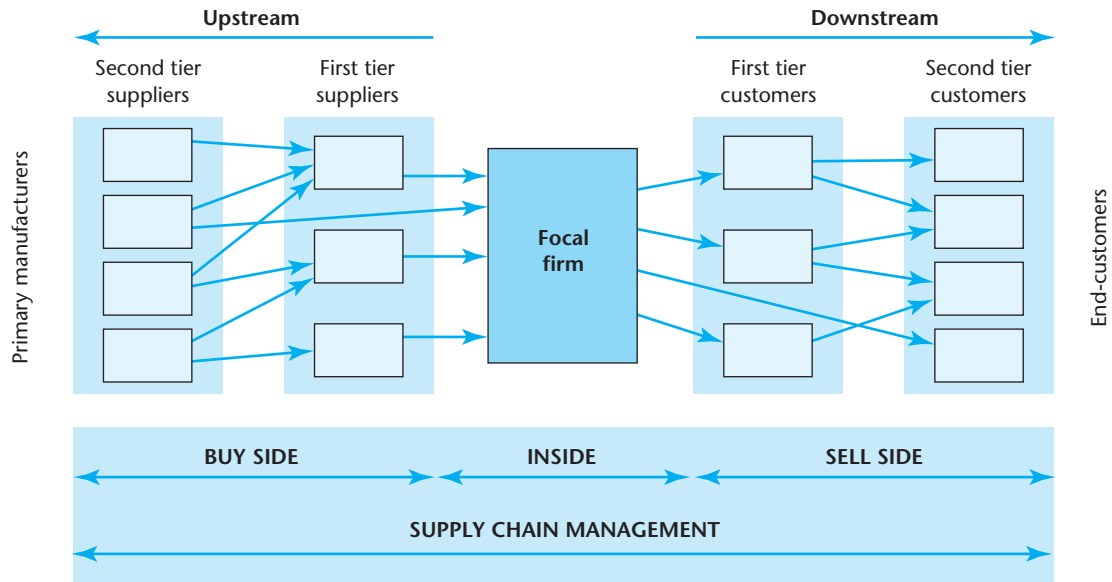


**Figure 1.1** From cow to customer

Here, 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 then be shipped in response to an order from the retailer, and is transported first to the retailer's regional distribution centre (RDC). From there, it is shipped to store. Looking at the arrows in Figure 1.1, material flows from left to right. Information is shared across the chain: it is demand from the end-customer that makes the whole chain work.

If we look more closely at what happens in practice, the term 'supply chain' is somewhat misleading in that the 'chain' represents a simple series of links between a basic commodity (milk in this case) and a final product (cheese). Thus

the cheese manufacturer will need packaging materials such as film, labels and cases. Cheese requires materials additional to milk in the manufacturing process. So the manufacturer deals with suppliers other than the milk cooperative alone. Once made, the cheese is dispatched for maturation to the supplier's NDC, and then dispatched to many customers in addition to Tesco. Once at a Tesco RDC, the 'chain' spreads again because up to 100 stores are served by a given RDC. The additional complexity prompts many authors to refer to *supply networks* rather than to supply chains, a point we return to shortly.



**Figure 1.2** Supply network

(Source: After Slack *et al.*, 1997)

A more realistic representation of the supply chain is shown in Figure 1.2, where each link can connect with several others. A *focal firm* is shown at the centre of many possible connections with other supplier and customer companies.

The supply chain can be seen in this diagram as a number of processes that extend across organisational boundaries. The focal firm is embedded within the chain, and its operational processes ('inside') must coordinate with others that are part of the same chain. Materials flow from left (upstream, or 'buy side') to right (downstream, or 'supply side'). If everything is as orderly as it seems, then only the end-customer (to the extreme right of the chain) is free to place orders when he or she likes: after that, the system takes over.

The supply chain is *tiered* in that supply side and demand side can be organised into groups of partners with which we deal. Thus if we place an assembler such as the Ford plant at Valencia as the focal firm, buy side comprises tier 1 suppliers of major parts and subassemblies who deliver directly to Ford, while tier 2 suppliers deliver to the tier 1s, etc. On the sell side, Ford supplies to the national sales companies as tier 1 customers, who in turn supply to main dealers as tier 2, and so on.

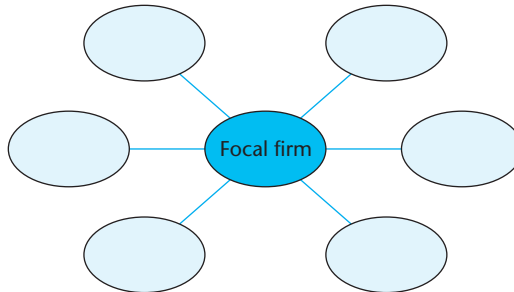
Other terms that are used to describe aspects of managing the supply chain are:

- *Purchasing and supply* deals with a focal firm's immediate suppliers (upstream).
- *Physical distribution* deals with the task of distributing products to tier 1 customers (downstream).
- *Logistics* refers to management of materials and information. Inbound logistics deals with links between the focal firm and its upstream ('buy side') suppliers, while outbound logistics refers to the links between the focal firm and its downstream ('sell side') customers.

Supply chain management thus appears as the 'end to end' (or 'cow to customer' as we have expressed it in Figure 1.1) management of the network as a whole, and of the relationships between the various links. The essential points were summarised long ago by Oliver and Webber (1982):

- Supply chain management views the supply chain as a *single entity*.
- It demands strategic decision making.
- It views *balancing inventories* as a last resort.
- It demands *system integration*.

A natural extension of this thinking is that supply chains should rather be viewed as *networks*. Figure 1.3 shows how a focal firm can be seen at the centre of a network of upstream and downstream organisations.



**Figure 1.3** A network of organisations

The terms 'supply chain' and 'supply network' both attempt to describe the way in which buyers and suppliers are linked together to serve the end-customer. 'Network' describes a more complex structure, where organisations can be cross-linked and there are two-way exchanges between them; 'chain' describes a simpler, sequential set of links (Harland *et al.*, 2001). We have used the terms interchangeably in this book, preferring 'chain' to describe simpler sequences of a few organisations and 'network' where there are many organisations linked in a more complex way.

Figure 1.3 takes a basic view of the network, with a focal firm linked to three upstream suppliers and three downstream customers. If we then add material flow and information flow to this basic model, and place a boundary around the network, Figure 1.4 shows the network in context. Here we have added arrows showing the logistics contribution of material and information flows, together with the

time dimension. Material flows from primary manufacture (for example farming, mining or forestry) through various stages of the network to the end-customer. Material flow represents the *supply* of product through the network in response to demand from the next (succeeding) organisation. Information flow broadcasts *demand* from the end-customer to preceding organisations in the network. The time dimension addresses the question ‘How long does it take to get from primary source to the end-customer?’ That is, how long does it take to get product through the various stages from one end of the supply chain to the other? Time is important because it measures how quickly a given network can respond to demand from the end-customer. In fact, the concept of flow is based on time:

Flow measures the quantity of material (measured in input terms such as numbers of components, tonnes and litres) that passes through a given network per unit of time.

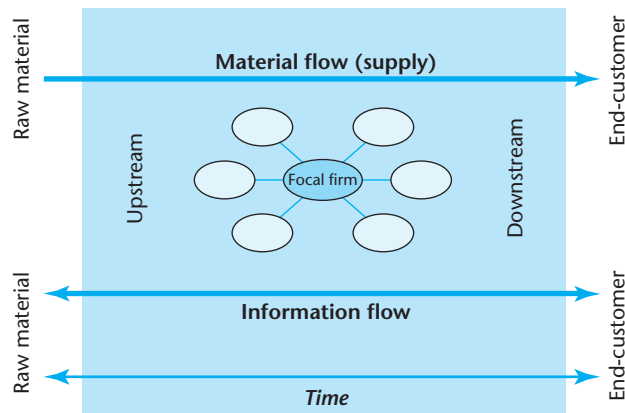


Figure 1.4 The network in context

Activity 1.1

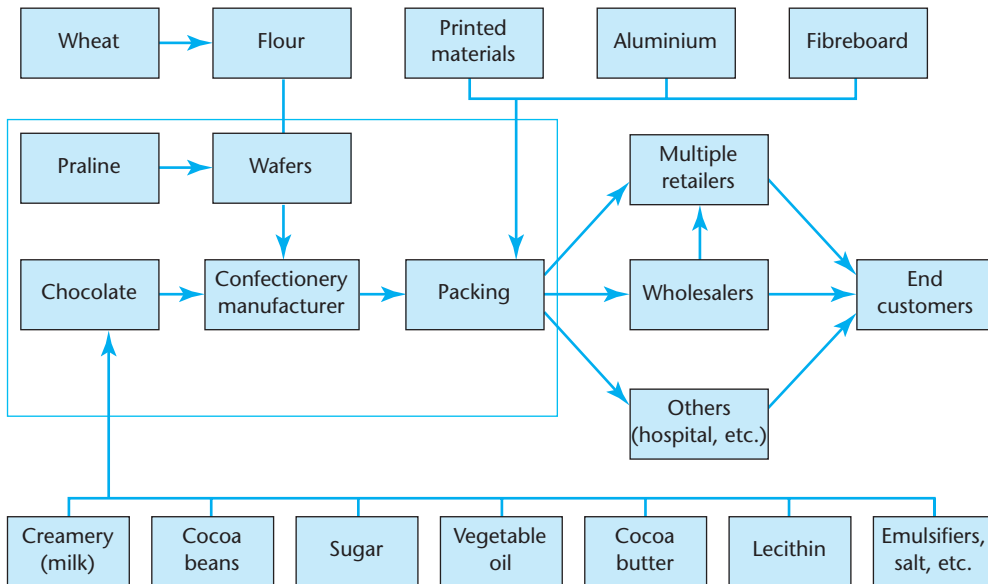


Figure 1.5 Example of a confectionery network map

(Source: After Zheng *et al.*, 1998)

Figure 1.5 shows an example network map of a chocolate bar. Draw a network map showing how your organisation, or one that you know well, links with other organisations. Explain the upstream and downstream processes as far as you can. We expect you to address at least the first tiers of demand and supply. You will derive further benefit from researching additional tiers, and by developing the linkage of relationships that is involved. Explain how these work in practice, and how materials flow between the different tiers.

An important point here is that the supply network should be viewed as a *system*. All processes within the network need to be understood in terms of how they interact with other processes. No organisation is an island: its inputs and outputs are affected by the behaviour of other players in the network. One powerful, disruptive player can make life very difficult for everyone else. For example, several auto assemblers optimise their own processes, but disrupt those of upstream suppliers and downstream distributors. The effect is to increase total system costs *and* reduce responsiveness to end-customer demand.

## 1.2 Material flow and information flow

**Key issue: What is the relationship between material flow and information flow?**

As we have already seen, logistics is about managing material flow and information flow. In this section, we examine material flow and information flow in more detail.

### 1.2.1 Material flow

The aim within a supply chain must be to keep materials flowing from source to end-customer. The time dimension in Figure 1.4 suggests that parts are moved through the supply chain as quickly as possible. And in order to prevent local build-ups of inventory, flow must be orchestrated so that parts move in a coordinated fashion. The term often used is *synchronous*. Caterpillar Inc. makes complex earth-moving equipment, and there are literally thousands of component parts and subassemblies that must come together in the final assembly processes. The vision is that parts and subassemblies should flow continuously through the supply chain, all orchestrated like a ballet (Knill, 1992: 54):

**The goal is continuous, synchronous flow. Continuous means no interruptions, no dropping the ball, no unnecessary accumulations of inventory. And synchronous means that it all runs like a ballet. Parts and components are delivered on time, in the proper sequence, exactly to the point they're needed.**

Often it is difficult to see the 'end to end' nature of flow in a given supply chain. The negative effects of such difficulty include build-ups of inventory and sluggish

response to end-customer demand. And sheer greed by the most powerful members of a supply chain often means that it is weaker partners (notably small to medium-sized enterprises – SMEs) who end up holding the inventories. So management strategies for the supply chain require a more holistic look at the links, and an understanding that organisational boundaries easily create barriers to flow.

Case study 1.2 describes how one company – Xerox in this case – re-engineered material flow in its distribution system.

## CASE STUDY 1.2

### Xerox

Once the problems of introducing ‘just-in-time’ production systems had been solved at the Xerox plant making photocopiers at Venray in Holland, attention shifted towards the finished product inventory. Historically, stocks of finished products had been ‘managed’ by trying to turn the tap of sales on or off as stocks developed. This was characterised by the familiar ‘feast or famine’ situations. The objective of the next move for Xerox became clear: making only what you need when you need it, then shipping direct to the customer. But the key question had to be answered: just-in-time for what? The answer is – the end-customer. And customer surveys showed that three types of delivery were needed:

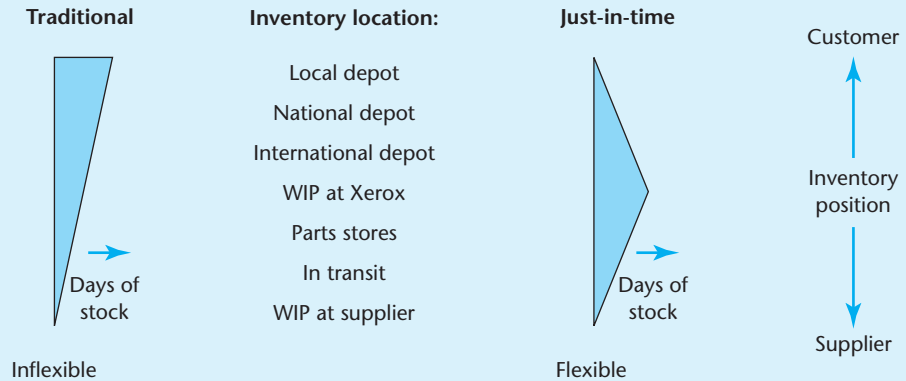
- Commodity products should be delivered ‘off the shelf’.
- Middle-range products were required in five days.
- Larger products that had to be integrated into existing customer processes and systems had to be planned months ahead: but the quoted delivery date had to be met 100 per cent.

It was envisaged that this would lead to a radically different inventory ‘profile’ in the supply chain. Figure 1.6 shows a traditional inventory profile on the left. Most of the stock was held in local depots waiting for customer orders. If the mix had been incorrectly forecast, too many of the wrong products were in plentiful supply, while needed products were unavailable. Further, a batch of replacement products would take a long time to fight their way through the pipeline. A new ‘just-in-time’ strategy was conceived to make the supply chain much more responsive. This strategy had a profound effect on the inventory profile, pushing much of the inventory away from the end-customer (where it has maximum added value and is already committed to a given finished product specification). Instead, inventory was mostly held further upstream, where it could be finally assembled to known orders, and where it had lower value. Of course, it has since been possible to remove several of the stages of the distribution process, thereby eliminating some of the sources of inventory altogether.

For commodity products, Xerox coined the term *deliver JIT*: that is, the product had to be delivered out of stock. Where sales forecasts are traditionally poor, the challenge was one of flexibility, simplicity and speed of manufacture. For mid-range products, it was unrealistic to hold ‘just in case’ inventories of products that are too complex to be assembled quickly. Instead, *finish JIT* was the term coined to describe the new policy of building semi-finished products with the minimum of added value, consistent with being able to complete and deliver the product in the five-day target. Finally, *build JIT*



was the term used to describe the new philosophy of building larger products quickly within a defined lead time.



Note: WIP = work in progress, i.e. products being worked on, but not yet ready for sale. Shaded areas indicate days of stock. The wider the area, the more days of stock in that position.

**Figure 1.6** Xerox: the impact on inventories

The impact of the new build philosophies on the downstream supply chain processes can be judged from Figure 1.6. While the traditional inventory profile shows a maximum number of days of stock (shown in the shaded area) at finished product level, this is risky. It always seems that demand is greatest for the very items that are not available! *Postponing* the decision on exact specification until as late as possible in the process, when we are more likely to know precisely what the end-customer wants, helps to create the much flattened inventory profile to the right of the diagram. These are issues to which we return in Chapters 6 and 7. (A development of this case, tracking ‘what happened next’, is Case Study 7.12.)

(Source: After Eggleton, 1990)

### Questions

- 1 How did inventory reduction in the supply chain lead to improved competitiveness at Xerox?

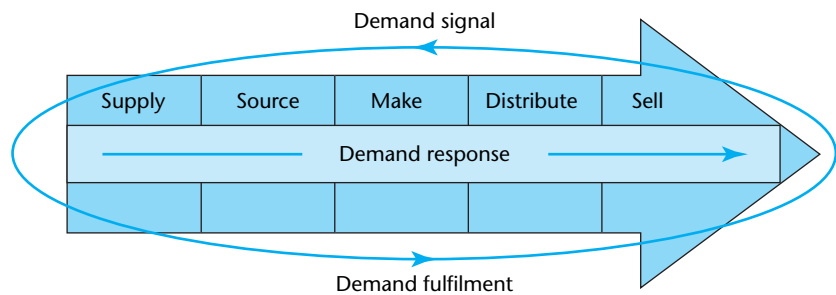
## 1.2.2 Information flow

As asked in the Xerox case study, just-in-time *for what*? It is all well and good to get materials flowing and movements synchronised, but the ‘supply orchestra’ needs to respond in unison to a specific ‘conductor’. The ‘conductor’ in this analogy is actually the end-customer, and it is the end-customer’s demand signals that trigger the supply chain to respond. By sharing the end-customer demand information across the supply chain, we create a *demand chain*, directed at providing enhanced customer value. Information technology enables the rapid sharing of demand and supply data at increasing levels of detail and sophistication. The aim is to *integrate* such demand and supply data so that an increasingly accurate picture is obtained about the nature of business processes, markets

and end-customers. Such integration provides increasing competitive advantage, as we explore further in Chapter 8.

The greatest opportunities for meeting demand in the marketplace with a maximum of dependability and a minimum of inventory come from implementing such integration across the supply chain. A focal firm cannot become 'world class' by itself!

Figure 1.7 gives a conceptual model of how supply chain processes (supply, source, make, distribute and sell) are integrated together in order to meet end-customer demand (Beech, 1998). Demand signals are shared across the chain rather than being interpreted and massaged by the 'sell' process next to the market. Demand fulfilment is also envisaged as an integrated process, as materials are moved from one process to the next in a seamless flow. Information is the 'glue' that binds the supply chain processes together.



**Figure 1.7** Integrating demand and supply chains

(Source: After Beech, 1998)

### Activity 1.2

Write a brief (200 words) appraisal of material and information flow in the supply network affecting one of the major products in the response you gave in Activity 1.1. Perhaps the current situation is different from the above ideals?

## 1.3 Competing through logistics

**Key issues:** How do products win orders in the marketplace? How does logistics contribute to competitive advantage?

There are many potentially conflicting demands on an organisation today. All those unreasonable customers seem to want it yesterday, at no cost, and to be compensated if it goes wrong! Within a given supply chain, it is important that each organisation understands how each group of products competes in the marketplace, and that it aligns its capabilities with those of its partners.

A 'product' is actually a combination of the *physical product* (for example, a 200g pack of Camembert cheese) and its accompanying *service* (for example, how it is merchandised in the store – easy to find, availability, attractive presentation,

lighting, temperature). While the physical product is determined by marketing and R&D, service is heavily influenced by logistics.

It is impossible to be outstanding at everything, and supply chain partners need to give priority to capabilities that give each product group its competitive edge. These are the advantages where supply chain partners ‘dig in deep’ by giving priority to investment by training and by focusing product development and marketing efforts. They need only to match industry average performance on other criteria. Let us now look at the competitive priorities that can be delivered by logistics in the supply chain.

There are various ways in which products compete in the marketplace. Perhaps a given product is something that no one else can match in terms of price. Or maybe you offer a product that is technically superior, such as Gillette razor blades. While new product development has logistics implications, the key advantage provided by logistics – as suggested in the Tesco example in section 1.1 – is *availability of conforming product in the marketplace at low cost*. Logistics supports competitiveness of the supply chain as a whole by:

**meeting end-customer demand through supplying what is needed in the form it is needed, when it is needed, at a competitive cost.**

Logistics advantage thus shows up in the form of such competitive factors as better product availability in the marketplace and low product obsolescence. Defining logistics advantage means that we need to set goals that are clear, measurable and quantifiable. We distinguish three ‘hard objectives’ for creating logistics advantage: *quality, time and cost*. There are two further important ways of creating logistics advantage: *controlling variability* in logistics processes, and *dealing with uncertainty*. We have called these ‘supportive capabilities’, and they can be just as important as hard objectives. Finally, there are ‘soft objectives’, which relate to service aspects such as the confidence customers develop in the way the logistics operation is performed. Let us look at each of these ways of creating advantage in turn.

### 1.3.1 Hard objectives

Traditional ways of competing are to offer the end-customer advantages related to product quality, the speed with which it is delivered, and/or the price at which it is offered. We refer to quality, time and cost as ‘hard objectives’ because they are easy to measure and relatively obvious to the end-customer.

#### *The quality advantage*

The most fundamental objective – in that it is a foundation for the others – is to carry out all processes across the supply chain so that the end product does what it is supposed to do. Quality is the most visible aspect of supply chain performance. Defects, incorrect quantities and wrong items delivered are symptoms of quality problems in supply chain processes that are all too apparent to the end-customer. Such problems negatively influence that customer’s loyalty. Robust

processes are at the heart of supply chain performance. Internally, robust processes help to reduce costs by eliminating errors, and help to increase dependability by making processes more certain.

While conformance quality in the factory may be controlled to defect levels that are below 25 parts per million (ppm), a product may end up on the retailer's shelf with between 2 and 5 per cent defects, which is 10,000 to 20,000 ppm. This huge escalation takes place as the result of cumulative problems in successive supply chain processes. Cases may be squashed when shrink-wrapped at the manufacturer's NDC. In the back of the retail store, cases may be cut open with a sharp knife – in spite of instructions to the contrary. The end-customer sees the product on the retail shelf at its *worst* state of quality performance, and that is where the buying decision is made that drives the supply chain as a whole.

In many logistics situations, quality of service is about selecting the right quantity of the right product in the right sequence in response to customer orders. For example, store orders must be picked from a range of thousands of skus (stock keeping units) at a Tesco RDC. This must be carried out accurately (correct sku, correct quantity) against tight delivery schedules day in day out. *Pick accuracy* (for example, 99.5 per cent correct sku and correct quantity) is widely used to measure the quality of this operation. And increasing requirements for in-store efficiencies mean that categories of product (for example, shampoos and tooth-pastes) need to be picked in a set sequence to facilitate direct-to-shelf delivery at the store. Logistics service providers who can implement and maintain the highest standards of service quality place themselves at an advantage over those who cannot.

### *The time advantage*

Time measures how long a customer has to wait in order to receive a given product or service. Volkswagen calls this time the *customer to customer* lead time: that is, the time it takes from the moment a customer places an order to the moment that customer receives the car he or she specified. Such lead times can vary from zero (the product is immediately available, such as goods on a supermarket shelf) to months or years (such as the construction of a new building). Competing on time is about survival of the fastest!

Time can be used to win orders by companies who have learned that some customers do not want to wait – and are prepared to pay a premium to get what they want quickly. An example is Vision Express, which offers prescription spectacles 'in about one hour'. Technicians machine lenses from blanks on the premises. Staff are given incentives to maintain a 95 per cent service level against the one-hour target. Vision Express has been successful in the marketplace by re-engineering the supply chain so that parts and information can flow rapidly from one process to the next. Compare this with other opticians in the high street, who must send customer orders to a central factory. Under the 'remote factory' system, orders typically take about 10 days to process. An individual customer order is first dispatched to the factory. It then has to join a queue with orders from all the other high street branches around the country. Once the order has been processed, it must return to the branch that raised the order. While this may

be cheaper to do (a central, highly productive factory serves all of the branches), it takes much longer to process an order.

The time advantage is variously described as *speed* or *responsiveness* in practice. Speeding up supply chain processes may help to improve freshness of the end product, or to reduce the risk of obsolete or over-aged stock in the system. Time is an *absolute* measure, that is, it is not open to interpretation like quality and cost. By following a product through a supply chain, we can discover which processes add value and which add time and cost but no value. We explore this further in Chapter 5, which is about managing time for advantage in the supply chain.

### *The cost advantage*

Cost is important for all supply chain processes – that goes without saying. Low costs translate into advantages in the marketplace in terms of low prices or high margins, or a bit of each. Many products compete specifically on the basis of low price. This is supported from a supply chain point of view by low cost manufacture, distribution, servicing and the like. Examples of products that compete on low price are ‘own brand’ supermarket goods that reduce the high margins and heavy advertising spend of major brands. They also perhaps cut some of the corners in terms of product specification in the hope that the customer will consider low price to be more important than minor differences in product quality.

The pressure to reduce prices at automotive component suppliers is intense. The assemblers have been setting annual price reduction targets for their inbound supply chains for some years. Unless a supplier can match reduced prices at which products are being sold by means of reduced costs, that supplier will gradually go out of business. As a result, many suppliers are cynical about the ‘price down’ policies of the assemblers. Reduced prices are the reward of cost cutting, and that is most often a collaborative effort by several partners in the supply chain. As indicated in section 1.1, Tesco can make only limited inroads into its in-store costs without the help of its supply chain partners. On the other hand, small dairy farmers continue to be forced out of business because the price of milk paid by supermarkets is ‘less than the price of water’. For them, there are few opportunities to cut costs.

## 1.3.2 Supportive capabilities

While the hard objectives listed above are always important to competitive advantage, supportive capabilities can also be key to creating logistics advantage in the marketplace. When there is little to choose in terms of quality, time or cost, supportive capabilities can make all the difference to the end-customer. Variability refers to real and identifiable differences within a population, such as the differences in time each patient at an optician has to wait for their eyes to be tested. Uncertainty refers to our lack of knowledge (Thompson, 2002): in logistics terms, uncertainty results in us having to deal with events that are not known in advance.

### Controlling variability: the dependability advantage

Time is not just about speed. Quality is not just about meeting defect targets. Behind both 'hard' objectives is the need to *control variability* in logistics processes. Variability undermines the *dependability* with which a product or service meets target. While Vision Express offers a one-hour service for prescription glasses, the 95 per cent service level is a measure of the dependability of that service against the one-hour target. Firms who do not offer instantaneous availability need to tell the customer – in other words to 'promise' – *when* the product or service will be delivered. Delivery dependability measures how successful the firm has been in meeting those promises. For example, the UK's Royal Mail offers a 'first class' service for letters whereby there is a 90 per cent probability that a letter posted today will reach its destination tomorrow. It is important to measure dependability in the same 'end to end' way that speed is measured. Dependability measures are widely used in industries such as train and air travel services to monitor how well published timetables are met. And in manufacturing firms, dependability is used to monitor a supplier's performance in such terms as:

- *on time* (percentage of orders delivered on time, and the variability against target);
- *in full* (percentage of orders delivered complete, and the variability against target);
- *on quality* (percentage of defects, and the variability against target).

So logistics is concerned not just with the *average* percentage of orders delivered on time but also with the *variability*. For example, a manufacturer has to cope with the day-to-day variability of orders placed. In practice, this is more important than the average orders placed because of the resource implications of 'ups and downs' in demand. Case study 1.3 explores the impact of variability on a supplier's processes.

#### CASE STUDY 1.3

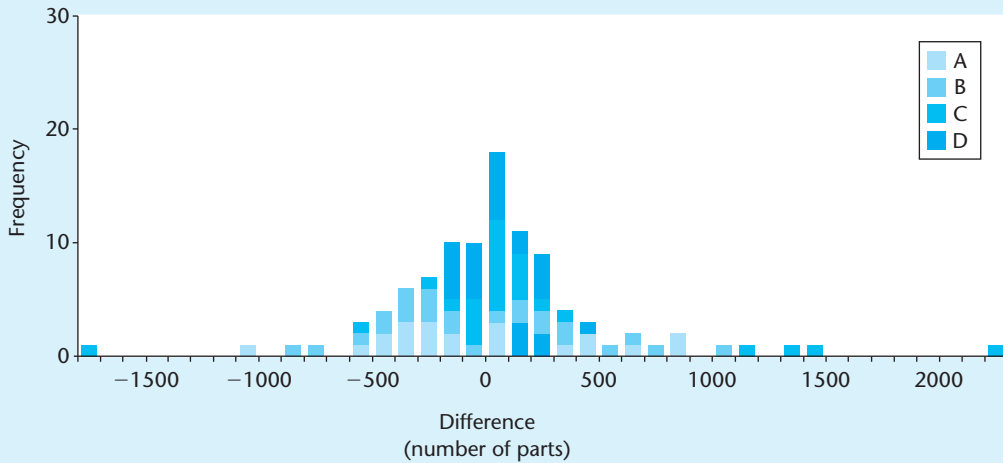
### Measuring schedule variability

A problem that is all too familiar to suppliers in the automotive industry is that of schedule variability. A vehicle manufacturer issues delivery schedules to specify how many parts of each type are required each day for the following month. And each day a 'call-off' quantity is issued, which specifies how many the vehicle manufacturer actually wants. The two sets of figures are not necessarily the same, although they usually add up to the same cumulative numbers for the month as a whole. In other words, the total scheduled quantities and the total call-off quantities are the same. So what is the problem?

The problem is that the supplier has to cope with ups and downs of call-off quantities that create huge problems for the supplier's process. Let scheduled demand =  $S$ , and call-off quantities =  $A$ . Then the difference  $D$  between schedule and actual is given by  $D = S - A$ . If the supplier produces to schedule, then  $S > A$ , the supplier will over-produce the part and end up with excess stock. Where  $S < A$ , the effects could either be a

reduction in stock held by the supplier, or a shortfall of  $(S - A)$  of parts from the supplier. The two conditions ( $S > A$  and  $S < A$ ) therefore have different logistics implications.

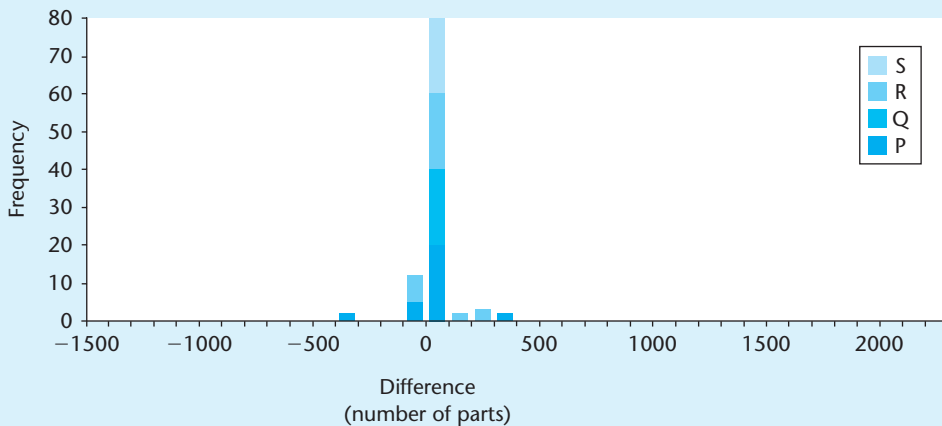
Figure 1.8 shows that actual demand, totalled across four different parts at PressCo (a supplier of pressed metal components), may be up to 1,600 units above schedule, or 2,200 below schedule in the case of vehicle assembler WestCo. This range has been divided up into intervals of 100 units. The mode (0 – 99) indicates that  $S = A$  for a frequency of 18 per cent of the observations.



**Figure 1.8** Distribution of differences between scheduled and actual demand for WestCo

Assuming that the distribution is roughly normal, the standard deviation (SD) is 573, which is characteristic of the flat, wide spread of data. Figure 1.9 shows the distribution of  $S - A$  for four similar parts from the same supplier but to a different vehicle assembler, EastCo. This time, the SD for the distribution is 95, representing a much narrower spread of differences than for WestCo.

(Source: Harrison, 1996)



**Figure 1.9** Distribution of differences between scheduled and actual demand for EastCo

### Questions

- 1 What are the logistics implications to PressCo for delivery reliability to customers WestCo and EastCo?
- 2 What steps will the supplier need to take in order to satisfy call-off orders from WestCo?
- 3 If separate parts of the PressCo factory were dedicated to production for WestCo and for EastCo, which would be the more efficient in terms of labour costs and inventory holding?

Quality is not just about meeting target pick accuracy, or target defect levels. It is also about controlling variability. The same argument can be made about costs. The implication of dependability for logistics is that supply chain processes need to be robust and predictable. In Chapter 6, we develop the case for dependability in supply chains under the themes of planning and control and lean thinking.

### Dealing with uncertainty: the agility advantage

Dealing with uncertainty means responding rapidly to unknown problems that affect logistics processes. Sometimes, problems can be foreseen – even if their timing cannot. Toyota UK manages inbound deliveries of parts from suppliers in southern Europe by a process called *chain logistics*. Trailers of parts are moved in four-hour cycles, after which they are exchanged for the returning empty trailer on its way back from the United Kingdom. One hitch in this highly orchestrated process means that incoming parts do not arrive just-in-time at the assembly plant. Toyota demands that its suppliers and logistics partner plan *countermeasures*. This means that alternative routes for suppliers to deliver to its Burnaston assembly plant in the UK have been planned in advance to deal, for example, with a French channel ferry strike at Calais. The weather is also a cause of uncertainty in logistics – for example, it may mean that Tesco has to switch between salads and soups as the result of a cold snap. Other forms of uncertainty concern events where neither the problem nor its timing can be foreseen. Case study 1.4 provides an example of such an event and how two organisations responded differently to it.

#### CASE STUDY 1.4

### Nokia deals with uncertainty

In March, 2000, a thunderstorm struck the Philips semiconductor plant at Albuquerque in New Mexico, which made silicon chips for products like cellphones. Damage at first seemed minor, and fire fighters soon left the premises. At first, Philips told major customers like Nokia and Ericsson that the delay to production would only be one week. But damage to some of the clean areas in the plant – created by smoke and water – was actually going to take months to remedy. Clean rooms in semiconductor plants must be spotless, and particles of more than  $0.5\mu$  are filtered out.



The one-week delay was quickly reported by Tapio Markki, Nokia's chief component-purchasing manager, to Pertti Korhonen, Nokia's top troubleshooter. 'We encourage bad news to travel fast', said Mr Korhonen. While Philips initially rejected offers of help from Nokia, it soon became apparent that production delays would be much more than one week. Korhonen put together a team to find solutions to supplying the five chips that were affected by the Philips fire. Three were quickly re-sourced from Japanese and American suppliers, but the other two were only supplied by Philips. This time Philips cooperated at the highest level. Nokia's chairman and chief executive, Mr Ollila, met with the Philips CEO Mr Boostra and the head of the Philips semiconductor division, Mr van der Poel. Factories at Eindhoven and at Shanghai were rescheduled to supply the missing chips, and engineers from both Nokia and Philips worked to accelerate the return of the Albuquerque plant to full production. As a result of these intensive efforts, there were relatively minor delays to Nokia's cellphone shipments.

Executives at Ericsson in Sweden only learned of the problem several weeks after the fire. Company culture was less proactive than at its Finnish rival. The bad news was withheld from senior management long after it became clear that delays were becoming serious. By the time that Ericsson realised the magnitude of the problem, it was too late to find alternative sources. Nokia had seized remaining world capacity, and it took nine months for the situation to be rectified. The disruption led to a 3 per cent loss of market share by Ericsson, and contributed in turn to its exit from the phone handset market.

### Question

- 1 What are the key lessons from this case for dealing effectively with disruptions to the supply chain?

(Source: Sheffi, 2005, and Latour, 2001)

The implication of uncertainty for supply chain processes is that they need to be *flexible*. Flexibility is defined as the 'ability to react or transform [supply chain processes] with minimum penalties in time, cost and performance' (Upton, 1995). Flexibility comes in two basic forms (Sawhney, 2006):

- *Proactive*: to create the capability in advance to handle uncertainty – for example, Toyota's counter-measures.
- *Reactive*: to cope with uncertainty in a focal firm's internal or external environment – for example, Nokia's response to the fire at Philips.

Uncertainties, wherever they originate, may affect other supply chain partners. In Chapter 7, we develop the case for managing uncertainty in supply chains under the theme of *agility*.

### 1.3.3 Soft objectives

There are other ways in which logistics advantage may be gained, but these are not so readily measurable as those listed above. They are referred to as 'soft'

objectives as distinct from the more easily measurable 'hard' objectives. Examples of soft objectives are:

- *confidence*: queries answered promptly, courteously and efficiently;
- *security*: customer's information and property treated in a confidential and secure manner.

Soft objectives need to be measured in different ways to hard objectives, such as customer attitude surveys.

Logistics is not the only way in which product competitiveness in the marketplace can be enhanced. The performance objectives listed above can be added to (and in some cases eclipsed by) other ways in which products may win orders, such as design and marketing features. No matter how good the logistics system might have been, lack of an early 'clam shell' design led to the reduction of Nokia's market share for mobile telephone handsets in Europe. Superior product or service design – often supported by brand image – may become the dominant ways of achieving advantage in the marketplace. Here, the logistics task is to support the superior design. BMW's supply chain is one of the most efficient there is, mainly because its products are sold (at least in Europe) as soon as they have been made. Finished cars do not accumulate in disused airfields across Europe, like those of the mass producers. Finished product storage adds cost, with no value added from an end-customer perspective.

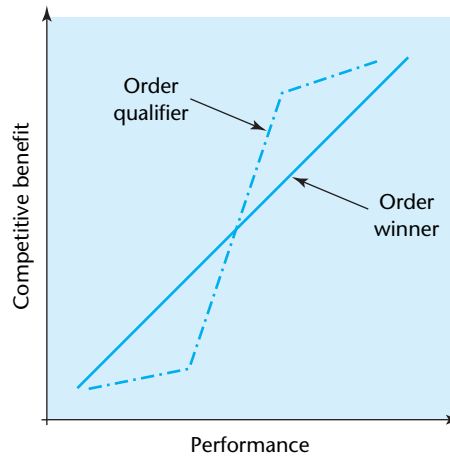
### 1.3.4 Order winners and qualifiers

The relative importance of the above logistics performance objectives is usually different for a given product or service. A helpful distinction is that between order winners and order qualifiers (Hill, 2000):

- *Order winners* are factors that directly and significantly help products to win orders in the marketplace. Customers regard such factors as key reasons for buying that product or service. If a firm raises its performance on those factors, it will increase its chances of getting more business. Thus a product that competes mainly on price would benefit in the marketplace if productivity improvements enabled further price reductions.
- *Order qualifiers* are factors that are regarded by the market as an 'entry ticket'. Unless the product or service meets basic performance standards, it will not be taken seriously. An example is quality accreditation: a possible supplier to major utilities such as PowerGen in Britain and EDF in France would not be considered seriously without ISO 9000 certification. And delivery reliability is a must for newspapers – yesterday's news is worthless. Note that, in both examples, order qualifiers are *order-losing sensitive*: loss of ISO 9000 accreditation would make it impossible to supply to major utilities, and late delivery of newspapers would miss the market.

The different impacts of the two sets of criteria are illustrated in Figure 1.10. Increased performance in an order winner, shown by the solid line, increases

competitive benefit for the product in proportion. Order qualifiers, shown by the dotted line, have different characteristics. Attainment of a required performance standard, such as ISO 9000 accreditation, gains entry to the market but no more than that.



**Figure 1.10** Order winners and order qualifiers

Order winners and qualifiers are *specific to individual segments*, a point we develop in the next chapter. Table 1.1 provides an example of how two different products made by the same manufacturer and passing through the same distribution channel have different performance objectives. The first product group comprises standard shirts that are sold in a limited range of ‘classic’ colours and sizes. The second product group comprises fashion blouses that are designed specially for each season in many colours and a choice of styles with associated designer labels.

Analysis of the order winners and qualifiers shows that the two product ranges have very different performance criteria in the marketplace. Of the two, the range of fashion blouses presents more logistics challenges because demand for individual skus are much more difficult to forecast. It is not until the season is under way that a picture begins to emerge about which colours are selling most in which region of the market. The logistics challenge is therefore concerned with speed of response and flexibility to changing demand. The logistics challenges between the two ranges are quite distinctive.

Not only can order winners and qualifiers be different for different products and services. They can also *change over time*. Thus, in the early phase of a new product life cycle, such as the launch of a new integrated circuit, the order winners are availability and design performance. Price would often be a qualifier: provided the price is not so exorbitant that no one can afford it, there is a market for innovators who want the best-performing chip that is available. But by the maturity phase of the life cycle, competitors have emerged, the next generation is already on the stocks, and the order winners have changed to price and product reliability. The former order winners (availability and design performance) have changed to become order qualifiers. The logistics challenge is to understand the market dynamics and to adjust capabilities accordingly.

**Table 1.1** Different product ranges have different logistics performance objectives

	Classic shirts	Fashion blouses
<i>Product range</i>	Narrow: few colours, standard sizes	Wide: many colours, choice of styles, designer labels
<i>Design changes</i>	Occasional	Frequent (at least every season)
<i>Price</i>	Everyday low price	Premium prices
<i>Quality</i>	Consistency, conformance to (basic) spec	High grades of material, high standards of workmanship
<i>Sales volumes</i>	Consistent sales over time	Sales peak for given fashion season
<i>Order winners</i>	Price	Time-to-market Brand/label Quality
<i>Order qualifiers</i>	Quality Availability	Price Availability
<i>Logistics priorities</i>	Cost Dependability Quality	Speed Flexibility Quality

The *actions of competitors* are therefore a further influence on logistics performance objectives. For example, low-price competitors are a feature of most markets, and attempt to differentiate themselves from the perhaps higher-grade but pricier incumbents. Thus competitors like Matalan have sparked fundamental changes in logistics strategy at the long-established UK clothing retailer Marks & Spencer ([www.marksandspencer.com](http://www.marksandspencer.com)). In response to loss of sales to cheaper new entrants, Marks & Spencer ditched long-standing agreements with local UK suppliers and sourced garments from new, lower-priced suppliers in the Far East.

### Activity 1.3

Select the top two product lines (in terms of sales) for your firm or one that you know well. Using the headings in Table 1.1, fill in the details for characteristics of both product lines. Aim to use precise details, so identify the actual sales figures instead of putting 'high' or 'low'. Use additional or other headings if they describe the situation better. Go on to identify the principal order winners and qualifiers for each product.

## 1.4 Logistics strategy

**Key issues:** What is 'strategy'? How can competitive criteria be aligned within a supply chain? How can logistics strategies be tuned to different product needs?

### 1.4.1 Defining 'strategy'

Strategy is about planning as distinct from doing. It is about formulating a long-term plan for the supply chain, as distinct from solving the day-to-day issues and problems that inevitably occur. Extending the concept of 'strategy' from Hayes and Wheelwright (1984),

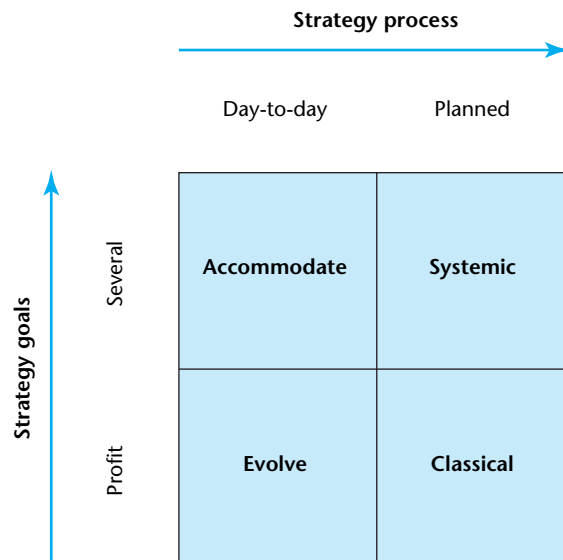
**Logistics strategy is the set of guiding principles, driving forces and ingrained attitudes that help to coordinate goals, plans and policies, and which are reinforced through conscious and subconscious behaviour within and between partners across a network.**

All too often, logistics 'strategy' is set using few such characteristics: decisions are made piecemeal by accident, muddle or inertia. We need, however, to recognise that strategic decisions may indeed be made by such means.

Whittington (2000) proposes four approaches to setting strategy. He starts by suggesting different motivations for setting strategy:

- *How deliberate are the processes of strategy setting?* These can range from clearly and carefully planned to a series of ad hoc decisions taken on a day-to-day basis.
- *What are the goals of strategy setting?* These can range from a focus on maximising profit to allowing other business priorities such as sales growth to be included.

If we make these two considerations the axes of a matrix, Figure 1.11 suggests four options for crafting strategy.



**Figure 1.11** Four options for crafting strategy

What are the implications for the way in which supply chain strategy is approached in different organisations? Here is a brief description of the four options:

- *Evolve*. 'Strategy' is not something that is formally undertaken at all. 'Our strategy is not to have a strategy' is a typical viewpoint. Operating decisions are taken in relation to the needs of the moment, with financial goals as the main guiding principle.
- *Classical*. While financial goals are again the main guiding principle, these are achieved through a formal planning process. This is called 'classical' because it is the oldest and most influential option.
- *Accommodate*. Here, decisions are back to the day-to-day mode, but financial objectives are no longer the primary concern. Strategy is accommodated instead to the realities of the focal firm and the markets in which it operates.
- *Systemic*. This option for strategy setting sees no conflict between the ends and means of realising business goals. While goal setting takes place across all major aspects of the business (including human resources, marketing and manufacturing policies), these are linked to the means by which they will be achieved in practice.

Logistics strategy usually demands systemic strategy setting between network partners, who may have to coordinate order winners and qualifiers across different market segments.

## 1.4.2 Aligning strategies

In section 1.1 we showed the supply chain as a network of operating processes. In section 1.2 we emphasised the need to 'integrate' these processes to maximise flow and focus on the end-customer. And in section 1.3 we saw how supply chains can choose to compete on a range of different competitive priorities. Now it is time to put these ideas together and show how strategies need to be *aligned* across the supply chain.

If different links in the supply chain are directed towards different competitive priorities, then the chain will not be able to serve the end-customer as well as a supply chain in which the links are directed towards the same priorities. That is the basic argument for alignment in the supply chain (Cousins, 2005). Where the links are directed by a common and consistent set of competitive criteria, then that supply chain will compete better in the marketplace than one in which the links have different, conflicting priorities. This is the concept of 'focus'.

Focus is based on the view that you cannot be good at everything. For example, it is difficult to handle high volume, low cost products in the same channel to market as low volume, high variety products, for which flexibility is the name of the game. While the assembly line is the method of choice for manufacturing cars in volume, development of prototypes for new models is kept well away from the factory in special facilities until close to launch. This is because the development process demands quite different technical skills and equipment that are better physically separated from the more routine, efficient and repetitive assembly line. In the example of the standard shirts and fashion blouses in section 1.3, the associated operations processes would be kept separate ('focused') for similar reasons. And the separation could be thousands of kilometres. 'Classic'

shirts could be sourced from China, where prices are low, and long delivery lead times are not so important. 'Fashion' shirts may be sourced nearer to home, because response time is key and cost is less important (see Case study 4.2).

What happens when the processes are not aligned within a supply chain? Let us address that question with Case study 1.4 to show the problems that can arise.

## CASE STUDY 1.4

### Talleres Auto

Talleres Auto (TA) is an SME based in Barcelona. TA attends to broken-down vehicles, providing a roadside repair and recovery service. Two of the parts that TA frequently uses are starters and alternators, which were obtained from a local distributor. In turn, the local distributor ordered parts from a prime distributor. Starters and alternators were obtained from a remanufacturer, who replaced the windings and tested the products using parts bought from a component supplier. A diagram of this part of the supply chain is shown in Figure 1.12.



- Talleres Auto is the installer
- TA buys starters and alternators from a local distributor
- the local distributor buys from a prime distributor
- the prime distributor buys from a remanufacturer
- the remanufacturer buys components from a component supplier

**Figure 1.12** The Talleres Auto supply chain

Most of TA's customers made 'distress purchases' – their car had broken down and they wanted it to be fixed quickly. So TA needed a fast replacement service from the local distributor. While the distributors both recognised the need for fast replacements, the performance of the purchasing department at the remanufacturer was measured on cost savings. Thus the component supplier thought that the name of the game was low cost.

(Source: Harland, 1997)

#### Questions

- 1 What were the order winners and order qualifiers at TA?
- 2 What were the order winners and order qualifiers at the component supplier?
- 3 What impact on customer service was this mismatch likely to cause?

### 1.4.3 Differentiating strategies

A supply chain, then, may choose to compete on different criteria. Such criteria need in turn to be recognised and form part of the business strategies of all the

members of a given network. The choices so made have major implications for the operation of each member. Failure to recognise competitive criteria and their implications for a given product or service *by any member* means that the supply chain will compete less effectively. It is like playing football when the goalkeeper makes an error and lets in a goal that should not have happened – s/he lets the whole side down.

What makes a successful strategy? Five principles of strategic positioning, related to logistics strategy, are as follows (after Porter, 1984):

- *A unique value proposition*: determining what makes the product/service different from its competitors.
- *A tailored supply chain*: governed by consistent order winning and qualifying criteria.
- *Identify the trade-offs*: by choosing not just the priorities but also what not to do. A responsive supply chain is not compatible with an efficient supply chain (Fisher, 1997).
- *Align logistics processes*: so that processes are mutually reinforcing.
- *Continuity*: logistics processes are continually and consistently improved over time.

To reinforce the issue of differentiating strategies, let us look at two commonly used strategies that have very different logistics implications. Consider products with different logistics priorities, such as those in Table 1.1:

- *Cost*: a high volume product for which demand is relatively stable throughout the year. While subject to occasional enhancements, these are usually small scale: the life cycle is comparatively long. Demand forecasts are usually pretty accurate.
- *Time*: a high variety product, which is designed for a given season and which is completely redesigned for the next season. Often, it is impossible to predict which colour or style will sell best. The product life cycle is short, and demand is much more difficult to forecast.

Cost and time have quite different logistics implications. The very actions that help to reduce costs, such as Far East sourcing, are completely the wrong strategy when speed and responsiveness are top of the agenda. Similarly, investing in high volume, low variety equipment in the factory may create efficiency and low cost, but limit a firm's ability to offer variety and fast response times. Developing the capability to support more of one priority (cost) hobbles the capability to support another (time). This is the principle of *trade-off* in logistics: more of one thing means less of another. Ideally, we want two separate supply chains, one focused on cost, the other on time. This may not be fully practical because of the need to maintain a single European distribution centre. But logistics operations within the DC may well be kept separate to avoid one product line interfering with the flow of the other. The same thinking may also apply *within* a given product range, when everyday ('base') demand may need to be kept separate from promotional ('surge') demand. We return to these concepts in the next chapter.



**Activity 1.4**

- 1 Using the concepts from this section, analyse the supply chain support for both of the products you analysed in Activity 1.3. What should the supply chain be (*functional-efficient or innovative-responsive*)? What is the reality, and why are the two different?
- 2 To what extent is there alignment of strategy in the supply chains for these two products?

**Summary***How does logistics work within the supply chain?*

- Supply chain management is defined as ‘planning and controlling all of the business processes – from end-customer to raw material suppliers – that link together partners in a supply chain in order to serve the needs of the end-customer’.
- Logistics is defined as ‘the task of coordinating material flow and information flow across the supply chain’.
- In a supply chain, materials flow from upstream to downstream. Demand information from the end-customer flows in the opposite direction. A focal firm is positioned within a supply ‘network’, with tier 1 suppliers and tier 1 customers its immediate neighbours. Material flow measures the quantity of material that passes through a given network per unit of time.
- A supply network is a system in which each organisation is linked to the others. Therefore the overall performance of the network results from the combined performance of the individual partners.
- Logistics supports competitiveness of the supply chain as a whole by meeting end-customer demand through supplying what is needed when it is needed at low cost.

*What are the performance objectives of the supply chain, and how does logistics support those objectives?*

- ‘Hard objectives’ are quality, speed and cost because they are easy to measure and relatively obvious to the end-customer. Briefly, quality is about doing things right, speed is about doing things fast, and cost is about doing things cheaply. Supporting capabilities are concerned with controlling variability (the dependability advantage), and dealing with uncertainty (the rapid response advantage). Uncertainty can be addressed by flexibility in logistics processes – either proactively or reactively. ‘Soft objectives’ are service-oriented, such as security and confidence. They are less easily measurable than hard objectives.
- Such performance objectives can, and often are, augmented by other objectives that are outside logistics. These include product superiority, innovation and brand. Here the logistics task is to support such performance objectives in the marketplace.
- The relative importance of logistics performance objectives varies from one situation to another. It can also vary over time. The concept of order winners

and qualifiers helps to prioritise the logistics task. Key influences on relative importance are individual product needs in the marketplace, position in the product life cycle, and competitor activity.

- Logistics strategy is the set of guiding principles, driving forces and ingrained attitudes that help to communicate goals, plans and policies, and which are reinforced through conscious and subconscious behaviour within and between partners across a network.

## Discussion questions

- 1 Bill Gates of Microsoft describes the 2000s as 'business @ the speed of thought'. Discuss the importance of speed in the supply chain. How can speed be increased within the supply chain?
- 2 Suggest logistics performance priorities for the following, explaining why you have come to your conclusions:
  - a a low fare airline such as Ryanair;
  - b a fast food chain such as McDonald's;
  - c an overnight parcels service such as TNT.
- 3 What is meant by the term *alignment* in relation to supply chain processes? Why is alignment important in setting a strategy for a given supply chain?
- 4 What does *flow* mean in a supply chain context? Explain how material flow relates to information flow in a supply network.

## References

- Beech, J. (1998) 'The supply-demand nexus', in Gattorna, J. (ed.), *Strategic Supply Chain Alignment*, pp. 92–103. Aldershot: Gower.
- Cousins, P. (2005) 'The alignment of appropriate firm and supply strategies for competitive advantage', *International Journal of Production and Operations Management*, Vol. 25, No. 5, pp. 403–28.
- Eggleton, D.J. (1990) 'JIT in a distribution environment', *International Journal of Logistics and Distribution Management*, Vol. 9, No. 1, pp. 32–4.
- Fisher, M. (1997) 'What is the right supply chain for your product?', *Harvard Business Review*, March/April, pp. 105–16.
- Gattorna, J. (ed.) (1998) *Strategic Supply Chain Alignment: Best practice in supply chain management*. Aldershot: Gower.
- Harland, C. (1997) 'Talleres Auto', in Johnston, R., Chambers, S., Harland, C., Harrison, A. and Chambers, S. (eds) (1997) *Cases in Operations Management*, 2nd edn, pp. 420–8. London: Pitman.
- Harland, C., Lamming, R., Zheng, J. and Johnsen, T. (2001) 'A taxonomy of supply networks', *Journal of Supply Management*, Fall, pp. 21–7.
- Harrison, A. (1996) 'An investigation of the impact of schedule stability on supplier responsiveness', *International Journal of Logistics Management*, Vol. 7, No. 1, pp. 83–91.

- Hayes, R.H. and Wheelwright, S.C. (1984) *Restoring Our Competitive Edge*. New York: John Wiley.
- Hill, T. (2000) *Manufacturing Strategy*, 2nd edn. London: Macmillan.
- Knill, B. (1992) 'Continuous flow manufacturing', *Material Handling Engineering*, May, pp. 54–7.
- Latour, A. (2001) 'Trial by fire: a blaze in Albuquerque sets off major crisis for cell phone giants', *Wall Street Journal*, 29 January, p. A1.
- Oliver, R.K. and Webber, M.D. (1982) 'Supply chain management: logistics catches up with strategy', *Outlook*, 6, pp. 42–7.
- Porter, M. (1984) *Competitive Advantage*. New York: Free Press.
- Sawhney, R. (2006) 'Interplay between uncertainty and flexibility across the value chain: towards a transformational model of manufacturing flexibility', *Journal of Operations Management*, Vol. 24, pp. 476–93.
- Sheffi, Y. (2005) *Resilient Enterprise: Overcoming vulnerability for competitive advantage*. Cambridge, MA: MIT Press.
- Slack, N., Chambers, S., Harland, C., Harrison, A. and Johnston, R. (1997) *Operations Management*, 2nd edn. Harlow: FT/Prentice Hall.
- Thompson, K.M. (2002) 'Variability and uncertainty meet risk management and risk communication', *Risk Analysis*, Vol. 22, No. 3, pp. 647–54.
- Upton, D.M. (1995) 'What makes factories flexible?', *Harvard Business Review*, July/Aug., pp. 74–84.
- Whittington, R. (2000) *What is Strategy and Does it Matter?* London: International Thompson Business Press.
- Zheng, J., Harland, C., Johnsen, T. and Lamming, R. (1998) 'Initial conceptual framework for creation and operation of supply networks', *Proceedings of 14th AMP Conference, Turku, 3–5 September*, Vol. 3, pp. 591–613.

### **Suggested further reading**

- Christopher, M. (2005) *Logistics and Supply Chain Management: Strategies for reducing cost and improving service*, 3rd edn. London: Financial Times Prentice Hall.
- Stock, J.R. and Lambert, M. (2001) *Strategic Logistics Management*, 4th edn. Boston, MA: McGraw-Hill/Irwin.

## CHAPTER 2

# Putting the end-customer first

### Objectives

*The intended objectives of this chapter are to:*

- develop the marketing perspective on supply chain management;
- explain how customer segmentation works, and to emphasise its importance to logistics;
- explain the connection between quality of service and customer loyalty;
- show how current segmentation practice can be re-engineered to set logistics priorities.

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

- how supply chains should compete by aligning logistics strategy with marketing strategy;
- how to use logistics strategy drivers to help redefine segments to achieve this alignment.

### Introduction

In Chapter 1 we looked at the logistics task from a perspective of material flow and information flow. We also saw how logistics contributes to competitive strategy and the performance objectives by which we can measure this contribution. But what is it that drives the need for flow in the first place? The key point to recognise here is that it is the behaviour of the end-customer that should dictate what happens. As stated in Chapter 1, the end-customer starts the whole process by buying finished products. It is this behaviour that causes materials to flow through the supply chain. Only end-customers should be free to make up their minds about when they want to place an order on the network – after that, the system takes over.

Quality of service addresses the process of handing over products and services into the hands of end-customers. Only after this process has been completed does the product/service reach its full value. And the handover process offers many opportunities for adding value. Instead of picking up a product from a distributor who is remote from the focal firm, there are opportunities during the sales transaction (for example, help and advice in using the focal firm's products), as well after the sales transaction (for example, after sales service and warranty).

This chapter probes the link between marketing strategy and logistics strategy. It introduces this link, and shows how it is possible to identify logistics priorities – the tasks at which logistics needs to excel.

### Key issues

**This chapter addresses four key issues:**

- 1 **The marketing perspective:** the impact of rising customer expectations and the information revolution.
- 2 **Segmentation:** and its implications for logistics strategy.
- 3 **Quality of service:** the link between customer satisfaction and customer loyalty.
- 4 **Setting priorities for logistics strategy:** creating advantage by redefining segments in logistics terms.

## 2.1 The marketing perspective

*Key issue: What are the marketing implications for logistics strategy?*

‘Marketing’ is a philosophy that can be applied to the network as a whole. Adapting Doyle’s (1994) definition,

Marketing is the philosophy that integrates the disparate activities and functions that take place within the network. Satisfied [end] customers are seen as the only source of profit, growth and security.

Marketing in practice is a series of plans and decisions that determines how the philosophy will be actioned.

‘Satisfied customers’ are increasingly hard to find. This has been caused by widespread changes that are affecting the world we live in. Two of the major changes are rising customer expectations and the information revolution (Doyle, 2000). We expand on these below. Sir Terry Leahy, Chief executive of Tesco plc, talks of harnessing customer power (2005):

The basic assumption that customers choose – that they know best what they want – means that they have become the centre of the retailer’s universe. In the best businesses, their decisions drive everything. These choices are also judgements. They pick the winners and losers in retail and in manufacturing. This is not theoretical: they regularly pass verdicts, moving from product to product and store to store. These judgements send strong feedback – shocks might be a better word – forcing change.

In Chapter 1, we referred to ‘tier 1 customers’ with whom a focal firm deals directly, and to ‘end-customers’ who are the individuals or businesses that buy the finished ‘product’ at the end of the supply network. It is therefore usual to refer to two types of customer:

- *business customers:* who represent the focal firm’s immediate trading environment (see Figure 1.2)
- *end-customers:* who represent the ultimate customer for the network as a whole (see Figure 1.4).

We refer to these types of relationships as ‘business to business’ (B2B) and ‘business to customer’ (B2C) accordingly. In section 1.2.2 of Chapter 1, we referred to the need to integrate supply chain processes so that they are aligned towards end-customer needs. In this sense, B2B integration should be aligned towards the ultimate B2C process.

We also need to distinguish here between customers and consumers. Webster (2000) defines them thus:

- *consumers* are people who use or consume the product;
- *customers* are individuals or businesses who buy the product, meaning that they acquire it and pay for it.

It is usual in business today to refer to ‘customers’ as the next process in a supply chain. This includes ‘all types of marketing intermediaries or channel members who buy for resale to their customers’ (Webster, 2000).

### 2.1.1 Rising customer expectations

Expectations have risen among customers in line with a general increase in the wealth of developed countries over the latter half of the twentieth century. This increase in expectations has many causes, including:

- better levels of general education;
- better ability to discern between alternative products;
- exposure to more lifestyle issues in the media.

These expectations have led to customers not only aspiring to more desirable products, they are also demanding much better levels of service to be associated with those products.

Businesses are also expecting more from their suppliers. Suppliers need to pay increasing attention to the service aspects of their dealings with industrial customers. This is especially true when the customer has implemented more customer-centric management systems such as just-in-time (Chapter 6).

### 2.1.2 The information revolution

Of the many technological advances in recent years, the explosion in applications of Internet technology is having the most sweeping effects. Our study of the future impact of buyer–supplier Internet-enabled exchanges (Daniel *et al.*, 2003) highlighted three areas:

- *Procurement, supply chain management and new product development.* Exchanges are helping to reduce cycle times and to remove errors and duplication. Suppliers benefit mostly from reduced transaction costs, enhanced marketing presence and reduced errors. However, buyers are expected to reap greater benefits – particularly in the areas of procurement (reductions in the cost of goods,

in transaction costs, and in procurement cycles) and of supply chain management.

- *Buyer–supplier relationships.* Exchanges are increasing the level of trust between buyers and suppliers, which is key to good trading relationships. Rather than leading to an increase in the number of suppliers used by buyers, e-hubs are encouraging the continued trend of supplier rationalisation – resulting in longer-term relationships with remaining suppliers. The increased ability to share information between buyers and suppliers made possible by the use of e-hubs will result in increased joint problem solving. This will accelerate the trend of supplier-led innovation and increased outsourcing to suppliers.
- *Impact on industry structure.* Exchanges are contributing to the trend of reducing the number of manufacturers and suppliers in most sectors. Exchanges encourage the use of open book accounting, and reduce the traditional mark-ups associated with multi-tier supply chains. They support the trend of tier 1 suppliers acting as service providers and directing a network of subsuppliers.

Faced with rising customer expectations and the information revolution, supply chain partners are increasingly asking how they can act together to meet these challenges. The starting point is to analyse needs and wants in order to satisfy a supply chain's end-customers. The marketing perspective has a well-known way to help in this analysis – segmentation.

## 2.2 Segmentation

**Key issue:** What is segmentation, and what are its implications to logistics strategy?

Segmentation describes how a given market might be broken up into different groups of customers with similar needs. It means 'describing the market as simply as possible while doing our best to emphasise its variety' (Millier and Palmer, 2000). We start by considering market segmentation from a *customer* perspective in what are usually described as 'fast-moving consumer goods (FMCG)' markets. For example, segmentation of the market for suntan creams and lotions would begin with an understanding of:

- the benefits wanted (e.g. water resistance, oil/non-oil, sun factor);
- the price consumers are prepared to pay;
- the media to which they are exposed (television programmes, magazines, etc.);
- the amount and timing of their purchases.

Profiles of the segments and evaluation of their relative attractiveness to the focal firm can then be developed.

There are many possible ways in which markets can be segmented, including:

- *demographic:* such as age, sex and education;
- *geographic:* such as urban v. country, type of house and region;

- *technical*: the use that customers are going to make of a product;
- *behavioural*: such as spending pattern and frequency of purchase.

Of the various ways to segment markets, we have found that behavioural segmentation, which ‘divides buyers into groups based on their knowledge of, attitude towards, and use of or response to a product’ (Kotler and Keller, 2006) is a powerful way to bridge marketing and logistics. It is vital that the definition of segments is not a marketing-only task, but that logistics is involved. The key point is that there is no point in defining segments that cannot be served because logistics capability does not exist. For example, if most of the spending pattern is around Christmas, then logistics must be capable of supporting the huge surge in demand at that time. Case study 2.1 explains how a retailer views its behavioural segments.

## CASE STUDY 2.1

### Managing events and promotions in the retail sector

If consumers only purchased their requirements in line with their use, then it would be relatively easy to reorganise the end-to-end supply chain from shelf to national warehouse using lean principles (see Chapter 6). A simple demand–pull system replenishing tomorrow that which has been sold today, direct to shelf, would streamline store operations and reduce inventories significantly. Retailers like Wal-Mart in the United States and Tesco in Britain have pursued an everyday low price policy in an attempt to maximise this ‘steady state’ replenishment policy. However, in Europe, most retailers have found that customers enjoy promotions and that promotions boost sales. In any case, events like Christmas and back to school create huge surges in demand.

Events may be divided in two: seasonal events and promotional events, as shown in Table 2.1:

**Table 2.1** Example seasonal events and promotions

Seasonal events	Promotions
<ul style="list-style-type: none"> <li>● Valentine’s Day</li> <li>● Mother’s Day</li> <li>● Summer holidays</li> <li>● Back to school</li> <li>● Christmas</li> </ul>	<ul style="list-style-type: none"> <li>● Three for two</li> <li>● Buy one get one free</li> <li>● 10% off for a week</li> <li>● Happy hour – 20%</li> <li>● Triple loyalty card points</li> <li>● Gift with purchase</li> </ul>

Retailers have no control over the timing of seasonal events and it is usually very difficult to forecast likely demand with normal levels of accuracy. In contrast, promotional events are planned by retailers and their suppliers. Consequently, while demand may be unpredictable, the timing of such events is known in advance. It is surprising, therefore, how often consumers will find that items on promotion are not on the shelf and that display aids and promotional material will be missing. The event which has the greatest effect is Christmas – where sales usually start growing in October, ramp up in November and peak in December. This is the *only* profitable quarter for many retailers. The product is frequently sourced from the Far East and once the order has been delivered there will be no further shipments. Retailers need to plan for this activity months in advance and cross their fingers that they will not miss sales through under-ordering



or buy too much with the consequent write-downs in the January sale. The position is further complicated in a national chain where demand patterns will be different store by store and region by region.

Many retailers allocate their Christmas merchandise to individual stores on the basis of previous year's sales for the particular product category and hope for the best. A lean design supply chain is unable to cope with such spiky demand, which will be affected further by marketing efforts and the latest fad. Retailers therefore need to be particularly agile in their approach in order to satisfy unknown demand.

Boots The Chemists (BTC) – the leading UK health and beauty retailer – has approached this problem by outsourcing specific Christmas merchandise deliveries. These deliveries are scheduled at different times of the day from 'normal' deliveries. In this way, while not dealing with the issues created by unpredictable demand, store operations can apply appropriate resources to unload vehicles and put away directly to shelf or indirectly to stockroom. Historically, promotional events in BTC were a fairly hit and miss affair with hundreds of products being promoted within a four-week window. There was a high reliance on good luck for all the elements to come together prior to the start of the promotional period. Inevitably some products, display aids and show material arrived late. Store operations at the end of the supply chain then had to try and mount the promotions with what had been delivered. Consumers were dissatisfied with the result and sales were lost.

The solution was to create a dedicated promotions team within the categories. The team masterminded the overall promotional plan and were made responsible for the delivery of products, display aids and show materials into the national distribution centres (NDCs). A successful trial was then conducted whereby most of the work required to mount the promotion was done by logistics staff in the regional distribution centres (RDCs) for each of the individual stores.

The trial comprised sending allocations of all the promotional requirements to the RDCs from the NDCs. Staff in the RDCs then picked products for a week's anticipated sales (based on historical data for that line by individual store) into totes for direct-to-shelf delivery together with appropriate display aids and show material. The totes were then placed on dollies, rolled on and off vehicles, and wheeled into the shop to the correct gondola end (end of free-standing 'island' shelf in a store). After three days, EPOS data was reviewed, and an accurate prediction of future sales to the end of the promotion was made. This was then used to calculate future replenishment requirements. Finally the merchandising teams were invited to devise clever ways to make shelves look full at the end of the promotion without using a lot of stock. This resulted in fewer 'remainders' from a promotion that had to be written down. BTC is currently implementing its design for a transformed end-to-end supply chain and the work described above is being gradually rolled out.

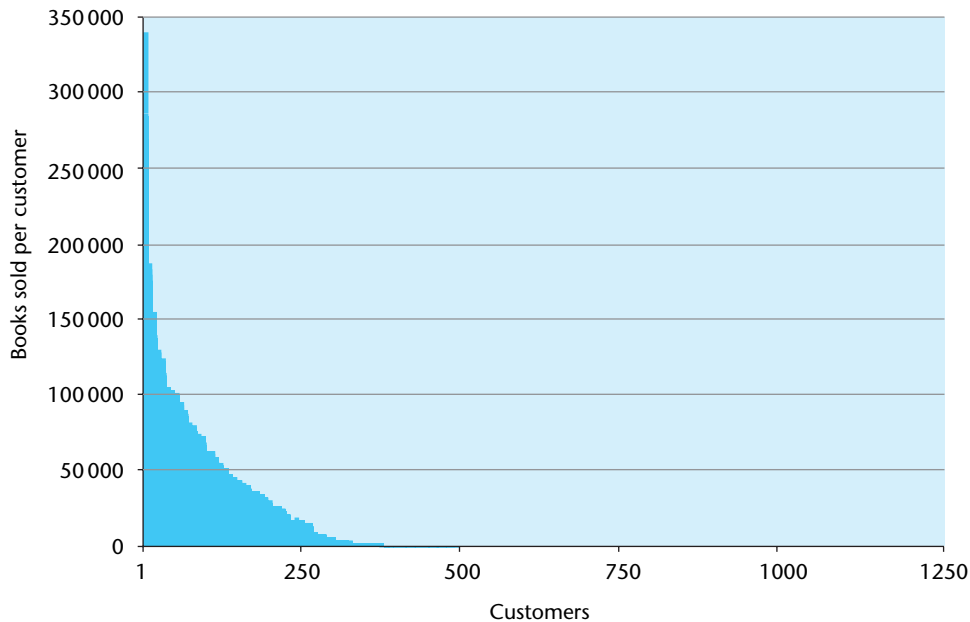
(Source: Philip Matthews, formerly Supply Chain Director, BTC)

### Questions

- 1 List the logistics challenges of mounting promotions and events at a retailer such as BTC.

## Activity 2.1

Figure 2.1 shows a Pareto analysis of the annual sales to 886 customers in the portfolio of a book stockist. What actions should the stockist take to segment its market? How could each segment best be served? What are the operational implications for the stockist? (Check out Chris Anderson, 'The Long Tail' at <http://www.thelongtail.com/about.html>)



**Figure 2.1** Annual sales per customer for a book distributor, shown as a Pareto diagram

The important characteristics of segments (McGoldrick, 2002) are that they must be:

- *measurable*: variables that can be easily identified and measured;
- *economically viable*: capable of producing the contribution that justifies the effort and cost of marketing;
- *accessible*: geographically or in terms of media communications;
- *actionable*: can be attracted and served effectively.

The next step is to select target segments and to identify how a focal firm is going to win orders in each. In other words, to define *differential advantage* that distinguishes our offerings from those of our competitors. In logistics terms, the important issues here are the order winning criteria (OWC), and qualifying criteria (QC) for the target segments. These help in turn to define the *marketing mix*.

The marketing mix is the set of marketing decisions that is made to implement positioning strategy (target market segments and differential advantage) and to achieve the associated marketing and financial goals. The marketing mix has been popularly termed the '4 Ps' (McCarthy, 1964):

- *product*: range, sizes, presentation and packaging, design and performance;
- *price*: list price, discounts, geographical pricing, payment terms;
- *promotion*: sales force, advertising, consumer promotion, trade promotion, direct marketing;
- *place*: channel selection, market coverage, distribution systems, dealer support.

Logistics contributes fundamentally to the ‘place’ decisions, as well as supporting ‘product’ and ‘promotion’ decisions. All too often, ‘place’ activities are viewed as the bit bolted to the back of production that gets inventory away from the factory and into stock-holding points such as warehouses. In order to achieve the goal of ‘the right product in the right place at the right time’, logistics systems and processes need to be designed to support products in the marketplace.

Segmentation principles can also be applied to industrial marketing. But ‘there are distinct differences between the marketing of industrial products and consumer goods’ (Millier and Palmer, 2000: 60), as summarised in Table 2.2.

**Table 2.2 Comparison between consumer and industrial marketing**

	Consumer	Industrial
<b>Customers</b>	Many, widely dispersed	Few, concentrated
<b>Market</b>	Consumers directly served by retailers and distributors	Derived demand Industrial chain, long and complex
<b>Buying behaviour</b>	Individual and family decision	Group decision Formal procedures High buyer power
<b>Relationships</b>	Low individual buying power	Formal procedures High buyer power
<b>Product</b>	Standard Positioned on emotional and perceptual factors	Technical complexity Specification important Bespoke and customised
<b>Price</b>	Low unit price Take it or leave it No negotiation	High unit price Tender and negotiation Standard items from price list
<b>Promotion</b>	Mass media advertising Role of the brand	Emphasis on personal selling Reputation important
<b>Place</b>	Established retail chain Stock availability Seasonality	Direct Made to order Standard items in stock

Let us turn to an industrial marketing example to illustrate how new segments can impact on logistics capability.

## CASE STUDY 2.2

### Powerdrive Motors

Tom Cross took over as Managing Director at Powerdrive Motors in South Africa three years ago. At the time, the company was an established manufacturer of small electric motors with a strong reputation for product reliability and technical leadership. On the

downside, it was also regarded in the trade as having high prices and variable delivery. Tom's first task was to tackle the huge product variety on offer. He saw this as the major problem in addressing the negative views in the marketplace, and also saw opportunities in streamlining design and production. The product range was replaced with a new generation of designs based on a few hundred 'modules', which could be assembled in many different combinations to give variety at low cost. This meant the loss of some customers who had gone to Powerdrive because they could rely on the company's technical leadership to produce designs that suited their particular needs. This was not considered important because the combined sales volume of such customers was under 5 per cent.

Using the new designs, Tom was now able to reorganise the factory into cells that produced major subassemblies such as rotors and stators. The work flow was transformed, and manufacturing throughput time was reduced from six weeks to just four days. Cost improvements meant that average price reductions of between 10 and 15 per cent could be offered.

Powerdrive's customer service policy was redrafted to offer quotations within a maximum of one hour of any enquiry, and for deliveries of finished product to be made within one week 'anywhere in northern Europe'. This new policy was explained to internal sales staff, and to sales representatives and agents employed by the organisation. If 'old' customers wanted special designs that were no longer in the range, the sales staff were instructed to explain Powerdrive's new policy and to politely decline the order.

At first, business soared. Impressed by the lower prices and short delivery times, customers flocked to Powerdrive and sales jumped by 50 per cent. But then things began to go sour. First, the factory could no longer cope with the demands being placed on it. The addition of a large order for lawnmower motors blocked out a lot of production capacity from January to June. Order lead times during this period in particular slid back to former levels. Second, a Brazilian supplier spotted the opportunity to enter the market with prices that undercut Powerdrive by 20 per cent. While only half of the product range was covered by this new entrant, it was the high volume products that were especially threatened. Further, the new competitor offered three-day lead times from stock that had been established in Europe. Third, some of the former customers who could no longer obtain their bespoke designs from Powerdrive were complaining within the industry that Powerdrive's technical leadership had been sacrificed. Although small in number, such customers were influential at trade fairs and conferences.

### Questions

- 1 Evaluate the changes that took place in the segmentation of Powerdrive's market.
- 2 Characterise the changes using the concept of order winners and qualifiers.

Segmentation is often undertaken by adopting the easy way to group customers – by account size. While this is easily measurable, it fails on the fourth of McGoldrick's criteria listed above – it is not actionable in logistics terms. An example from our research in the FMCG sector illustrates the problems of poor alignment between marketing and logistics.

**CASE STUDY**  
**2.3**

## Segmentation at CleanCo

CleanCo is a Polish manufacturer of cleaning products that serves the European grocery retailing market. CleanCo currently segments its customers on the value of customer accounts. The primary division is between *national accounts*, for which 10 accounts constitute 70 per cent of sales by value, and *field sales*, which comprise a long ‘tail’ of more than 200 accounts that together make up only 30 per cent of sales. Due to the size of the field sales structure, a secondary classification groups accounts by channel type: neighbourhood retail, discount and pharmacy. CleanCo recognises the need to reduce the long customer ‘tail’ and is introducing distributors for orders below a minimum quantity. CleanCo’s current approach to segmentation is summarised in Table 2.3.

**Table 2.3** CleanCo – Current approach to market segmentation

National accounts	Field sales		
70% sales	30% sales, 200+ accounts		
10 accounts	Neighbourhood retail	Discount sector	Pharmacy

While CleanCo currently segments its retail customers by account size, its sales organisation has identified two significant types of buying behaviour displayed by the customer base, shown in Table 2.4:

- *volume-driven* buying behaviour;
- *margin-driven* buying behaviour.

Volume-driven customers are keen to capitalise on both product and supply chain cost savings in order to pass them on to their customers to drive volume sales. There are two variants of the volume-driven behaviour:

- everyday low price (EDLP);
- discount.

Retailers pursuing an EDLP strategy strive for continuous price reduction from suppliers like CleanCo to drive a fairly consistent, high volume of sales. This should result in a relatively stable pattern of demand in the washing and bathing sector. Discounters on the other hand are looking for bargains so they can ‘stack ‘em high and sell ‘em cheap’, a strategy more likely to result in a volatile demand pattern. Margin-driven customers are keen to add value for their customers by offering a wide selection of products and value-adding services. This strategy also results in a relatively stable demand pattern in this sector.

**Table 2.4** CleanCo – potential for behavioural segmentation

Volume-driven	Margin-driven
Every day low price (EDLP)	
Discount	

A complicating factor when trying to deconstruct the buying behaviour of CleanCo's customers is that several secondary factors are used to support products in the marketplace. Such factors include product types (e.g. premium, mid, utilitarian), product range (e.g. current products, end of lines, 'b' grade), merchandising requirements (e.g. category captains) and promotions strategy (e.g. roll-back, 12-week, 4-week, Hi-Lo). Promotions are by far the most disruptive of these factors. Although the promotions are generally planned well in advance with the retailers, they cause significant disruption to the supply chain operations due to the peaks and troughs in demand that they create. Furthermore, the deeper the promotional activity the greater the volatility created and the greater the disruption to the supply chain. This has the effect of masking what is fundamentally a fairly stable demand pattern with somewhat artificial volatile demand.

Strategic alignment can only be achieved if the supply chain is aligned behind the segmentation strategy that CleanCo has adopted. This is not currently the case with the CleanCo supply chain. Each operation within the supply chain makes decisions or segments its customers based on the functional criteria that affect its part of the supply chain. We have called this lack of alignment 'matrix twist', because the matrix of business processes at each stage of the supply chain has been apparently twisted so that the processes fail to fit with each other. As illustrated in Table 2.5, the decision criteria for CleanCo and its suppliers and customers change at each stage. This not only complicates material flows, but becomes a minefield if one considers it in terms of behavioural segments.

**Table 2.5** Supply chain segmentation criteria

Management process	Supply chain decision	Determined by
Source	Which suppliers?	Raw material commodity type
Make	Which manufacturing site?	Product family type
Deliver	Which manufacturer warehouse?	Historically a function of order size  In process of being divided by export paperwork requirements and customer account (arbitrary split)
	Which customer RDC?	Product type and location of store to serve
	Which products to which store?	Demographics of the store's catchment area, which drives layout and range decisions

(Source: Godsell and Harrison, 2002)

We develop the management processes 'source', 'make' and 'deliver' in the next chapter.

### Questions

- 3 What has caused the 'matrix twist' between CleanCo and its retail customers?
- 4 What actions are needed to straighten out the 'matrix twist'?

## 2.3 Quality of service

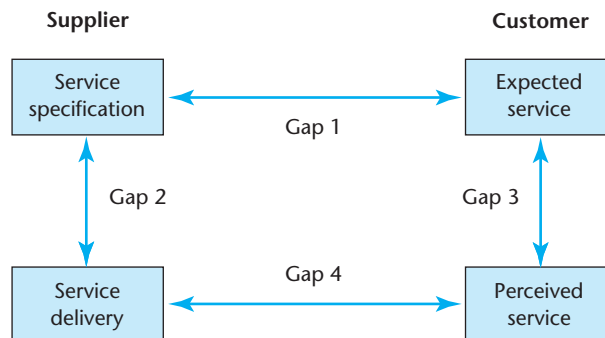
**Key issues:** How do customer expectations affect logistics service? How does satisfaction stack up with customer loyalty?

Most supply chains that involve physical products end with *service* processes such as retailing (grocery or apparel), healthcare (pharmaceutical and other medical goods) and distribution (motor cars). Service processes mean that the customer is present in some way, although distribution through web-based shopping, telephone and mail order mean that customers do not have to be physically present. Performance of service processes often differs between employees, between customers and from one hour to the next. If you want good service from the local supermarket, do not go on Saturdays or near to Christmas when the service is under severe capacity pressure: on-shelf availability is at its lowest, and queues at the checkout are at their longest. The key point is that ‘service is the combination of outcomes and experiences delivered to and received by the customer’ (Johnston and Clark, 2005).

Quality of service takes place during service delivery, which is the interaction between the customer (B2B or B2C) and the service process. ‘Gaps’ can emerge between what the service is supposed to be, what the customer expects it to be, and how the customer perceives it when it is delivered (Zeithaml *et al.*, 1988, Parasuraman *et al.*, 1991). We can illustrate these gaps as a simplified gap model (Figure 2.2):

- *Gap 1* refers to differences between customer expectations and how these have been developed into a service specification by the supplier.
- *Gap 2* refers to differences between how the specification was drawn up and how it was delivered.
- *Gap 3* refers to differences between what the customer expected and what s/he perceived was delivered.
- *Gap 4* refers to differences between how supplier and customer perceived the service delivery.

Gaps in quality of service can arise, as seen in the IKEA case study.



**Figure 2.2** Simplified service quality gap model

(Source: After Parasuraman *et al.*, 1991)

## CASE STUDY 2.4

### Tears at teatime at IKEA

Next week, Jane Fillimore will move into a new flat. You can tell something about the 28-year-old music-industry publicist from Kilburn, north-west London, from the list of furniture she is buying. There is the Pax Brivic wardrobe, the Norden dining table and the Bonde media storage combination. Fillimore wants style – but on a budget. She is part of Generation Ikea.

Not that she wants to be. She hates the Swedish retailer, and only last Sunday had her worst shopping day ever at the firm's superstore in a drab retail park near the new Wembley stadium in London.

She wanted to pick up the Pax Brevic wardrobe she had ordered the week before. Easy, you might think, but just getting served was an ordeal. When she entered the store, an assistant told her to 'walk the mile of hell' past wannabe-stylish urban living rooms to the giant storage zone.

The store did not have her wardrobe and a salesman sent her back through road works to IKEA's nearby distribution centre. The distribution centre had the wardrobe, but could not give it to her without a receipt. To get one, she had to go back to the main store. But the main store had lost her order, so she had to go to customer service. This department is not called customer service at IKEA, it's called customer returns, and it took her half an hour to find.

By 4.30 pm, Fillimore was right back where she started. Exasperated, she put her head in her hands and burst into tears. 'I don't even like the wardrobe', she sobbed. 'I bought it because it's cheap. That's the only reason I come here.' By 5.00 pm, the store is closing, and she can only dream of getting her wardrobe by Friday. She could walk back through the little sets that represent the nation's living rooms to try one last time to find her wardrobe, but she can't face it. As she walks out, I ask her if she knows that Argos and Sainsbury's (two other UK retailers) are selling furniture. For the first time all day, she breaks into a smile.

'Really?', she grins. 'I'll go there tomorrow. I never want to come back to this place again.'

(Source: Based on an article by John Arlidge, *Sunday Times*, 26 October 2003)

#### Questions

- 1 When IKEA was founded 60 years ago by Ingmar Kamprad, he realised that customers did not mind queuing, collecting their purchases and assembling the furniture themselves as long as the price was right. Suggest why gaps in quality of service have opened up.

### 2.3.1 Customer loyalty

While plugging gaps in service quality helps to improve customer satisfaction, this is a 'qualifier' for long-term customer loyalty. The two concepts are not the same. Piercy (2002) distinguishes them as follows:

- *Customer satisfaction* is what people think of us – quality of service, value for money. It is an *attitude* (how does a customer feel about our product/service?).



- *Customer loyalty* is how long we keep a customer (or what share of their business we take). It is a *behaviour* (do they buy from us more than once?).

Nevertheless, the attitude of customer satisfaction is key to the behaviour of customer loyalty. Parasuraman and Grewal (2000) link the two concepts by proposing the ‘key drivers of customer loyalty’, shown in Figure 2.3. Also, note the connection to Tesco’s core purpose on page 6.

The benefits of customer loyalty are potentially huge. The loyal customer should be viewed in terms of lifetime spending potential. Thus, a customer of VW Audi Group could be viewed as worth €300k rather than the €30k of today’s sales transaction. As Johnston and Clark (2005) put it, loyal customers:

- generate long-term revenue streams (high lifetime values);
- tend to buy more than new customers;
- tend to increase spending over time;
- may be willing to pay premium prices;
- provide cost savings compared with attracting new customers.

The logistics challenge is to support the development of customer loyalty by designing and delivering quality of service. Of the three drivers of customer loyalty shown in Figure 2.3, quality of service is ‘essential for excellent market performance on an enduring basis’ (Berry, 1999: 8–9). The rationale for this is that ‘service quality is much more difficult for competitors to copy than are product quality and price’. Supporting product availability through such means as channel selection, market coverage, distribution systems and dealer support all help to nourish customer loyalty. So does logistics support of product characteristics (such as variety or product range) and of marketing initiatives (such as promotions).

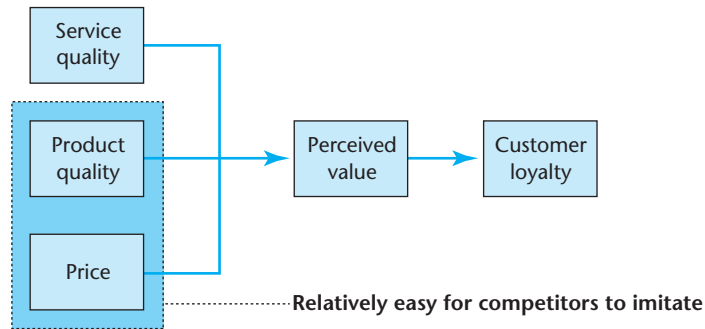
### 2.3.2 Value disciplines

Figure 2.3 refers to ‘perceived value’. A development of the service quality–product quality–price model is that of *value disciplines*. Instead of competing on all of these fronts equally, Treacy and Wiersema (1997) argue that companies taking leadership positions do so by narrowing their competitive focus, not by broadening it. They propose three strategies, or ‘generic value disciplines’ that can be followed:

- *Operational excellence*. Here, the strategy centres on superb operations and execution, often by providing a reasonable quality at low price. The focus is on efficiency, streamlining operations, supply chain management, everyday low price. Most large international corporations use this discipline.
- *Product leadership*. Here, the leaders are very strong in innovation and brand marketing and operate in dynamic markets. The focus is on development, innovation, design, time-to-market and high margins in a short timeframe. ‘It was the ability of Apple to innovate in many spaces – getting the music companies to agree to 99 cent pricing, creating wonderful iTunes software, making a ter-

rific physical product, the iPod, that just works in your hand – that gave Steve Jobs his success. It was building an ecosystem of innovation, not just the iPod, that did it.’ (<http://www.businessweek.com/innovate/NussbaumOnDesign/>)

- *Customer intimacy.* Here, leaders excel in customer attention and customer service. They tailor their products and services towards individual or almost individual customers. The focus is on customer relationship management (see section 2.3.3): they deliver products and services on time and above customer expectations. They also look to life-time value concepts, reliability and being close to the customer.



**Figure 2.3** Key drivers of customer loyalty

(Source: After Parasuraman and Grewal, 2000)

While most organisations are under pressure to reduce prices, speed up delivery and improve customer service, the best will have a clear focus (page 27) as a key part of their competitive strategy. This focus needs to be improved and adapted over time.

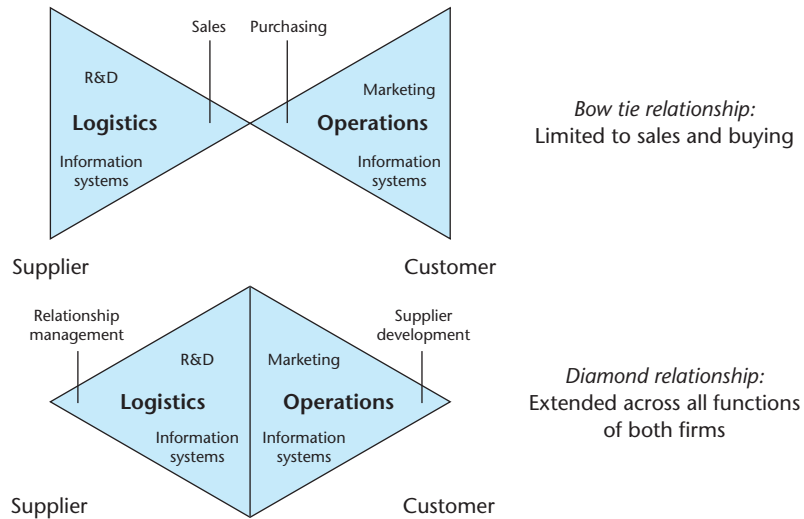
### Activity 2.2

Evaluate Treacy and Wiersema’s value disciplines based on Porter’s views on differentiating strategies (section 1.4.3).

### 2.3.3 Customer relationship management (CRM)

A development of customer intimacy is customer relationship management (CRM). The principle behind CRM is that marketing strategies are continuously extended in order to strengthen customer loyalty. Eventually, customer and supplier are so closely intertwined that it would be difficult to sever the relationship. In other words, the exit barriers become higher and higher. Figure 2.4 compares CRM thinking with traditional relationships that are limited to buying and selling functions of the organisations concerned (Payne *et al.*, 1995). We explore the issue of partnerships in the supply chain further in Chapter 9.

CRM software can be used to capture and monitor individual customer data from – for example – loyalty cards to enhance demand management (section 6.1.1). The next case study, Batman, illustrates the evolution of diamond-type relationships in an industrial setting.



**Figure 2.4** Customer relationship management: bow tie and diamond

(Source: After Payne *et al.*, 1995)

## CASE STUDY 2.5

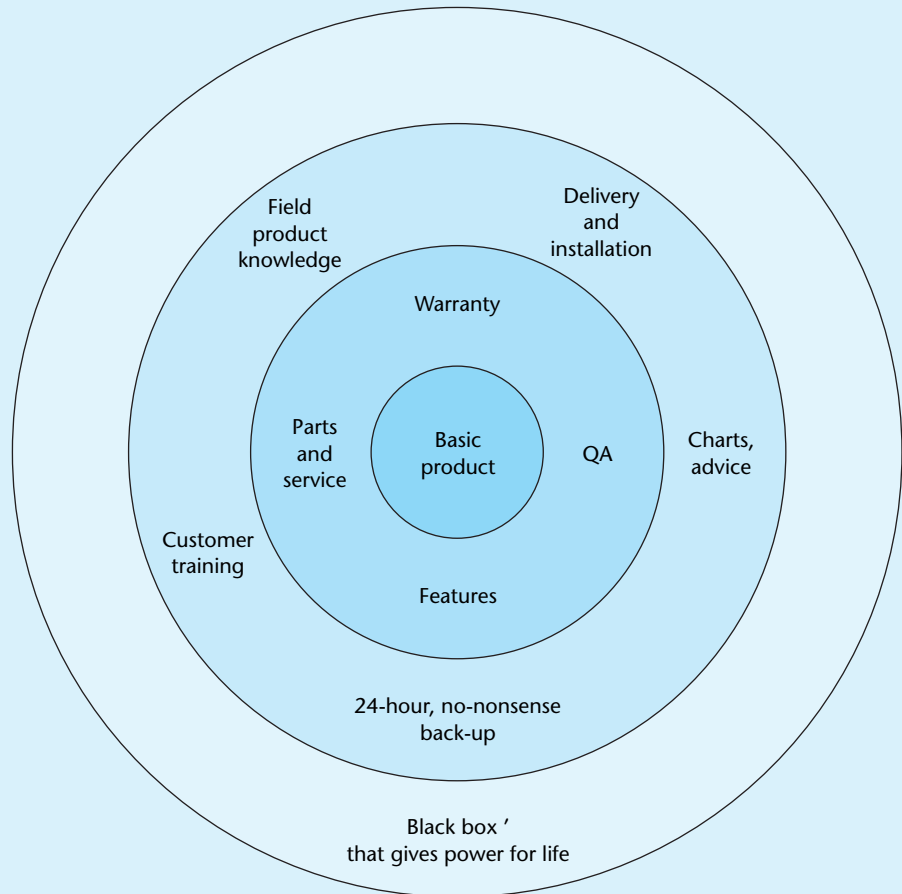
### Batman – adding value through quality of service

Everglo Battery, the premier battery manufacturer and service provider in South Africa, looked back on the development of its marketing strategy in four stages. Each had been signalled by advancing the concepts of what is meant by 'quality of service'. Stage 1 had been the basic product: a sealed lead-acid battery for use in mining applications. Batteries were regarded by customers as a mature product and as a 'grudge buy'. Each year, the basic product was under heavy downward price pressure. Stage 2 had been the industry reaction to customer service: the addition of warranty replacement of defective products, of quality assurance (QA) audits of a supplier's design and manufacturing processes, and of parts and service provision.

Stage 3 had recognised the need to go much further in terms of customer service. A whole raft of additional services had been conceived with a view to adding value. Breakdowns were fixed at short notice by means of field service engineers. Everglo products could now be delivered and installed at customer premises. Price lists were simplified by including peripheral equipment, such as contactors, that had to be added to a battery rack in order to make it work. Advice and tips were added to help customers warm to Everglo products. In a proactive move, Everglo introduced charts and advice about the application of battery products in general, and the resulting tables became an industry standard. Parts and service in the field were upgraded to a '24-hour, no-nonsense back-up service'. And customer training built on Everglo's position as an industry leader. Rather than sales seminars, Everglo's were customer training seminars, where the company spoke on behalf of the industry rather than as a supplier.

In spite of having reached a pre-eminent position in mining power supply, Everglo recognised that the centre of Figure 2.5 was in effect a 'black hole'. Each year, competitors added more services to their basic products too. In effect, the second and to some extent the third circles were being absorbed into the 'commodity' category, and customer expectations increased all the time. A new stage 4 strategy was conceived to

take Everglo into a position that competitors would find even more difficult to follow. The new strategy was coined 'Batman': battery management for life. The aim was nothing less than a total, customer-oriented product management service that provides 'power for life'. The supplier takes over the task of managing the customer's assets, including problem identification, training and managing cash flow. The objective of 'Batman' is to look at the product the way the customer does, performing best at what the customer values most rather than at what the supplier values most.



**Figure 2.5** Adding value by quality of service

### Questions

- 1 Has Everglo reached the end of the line in terms of its quality of service strategy?
- 2 As a competitor to Everglo, what would be your options in response to Everglo's latest moves?

### 2.3.4 Measuring service quality

Going back to the start of this section, it is helpful to have in place measures of performance of service processes. These can be used to monitor performance over time and to compare ('benchmark') the processes with others. Table 2.6 lists examples of service level measures used in retail supply chains (after Rafele, 2004).

## 2.4 Setting priorities for logistics strategy

**Key issues:** How can we segment our market to make it easier to supply? How can we use such knowledge to improve logistics strategy?

Setting priorities to assure quality of service leads to establishment of performance measures. Priorities should be used to help ensure that:

- partners in a supply network focus on providing end-customer value;
- partners in that network can see how well the network as a whole is performing against this yardstick.

In this way they can judge whether performance is improving or declining, and assess the effect on quality of service of changes to the system.

In order to set priorities for quality of service, we begin by putting the end-customer first. The aim is to identify groups of end-customers whose needs can be serviced in focused, targeted ways. The needs define groups and give them an identity, as we explained in section 2.2 on segmentation. Because segments therefore have different characteristics, it is usually a mistake to take a 'one size fits all' approach to servicing them. Our research has shown that the starting point for segmentation is often conceived by marketing in isolation, and does not make any sense in logistics terms (Godsell *et al.*, 2006). Logistics is therefore left with an impossible task. Since logistics is actually part of the marketing mix (see 'place' under section 2.2 above), ability to provide quality of service is off to a bad start! As Gattorna (2006: 32) states, 'a real disconnect continues between the way that market-facing personnel view customers and the information they communicate back to non-market facing personnel'.

Our framework for creating logistics advantage (Harrison *et al.*, 2007), shown in Figure 2.6, therefore starts by reviewing and re-engineering the current approach to market segmentation.

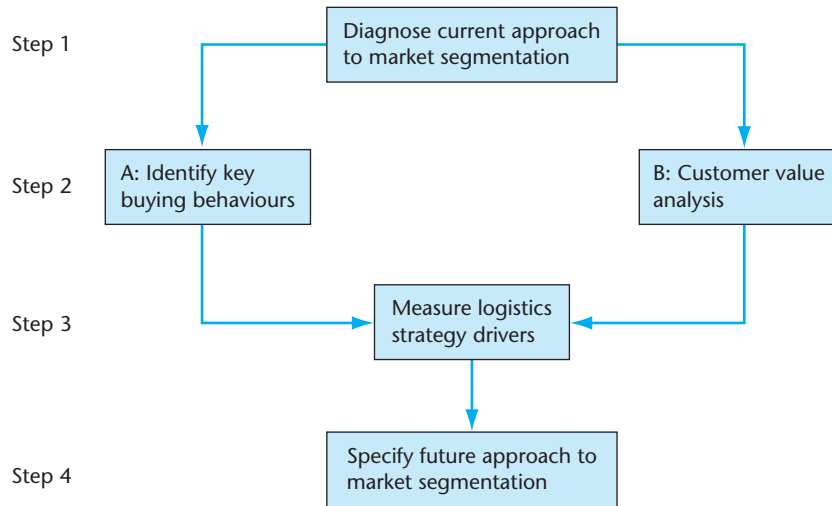
### 2.4.1 Step 1: Diagnose current approach to market segmentation

Current approaches to segmentation may drive elements of logistics strategy to a limited extent, or they may have no relevance in logistics terms. Segmentation in the CleanCo case (Case study 2.3 above) was based on national accounts and field sales, that is, by account size. This was in line with the way that sales and

**Table 2.6** Selected service level measurements

<b>Inventory/availability</b>	<p><i>Physical and accounting correspondence:</i> number of orders with mistakes divided by the total number of orders in the warehouse in the same period of time</p> <p><i>Stock turnover:</i> quantity delivered or shipped divided by the average stock in the warehouse in the same period of time</p> <p><i>Stockout:</i> number of orders out of stock divided by the total number of orders placed in the same period of time.</p>
<b>Flexibility</b>	<p><i>Flexibility:</i> number of special/urgent/unexpected orders confirmed to the customer divided by the total number of special/urgent/unexpected orders required by the customer multiplied by 100 in the same period of time</p>
<b>Service care</b>	<p><i>Punctuality:</i> number of orders delivered on time divided by the total number of orders delivered multiplied by 100 in the same period of time</p> <p><i>Regularity:</i> number of orders delivered with a <math>\Delta t</math> of delay/advance divided by the total number of orders delivered multiplied by 100 in the same period of time</p> <p><i>Completeness:</i> number of full orders delivered divided by the total number of orders delivered multiplied by 100 in the same period of time</p> <p><i>Correctness:</i> number of orders with mistakes dispatched divided by the total number of orders dispatched multiplied by 100 in the same period of time, or</p> <p>Number of codes/articles sent back divided by the total number of codes/articles sent multiplied by 100 in the same period of time</p> <p><i>Harmfulness:</i> number of damaged orders dispatched in a period divided by the total number of orders dispatched in the same period multiplied by 100</p> <p><i>Delay:</i> number of days of delay (or number of days of delay divided by the number of days promised) multiplied by 100</p>
<b>Supply conditions</b>	<p><i>Delivery frequency:</i> number of orders delivered in a certain period of time</p> <p><i>Shipped quantity:</i> quantity shipped in a certain period of time or quantity dispatched for each shipment</p> <p><i>Presentation:</i> method of packaging and of shipment, alignment with customer process</p>
<b>Lead time</b>	<p><i>Total order cycle time:</i> occurring from the arrival of a customer order to the receipt of goods or cycle time of the single activities (order transmission, order processing, order composition, order transfer to the production plant, article production, warehouse delivery, final delivery to the customer)</p> <p><i>Response time:</i> to order tracking requests, etc.</p>
<b>Marketing</b>	Range completeness, information on products and selling assistance
<b>Order management</b>	Documents management (invoices and orders), client contacts and order advancement state, etc.
<b>After sales</b>	<i>Speed of response:</i> to back orders, claims management, use assistance and payment management, fulfilment of warranty conditions, etc.
<b>e-information</b>	Web site completeness, ease of making orders by network and data transmission security, etc.

(Source: After Rafele, 2004)



**Figure 2.6** Creating logistics advantage: a four-step process

Source: (Harrison *et al.*, 2007)

marketing functions were organised. There were no effective links between marketing and logistics – in logistics terms, only the distribution function was differentiated according to channel.

Another example from our research is AutoCo, a manufacturer of automotive seat subassemblies which supplies seat manufacturers like The Lear Corporation, and automotive assemblers like BMW. AutoCo currently segments its customers firstly by the country from which customers purchase, and secondly by customer within that country. Customer facing teams (CFTs) comprise a sales manager, an engineer and a product designer. These teams deal with each of the segments, and place orders on manufacturing units (based in England, Poland, Norway and Sweden). Because CFTs are not coordinated between customer countries, the supply network is fragmented, and manufacturing units may compete with each other for business.

### 2.4.2 Step 2a: Understand buying behaviour

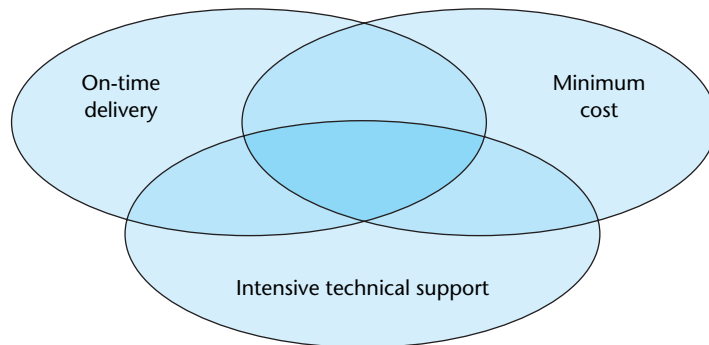
The CleanCo case (Case study 2.3) also shows that our focal firm's sales organisation has identified two significant types of buying behaviour by its retail customers: volume driven and value driven.

- *volume-driven behaviour* is driven by the retailers who want to offer low prices to end-customers in order to drive high volumes. The everyday low price (EDLP) variant of this behaviour places pressure on supply partners like CleanCo for continuous price reduction. In turn, this generates a relatively stable demand pattern for the supply chain – unlike a retailer who regularly promotes the same product by means of special offers.
- *margin-driven behaviour* is driven by offering a wide selection of products and value adding services. Cost savings were not necessarily passed on to the cus-

customer but could be used to invest in additional value adding activities. This strategy also resulted in a relatively stable demand pattern.

Other behaviours by retailers are also possible – such as discounting and promotion. But the key point is that the different behaviours must be characterised and specified in terms of their logistics implications, along the lines of Table 1.1. Using order winners and qualifiers helps to bridge marketing and logistics perspectives. While there are dangers in a ‘one size fits all’ logistics strategy (low cost but low service) in the same way that there are dangers in over-customisation (high cost and complexity), the compromise solution is to specify three or four substantive segments (Gattorna, 2006).

Discussing the characteristics of customer behaviour within a cross-functional group in a workshop setting helps to spawn ideas on patterns. It is often easier to make sense of the data if they are used to plot graphs and charts. Venn diagrams such as the one shown in Figure 2.7 are helpful to illustrate patterns that may appear among the analysed data.



**Figure 2.7** Customer segmentation using order winners

### 2.4.3 Step 2b: Customer value analysis

Customer value is the customer-perceived benefit gained from a product/service compared with the cost of purchase. In order to measure customer value, we need to understand what *aspects* of a product or service it is that a customer values (Johnson and Scholes, 2002). Here, we are primarily interested in aspects of customer value which impact on logistics strategy. Two aspects in particular relate to buying behaviours:

- *demand profile*: the characteristics of demand in terms of volume and variety, and of demand variability and uncertainty;
- *competitive profile*: how the focal firm chooses to compete in the marketplace (see section 1.3).

Customer value is assessed by means of a questionnaire to measure customer views of these aspects in terms of:

- *importance* (on a 0–100 scale);
- *performance* of the focal firm and a key competitor (0–5 Lickert scale);
- *price level* of the focal firm relative to the key competitor (0–5 Lickert scale).



Examples of customer value profiles for two customers of AutoCo (referred to in step 1 above) are shown in Figure 2.8. We return to the concept of ‘value’ in Chapter 3. Meanwhile, we will continue to use the AutoCo example to illustrate steps 3 and 4.

### 2.4.4 Step 3: Measure logistics strategy drivers

Here, we examine demand profile and competitive profile as drivers of logistics strategy:

- *Demand profile.* Usually, high volume products are associated with comparatively low variety (few skus) and low demand variability and uncertainty. Examples are washing powders in retail, and volume cars like Ford and VW’s big sellers. Note that demand variability can be created by means of promotions. Low volume, high variety products – such as most automotive spare parts, and many health and beauty products – tend to have the opposite demand profiles.
- *Competitive profile.* This is based on the competitive factors we introduced in section 1.3 – hard objectives (quality, time and cost), supporting capabilities (controlling variability and dealing with uncertainty in logistics processes) and soft objectives (such as confidence and security). For example, Ford chooses to compete on low price and delivery speed (by making to stock), while BMW chooses to compete by making more expensive and highly specified cars to customer order while the customer waits. While they also appear in the demand profile as characteristics, we refer here to variability and uncertainty in terms of a focal firm’s capability to cope with them better than the competition.

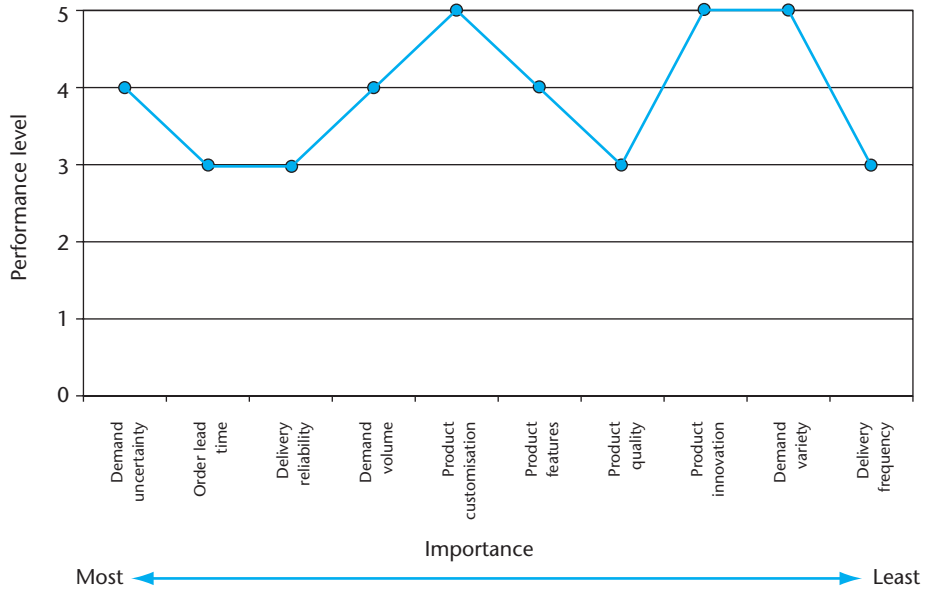
Both of these profiles have profound implications for logistics strategy, some of the key implications for which are summarised in Figure 2.9.

For example, the higher the demand variability and uncertainty, the greater the need for buffers. Buffers can be in the form of spare capacity, inventory and order lead times. If we want to shorten the time the customer has to wait, then it is necessary to make speculatively – perhaps finishing off (customising) the product once the final order details are known. Finally, planning and controlling the flow of materials across the supply chain needs to be carried out centrally when in high demand variability and uncertainty conditions in order to coordinate the response of supply partners. In more stable demand conditions, it is possible to relax controls and allow more local flexibility.

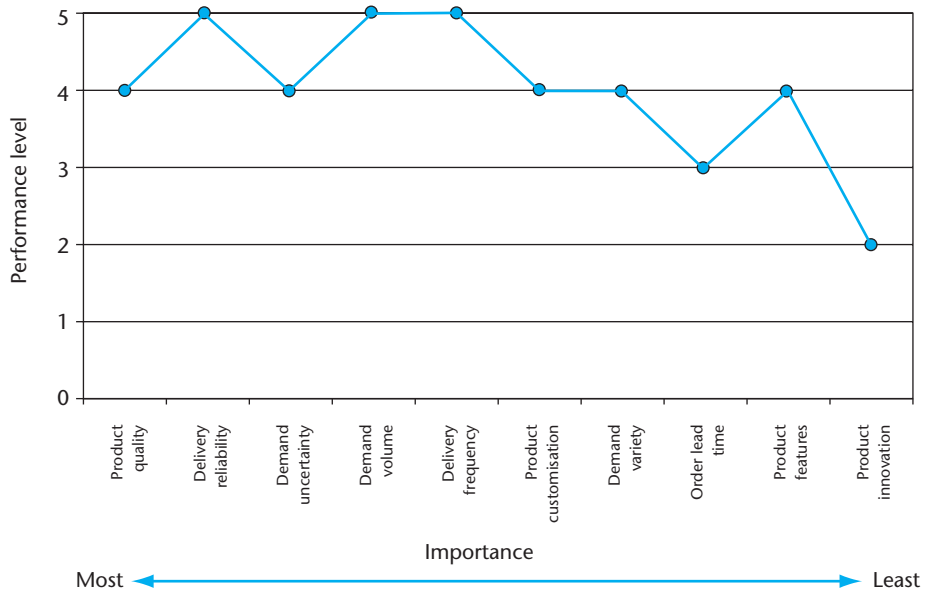
### 2.4.5 Step 4: Specify future approach to market segmentation

Using logistics strategy drivers it is now possible to revisit the customer value profiles in Figure 2.8 and develop a fresh approach to segmentation that makes sense in logistics terms. In Figure 2.10, we have analysed the two customers (A and B) in Figure 2.8 in terms of their key demand and competitive profiles. Customers

**AutoCo customer A:**  
 high volumes, short lead times  
*Coping with demand uncertainty and short order lead times are most important*

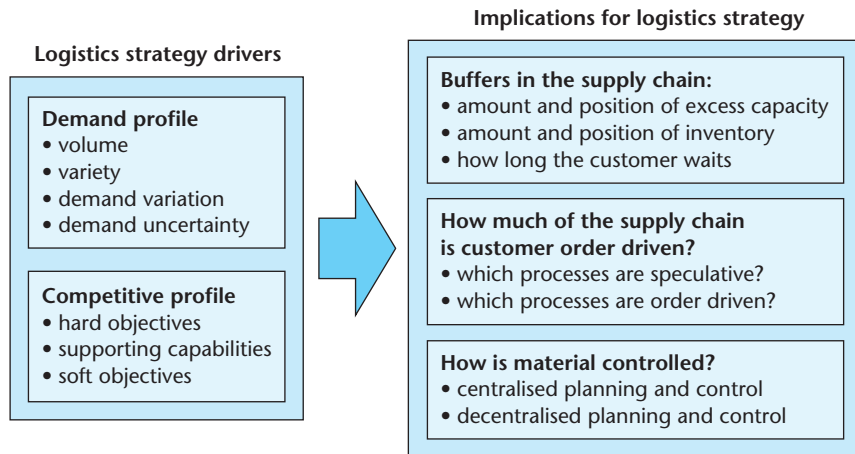


**AutoCo customer B:**  
 uncertain demand, lower volumes  
*Product quality and delivery reliability are most important*



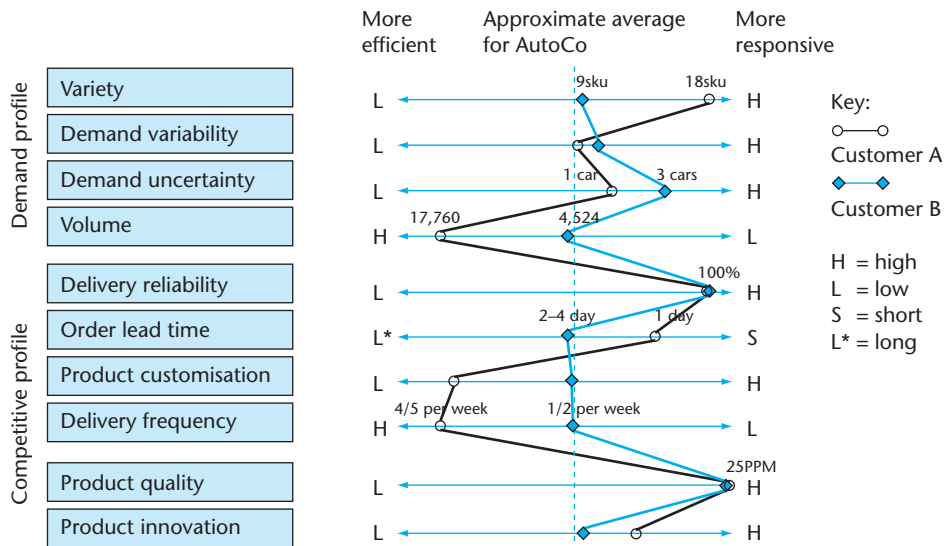
**Figure 2.8** Customer value profiles for two AutoCo customers

Source: (Harrison *et al.*, 2007)



**Figure 2.9** Strategy drivers and their implications for logistics strategy

A and B both want 100 per cent on time in full on quality delivery. However, customer A places priority on higher volumes on shorter delivery lead times with higher delivery frequencies. Customer B places priority on AutoCo’s capability to meet uncertain demand, and on higher levels of customisation. It is now possible to describe the segments typified by customers A and B in terms of:



**Figure 2.10** Strategy drivers and their implications for segmentation

Source: (Harrison *et al.*, 2007)

- buying behaviour relevant to logistics strategy;
- customer-perceived value;
- profile of logistics strategy drivers.

It is then necessary to evaluate all other major customers at AutoCo in similar terms to develop and refine an overall segmentation strategy for the focal firm.

As indicated earlier, the aim is to develop a 'compromise' strategy which – like segmentation itself – seeks to describe logistics strategy 'as simply as possible while doing our best to emphasise its variety' (Millier and Palmer, 2000).

## Summary

### *What is customer service in the context of logistics?*

- Business to business (B2B) refers to upstream relationships between members of a network. Business to customer (B2C) refers to handover to the end-customer. B2B relationships therefore need to be aligned towards B2C.
- Marketing is a philosophy that integrates the disparate activities and functions that take place within the network. Loyal customers are seen as the source of profit, growth and security. Marketing in practice starts with analysing segments, evaluating those segments and targeting them. Segments need to be measurable, economically viable, accessible and actionable. Marketing in practice continues by market positioning, which requires differential advantage to be defined, and the marketing mix to be formulated.
- The key logistics contribution to the marketing mix is in the 'fourth P', place. This includes decisions about factors such as channel selection, market coverage, distribution systems and dealer support. Logistics also supports product decisions (for example, product range) and promotion activity.
- Supply networks end with service processes, where the end-customer is present in some way. 'Gaps' can emerge between what the service is supposed to be, what the customer expects it to be, and how the customer perceives it when it is delivered. The size of these gaps has implications for quality of service, a major driver of customer loyalty.

### *How do we win and retain customers through logistics?*

- The principle here is that loyal customers have many advantages over new ones. The logistics challenge is to reinforce loyalty by exceeding customer expectations via superior quality of service.
- Customer relationship management is based on the principle that marketing strategies should be continuously extended to strengthen customer loyalty. Phases of logistics development are needed, each phase placing increasing demands on the development of logistics capabilities.
- Setting logistics priorities should be carried out with market segments in mind. This is a joint task between marketing and logistics functions. Order winners and qualifiers by segment help develop a common language to assist this task.
- Often, the current approach to segmentation is unsatisfactory in logistics terms. We present a four-step model to diagnose the current approach, and to re-engineer that approach using the concept of logistics strategy drivers (demand profile and competitive profile).

## Discussion questions

- 5 suggest ways in which logistics can play a part in the marketing mix for:
- an airline;
  - a supermarket;
  - an automotive manufacturer;
  - a hospital.

In each case, specify the organisation you have in mind and explain the reasons for your suggestions.

- 6 The 'Batman' case (Case study 2.5) presents what might be described as a 'marketing wish list'. Analyse the likely logistics challenges at each stage of development, and suggest how these might be addressed.
- 7 Read the case study 'Global Lighting', and answer the study questions at the end.

### CASE STUDY 2.6

## Global Lighting

This case study contains information on how Global's expectations of quality of service from its suppliers evolved over a number of years. Further changes are affecting these suppliers as Global's own customers continue to demand higher levels of service. If you are unfamiliar with the term material requirements planning (MRP), it is explained in Chapter 6 (e.g. see page 175).

Global is one of Britain's largest manufacturers of lighting products. The market for architectural lighting, one of its major product lines, has become increasingly volatile and competitive in recent years. Pressure to supply products more cheaply and more quickly to a higher standard on an international basis has meant that Global has had to work hard on shortening product life cycles and reducing delivery lead times.

During 1996, the new managing director raised the profile of logistics by making an appointment at board level. Following this change in organisational structure, a 'lean' approach to supply chain management and manufacturing was implemented over the next three years. But recently the lean approach to managing the supply chain has been found to have serious shortcomings in terms of meeting increased demand for customised products such as architectural lighting. Consequently, Global's supply chain management strategy has evolved to accommodate the rapid growth in the market for these products. This change resulted in a multifaceted supply chain strategy, which increases Global's ability to meet the mass customisation needs of its customer base. This multiple strategy approach has created many challenges for suppliers.

### Prior to 1996

Before 1996 Global's organisation and management of its internal and external supply chains was based on a single, familiar approach. Global managed internal manufacturing operations and material flow on a push principle driven by MRP.

The supply base was managed through an essentially adversarial approach. The supply base was broad, as the strategy of the buying function of the company operated on the principle of lowest price is best. Buyers routinely moved the sourcing of com-

ponents to a new supplier if the price was lower. New suppliers would be assessed on the basis of price and component quality only, and no obligation of repeat purchase was expected if the supplier did not retain the lowest price. Price, not cost, was the main objective of the buying group.

### After 1996

During 1996, the managing director and his changed board of directors developed a new strategy to manage internal and external operations. Manufacturing was restructured to improve customer service and to increase profitability. Following an extensive programme of data collection and analysis, the production facility was segmented into two distinct sections. One section became a low-volume, irregular-demand factory employing operators with broad product knowledge. The other area became the high-volume, regular-demand factory, with focused and repetitive build tasks. These two areas also operated their internal supply chains in distinctly different formats. The low-volume area continued with a push (MRP) strategy, while the high-volume section operated a pull strategy using *kanban*, as shown in Table 2.7.

**Table 2.7 Focused factory structure**

	Low volume	High volume
Material control	MRP	<i>Kanban</i>
Product codes	> 5,000	< 800
Material flow	Push	Pull
Demand predictability	Low	High
Minimum order quantity	1	Pallet
Service offer	MTO	MTS

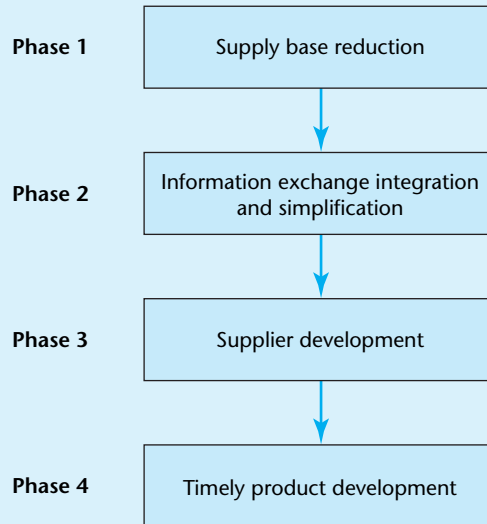
In addition to restructuring the internal supply chain, the historical approach to managing the external chain of suppliers was altered. Because materials constituted more than 80 per cent of the cost of sales, the decision was made to acknowledge vendors as an intrinsic part of the organisation. Improving the performance of the suppliers and the efficiency of the exchange between the firms was recognised as key to Global's success. In order to achieve the necessary improvements a four-phase plan was conceived. Figure 2.11 gives an overview of the four phases.

#### *Phase 1: Supply base reduction*

Before Global committed any substantial resource to develop its suppliers, it was necessary to reduce the number of companies that it dealt with. Reducing the number of direct suppliers was essential to maximise the limited time and resources available. In order to reduce the number of suppliers who dealt directly with Global, resourcing and tiering activities were put in place. Suppliers were selected for the ongoing supply base on the following criteria:

- ppm defects (quality performance);
- ability to operate with *kanban* system (delivery performance);
- computer aided design/manufacture (CAD/CAM) facilities (new product development);

geographical location (new product development and delivery performance); price.

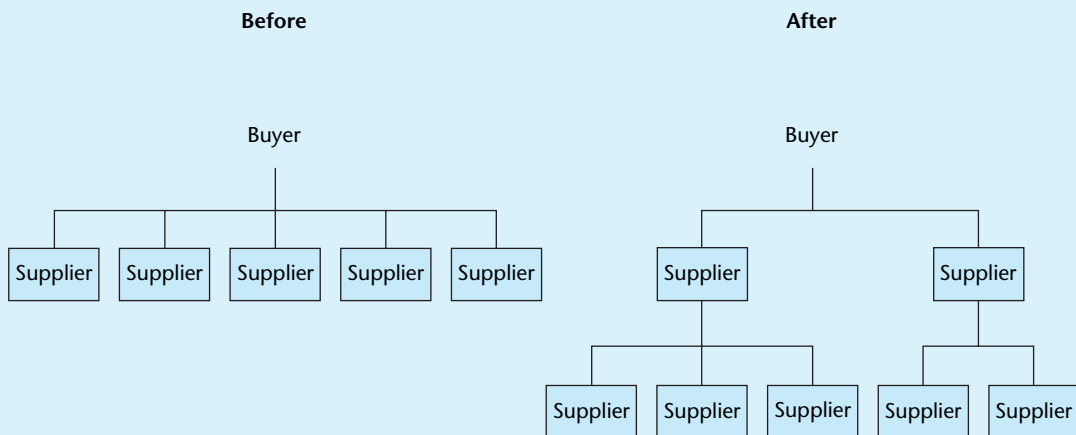


**Figure 2.11** The four-phase plan for supplier improvement

If a supplier could not or planned not to operate in accordance with Global's quality, logistical or product development criteria, they were either delisted (and the components switched to another current supplier) or became a tier 2 supplier.

For example, the principal supplier of injection moulding components coordinated purchase and delivery of plastic parts from the other smaller suppliers, which had formerly all been tier 1. The 'before' and 'after' scenarios are shown in Figure 2.12.

The result of these activities was a reduction in direct supplier numbers from 267 to fewer than 100. This is shown in Table 2.8.



**Figure 2.12** Restructuring the supplier base

### *Phase 2: Information exchange integration and simplification*

Following the segmentation of the factory into low- and high-volume sections, and reduction of the supply base, it became possible to simplify communications between Global and its suppliers. The high-volume factory introduced, with the assistance and agreement of the suppliers, a two-bin, *kanban* material-ordering system. The support of the suppliers in introducing the simple material-ordering system was an early example of greater integration of working practices within the supply base. Only through the agreement of a new way of trading was it possible to stop posting weekly MRP schedules, which were out of step with 'real time' customer demand. Introduction of the *kanban* system reduced waste created by the delay in transmitting demand data. Similarly, waste related to inappropriate processing, unnecessary inventory, unnecessary motion, waiting and transporting was reduced.

**Table 2.8** Supplier reduction figures

Year	No. of suppliers
1995	267
1996	198
1997	132
1998	106
1999	< 100

### *Phase 3: Supplier development*

Introducing *kanban* proved to be an early and rewarding example of supplier development for Global and its suppliers. However, development was not limited to one-off, functional improvements. Before improvements were attempted in the more complicated arena of new product development, it was planned to introduce cross-functional teams between Global and its supply base through team-building weekends. For example, the managing director of the main die-casting supplier attended a team-building weekend with Global engineers, sales people, manufacturing managers and finance personnel. This weekend experience prompted the die-caster to introduce team building within its own operation, thus helping to reduce new product development times between the two companies.

### *Phase 4: Timely product development*

Lead times for new product development in the lighting industry in 1996 were typically 18–24 months. For an industry that was becoming more and more fashion conscious the time from concept to product delivery was proving costly in terms of competitiveness in the market.

One of the prime driving forces for Global's new management approach towards suppliers was the desire to reduce time and cost to market drastically. Suppliers within this new ethos became involved at the concept stage for new products. Product development activities became concurrent rather than sequential. Designers and engineers of suppliers with CAD and CAM technologies began to interact directly with Global's designers and engineers at each stage of the development process. At the same time, shopfloor operators became involved with designers to bring cohesion between design



and build activities. The result of these changes in approach, internally and externally, was a reduction in development lead times for standard production items from 18 months to 14 weeks by early 1999.

### Outcomes

Restructuring Global's approach to managing suppliers would have provided limited benefits if it had not occurred in conjunction with changes to Global's internal operations. For example, improvements in the efficiency of the supply chain in terms of introducing a concept such as *kanban* would not have been as effective if a restructuring of manufacturing had not taken place at the same time. Simultaneous internal and external changes propelled Global's performance forward in terms of product development, cost and lead-time reduction, as shown in Table 2.9.

**Table 2.9** Changes between 1995 and 1998

	1995	1998	
		MRP	Kanban
Product codes	8000+	>5000	>800
Product development	24 months	6 months	6 months
Delivery lead times	8–12 weeks	2–4 weeks	0–2 weeks
Costs (1995 index = 100)	100	85	73
Sales volume (1995 index = 100)	100	110	125

The performance improvements shown in Table 2.9 were achieved through the efforts of both supplier and buyer alike. Integration of supply chain activities and information flows accelerated the implementation of lean practices such as *kanban*, which in turn reduced the uncertainty in demand and improved relationships. Operational improvements followed a consistent and deliberate strategy of developing confidence, trust and openness between Global and its suppliers. Those who were prepared to work in partnership to develop improvements gained additional sales volumes, which in turn increased the interdependence of the parties.

Improvements in relational as well as operational performance developed a virtuous circle for both parties. Implementing pull scheduling in the supply base necessitated the simultaneous implementation of a partnering strategy. The demise of the traditional 'arm's length' approach to managing the buyer–supplier exchange helped both parties to improve their business volumes and performance over this period.

(Source: Jim Aitken, visiting Fellow, Cranfield Centre for Logistics and SCM)

### Questions

The next phase of development at Global addresses the continuing growth in demand for customised, non-standard products. Linked to an ever-increasing demand for customisation is the drive for shorter lead times and lower costs. With increasing globalisation of the lighting market, several parts of Global's product portfolio became commodity in nature. Customers in the United Kingdom now have the opportunity to purchase their lighting products from low labour cost countries such

as China. But supplying the lowest-price product is not the answer to this problem for UK companies. Instead of competing on price, companies must find alternative ways to retain their customers. One way is through the improvement of customer service.

- 1 What actions do you think Global could take to respond to the needs of its customers?
- 2 How will Global's own customer service priorities change as a result of this?
- 3 What are the opportunities and threats facing suppliers as a result of the likely changes to Global's quality of service priorities?

## References

- Berry, L.L. (1999) *Discovering the Soul of Service: The nine drivers of sustainable business success*. New York: Free Press.
- Daniel, D., White, A., Harrison, A. and Ward, J. (2003) *The Future of e-Hubs: Findings of an International Delphi Study*, Information Systems Research Centre and Centre for Logistics and SCM, Cranfield School of Management.
- Doyle, P. (2000) *Value-Based Marketing: Marketing strategies for corporate growth and shareholder value*. Chichester: Wiley.
- Doyle, P. (1994) *Marketing Management and Strategy*. New York: Prentice-Hall International.
- Gattorna, J. (2006) *Living Supply Chains: How to mobilise the enterprise around delivering what your customers want*. Harlow: Financial Times/Prentice Hall.
- Godsell, J. and Harrison A. (2002) 'Strategy formulation in an FMCG supply chain', *Proceedings of the EurOMA Conference*, Copenhagen.
- Godsell, J., Harrison, A., Storey, J. and Emberson, C. (2006) 'Customer responsive supply chain strategy – an unnatural act?', *International Journal of Logistics: Research and Applications*, Vol. 9, No. 1, pp. 47–56
- Harrison, A., Godsell, J., Julien, D., Skipworth, H., Achimugu, N. and Wong, C. (2007) *Developing Supply Chain Strategy: A management guide*, Cranfield University.
- Johnson, G. and Scholes, K. (2002) *Exploring Corporate Strategy*, 6th edn. London: Financial Times/Prentice Hall.
- Johnston, R. and Clark, G. (2005) *Service Operations Management*, 2nd edn. London: Financial Times/Prentice Hall.
- Kotler, P. and Keller, K.L. (2006) *Marketing Management*. Harlow: Pearson Education.
- Leahy, T. (2005) 'Sir Terry Leahy at the Guardian Summit', [www.guardian.co.uk/print/0,,5120038-113379,00.html](http://www.guardian.co.uk/print/0,,5120038-113379,00.html).
- McCarthy, E.J. (1964) *Basic Marketing: a managerial approach*. Homewood, IL: Irwin.
- McGoldrick, P. (2002) *Retail Marketing*, 2nd edn. Maidenhead: McGraw-Hill Education Europe.
- Millier P. and Palmer, R. (2000) *Nuts, Bolts and Magnetrons: a practical guide for industrial marketers*. Chichester: Wiley.
- Parasuraman, A., Berry, L. and Zeithaml, V. (1991) 'Understanding customer expectations of service', *Sloan Management Review*, Spring, pp. 39–48.
- Parasuraman, A. and Grewal, D. (2000) 'The impact of technology on the quality–value–loyalty chain: a research agenda', *Journal of the Academy of Marketing Science*, Vol. 28, No. 1, pp. 168–74.

- Payne, A., Christopher, M., Clark, M. and Peck, H. (1995) *Relationship Marketing for Competitive Advantage*. Oxford: Butterworth Heinemann.
- Piercy, N. (2002) *Market-led Strategic Change*, 3rd edn. Oxford: Butterworth Heinemann.
- Rafele, C. (2004) 'Logistics service measurement: a reference framework', *Journal of Manufacturing Technology Management*, Vol. 15, No. 3, pp. 280–90.
- Treacy, M. and Wiersema, F. (1997) *The Discipline of Market Leaders*. Reading, MA: Addison-Wesley Publishing Co.
- Webster, F. (2000) 'Understanding the relationships among brands, consumers and retailers', *Journal of the Academy of Marketing Science*, Vol. 28, pp. 17–23.
- Zeithaml, V., Berry, L. and Parasuraman A. (1988) 'Communication and control processes in the delivery of service quality', *Journal of Marketing*, Vol. 52, pp. 35–48.

### **Suggested further reading**

- Christopher, M. and Peck, H. (2003) *Marketing Logistics*, 2nd edn. Oxford: Butterworth-Heinemann.
- Doyle, P. (2000) *Value-Based Marketing*. Chichester: Wiley.
- McDonald, M. and Dunbar, I. (2001) *Market Segmentation*, 3rd edn. Oxford: Butterworth Heinemann.

## CHAPTER 3

# Value and logistics costs

### Objectives

*The planned objectives of this chapter are to:*

- explain the concept of value and its implications for managing the supply chain;
- explain how total costs can be divided up in different ways, and how they can be applied to managing the supply chain;
- identify how better cost information can be used to create more value.

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

- what is meant by the term 'value creation';
- how logistics costs can be managed for better value creation;
- how activity-based management can be used to identify the cost drivers in your business.

### Introduction

In section 1.3 of Chapter 1 we reviewed the way in which different products may have different logistics strategies. While the range of classic shirts compete on price and brand, and demand is relatively stable over the year, fashion blouses compete on style and brand. For a fashion product, the logistics challenge is to be able to support highly uncertain demand in the marketplace. The logistics task for the two supply chains is essentially different, and some companies refer to a 'supply chain for every product' to emphasise this difference. In Chapter 2, we stated the need for compromise here – between 'one size fits all' on the one hand, and endless customisation on the other.

Here, we develop the information flow aspects of our model in Figure 1.4. We also show how there is another flow in supply chains – *funds flow*. Funds flow in the opposite direction to materials. Funds – in the form of cash – originate from the end-customer, and are used to pay the bills progressively from one supply chain partner to the next upstream.

While funds flow has not yet been formally included in the logistics domain, the integration of finance and logistics is an increasingly important aspect of logistics in the twenty-first century. The acquisition of Vastera (a third party logistics company) by JP Morgan Chase Bank (a financial institution) to form JP Morgan Chase Vastera is aimed at 'driving cost savings and global supply chain

efficiencies while providing best-in-class compliance with government regulations’.

This chapter probes the financial implications of different logistics strategies. While it may be clear that cost must form a central plank of supply chain strategy for classic shirts, that is not to say that the product team for fashion blouses can ignore the cost implications of their actions (see Table 1.1). The common theme is the concept of *value*, and the extent to which both management teams are creating value for the end-customer. Here, we advance the concept of ‘value’ beyond the mainly end-customer view that we took in Chapter 2, and extend it to other stakeholders in the supply chain.

While value is based on *cost* from the point of view of the company accountant, the concept of value may have different interpretations outside the company. In section 2.4.3, we stated that value from the end-customer’s point of view is the *perceived benefit* gained from a product/service compared with the cost of purchase. From the shareholder’s point of view, value is determined by the *best alternative use* of a given investment. In other words, value is greatest where the return on investment is highest.

### Key issues

**This chapter addresses five key issues:**

- 1 Where does value come from?:** different views of value, and how it can be measured using return on investment.
- 2 How can logistics costs be represented?:** three different ways to divide up total costs.
- 3 Activity-based costing (ABC):** a process-based alternative to allocating overheads.
- 4 A balanced measurement portfolio:** balancing the needs of all stakeholders.
- 5 Supply chain operations reference model (SCOR):** a further process-based approach to measuring supply chain costs and performance.

The chapter assumes a basic knowledge of a profit/loss account and balance sheet. If finance is not your long suit, then a helpful accompanying financial text is *Management Accounting for Non-Specialists* (Atrill and McLaney, 2007). We acknowledge the assistance from our colleague at Cranfield, Sri Srikanathan, for his help with sections 3.1 and 3.2. Figures 3.1 to 3.7 and Table 3.2 are from his lectures.

## 3.1 Where does value come from?

**Key issue: How can shareholder value be defined? What is economic value added, and how does it help in this definition?**

Creating shareholder value is widely used today to describe the main objective of a business. In its simplest form, shareholder value is created when the shareholder gets a better return by investing in your business than from a comparable investment. A *comparable investment* is one that has a similar level of risk. You

might make the same return on €100,000 from playing roulette as you do from buying a house, but the risk profiles are very different! In order for a business to create superior shareholder value, it must have a competitive advantage. Return on investment is an important measure that is widely used to assess shareholder value.

### 3.1.1 Return on investment (ROI)

One way of looking at the creation of shareholder value is to end the year with a lot more money than at the start. If this extra money results from profitable trading, then management has been successful in *improving the productivity of capital*. Return on investment (ROI) is measured as profit (in €) before interest and tax as a percentage of capital employed (also in €):

$$\% \text{ ROI} = 100 \times \frac{\text{€ Profit}}{\text{€ Capital employed}}$$

The term ‘investment’ is used because capital employed is equivalent to the money invested in the business. ROI can also be seen as the outcome of profitability and asset utilisation:

$$\% \text{ ROI} = 100 \frac{\text{Profit}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Capital employed}}$$

Let us look at the detail behind each of these ratios, and the way they fit in with each other. Figure 3.1 gives a family tree of the way return on investment is made up. Let us look at the potential for improving each from a point of view of managing the supply chain better.

#### Sales

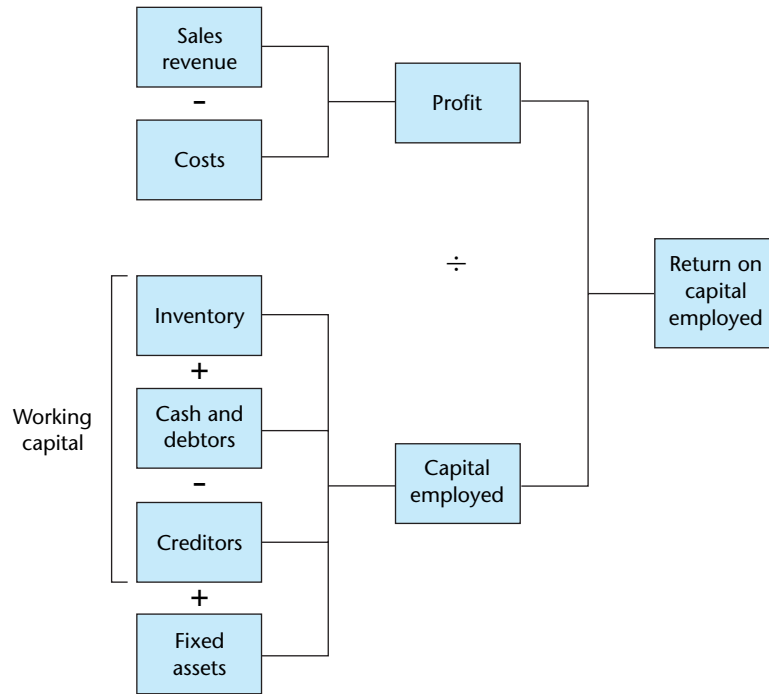
Superior customer service improves sales, and makes our company more valued by the customer in the long term.

- Improving customer responsiveness is a key goal for managing the supply chain.

#### Costs

The supply chain is a potential gold mine for making bottom line improvements to business performance. But directors of many businesses are impatient for cost improvement, and consider that cutting stocks and headcount is all that is needed. This may achieve short-term margin improvement, but strategic supply chain management is about improving the way things are done and hence improving long-term performance.

- Supply chain modelling shows that manufacturing and distribution costs together with inventories can be optimised while customer service is maximised.
- Studies in efficient consumer response (ECR) have shown that cutting out non-value-added products and inefficient promotional activity can reduce overall costs by 6 per cent. (ECR is discussed in Chapter 8.)



**Figure 3.1** The make-up of return on capital employed (investment)

(Source: Courtesy of Sri Srikanthan)

### Working capital

Note that the combination of inventory, cash and debtors *less* creditors is called working capital. Each of the elements of working capital is considered in turn.

### Inventory

This is a major asset in many businesses. It is there to buffer uncertainty of supply and demand, and to permit immediate availability when replenishment times are too lengthy. However, inventory is often regarded as a hindrance rather than a help: it ties up cash, it needs resources to be stored and it becomes obsolete.

- A primary goal for supply chain management is to replace inventory with information. Try to minimise the use of forecasts and to increase the use of real demand.
- Question any means for automatically replenishing inventory.

### Cash and debtors

The key task here is to make the time between receipt of customer order and receipt of the cash as short as possible. Progress against this ideal not only makes the company more competitive by reducing lead times, but also improves its cash position. This means that business processes from sales order processing to distribution should be integrated and free from waste.

- Debtors (customers who owe us money) can be minimised by basic controls such as regular review and problem resolution. Sending out incomplete invoices is an invitation for non-payment!

### Creditors

Creditors are people we owe money to. In supply chain terms, this term applies mainly to our suppliers. Many organisations think that lengthy payment terms to suppliers maximise credit and therefore improve the balance sheet. The downside of this thinking is that suppliers factor in the credit terms to their prices, and their own balance sheets become saddled with debt.

- Plan material requirements and distribution requirements to maximise flow of parts through the supply chain as needed.
- Discipline goods inwards to check delivery date, quality and correct prices. There is no point in starting the credit cycle early.
- If the supplier is a smaller company, it may be that the cost of capital is higher than it is for your company. It may be worthwhile to consider negotiating with the supplier to pay early, and therefore getting a share of the money that the supplier is paying in interest to the bank.

### Fixed assets

The value-generating assets of a business that form the focus of supply chain management are a heavy drain on capital. They include manufacturing facilities, transport and distribution. They contribute to high *fixed costs* for an operation: that is, costs that do not change much with throughput. Such costs are therefore highly volume sensitive, as we shall see.

- Many organisations respond by a ‘maximum variable, minimum fixed’ policy. This is helped by *outsourcing* all but the core capabilities, which are retained in-house. Thus transport and warehousing are today often outsourced to specialist ‘third-party logistics providers’ such as DHL Exel and UPS.

#### Activity 3.1

- 1 Review the categories in Figure 3.1 and compile your own list of the way in which these categories can be influenced (made better or worse) in an organisation.
- 2 What are the implications for logistics strategy?

### 3.1.2 Financial ratios and ROI drivers

ROI is an important measure for assessing shareholder value and is underpinned by two main drivers:

- increased profitability;
- increased asset utilisation.



As discussed section 3.1.1, these two supporting drivers are the key determinants for increasing ROI and hence shareholder value. An understanding of the financial ratios that affect these two drivers is essential when formulating an organisation's supply chain strategy. While financial ratios are based on historical information, and therefore have limitations, they have a number of advantages for an organisation. They can be:

- a benchmark for comparing one organisation with another;
- used as a comparator for a particular industrial sector;
- used to track past performance;
- a motivator for setting performance targets;
- an early warning indicator if the organisation's performance starts to decline.

Table 3.1 provides a guide to linking ROI and its drivers with the financial ratios for a manufacturing company (CIMA, 1989).

**Table 3.1 ROI and its key drivers**

Level 1	Level 2	Level 3	Level 4
<b>Return on investment</b>	$\frac{\text{Net profit}}{\text{Sales}}$	Production costs as % of sales	Labour costs as % of sales Materials as % of sales
		Selling costs as % of sales	Labour costs as % of sales
		Administration costs as % of sales	Labour costs as % of sales
	$\frac{\text{Sales}}{\text{Total assets}}$	Fixed assets as % of sales	Property as % of sales Plant as % of sales Vehicles as % of sales
		Current assets as % of sales	Inventory as % of sales Debtors as % of sales Cash as % of sales

Section 3.2 of this chapter tackles the issues concerning the visibility of costing information. This form of analysis can be applied to benchmark an existing operation with a competitor, or it can be used to assess the implications on ROI against potential *trade-offs* (see section 1.4.3), such as comparing an in-house operation with a third party outsourcing alternative.

The use of financial ratios in relation to time are key to monitoring working capital and the 'cash to cash' cycle. Key time-related ratios include:

- *average inventory turnover*: the number of times inventory is turned over in relation to the cost of good sold;
- *average settlement period for debtors*: the time taken for customers to pay their invoices;

- *average settlement period for creditors*: the time taken for an organisation to pay its creditors.

Reductions in working capital will have a beneficial effect on an organisation's ROI. For example, inventory reductions increase both profitability (reduced costs) and capital (increased asset utilisation). Supply chain decisions have an impact on costs *and* assets, so they affect both the drivers of ROI. Understanding the trade-offs involved is key to increasing value.

## 3.2 How can logistics costs be represented?

**Key issues:** What are the various ways of cutting up the total cost 'cake', and what are the relative merits of each?

We all have a pretty good idea of what the total costs of a business are in practice. The costs of such items as materials used, power and wages all lead to bills that have to be paid. What is not so clear is how these costs should be allocated to supply chain processes – or even to products for that matter. Christopher (2005) states that problems with traditional cost accounting as related to logistics include:

- the true costs of servicing different customer types, channels and market segments are poorly understood;
- costs are captured at too high a level of aggregation;
- costing is functionally oriented at the expense of output;
- the emphasis on full cost allocation to products ignores customer costs.

This section reviews commonly used ways of representing costs (fixed and variable, direct and indirect), and one less commonly used way (engineered and discretionary). If you are already familiar with the concepts of variable and fixed costs and break-even charts, then start at section 3.3. Bear in mind that the total cost picture is always the same; the different ways of representing them are simply different ways of 'cutting the cake'. Let us look at the total cost as a cube instead of a cake. Then the three different ways of representing costs can be shown as different ways of cutting up the cube (Figure 3.2).

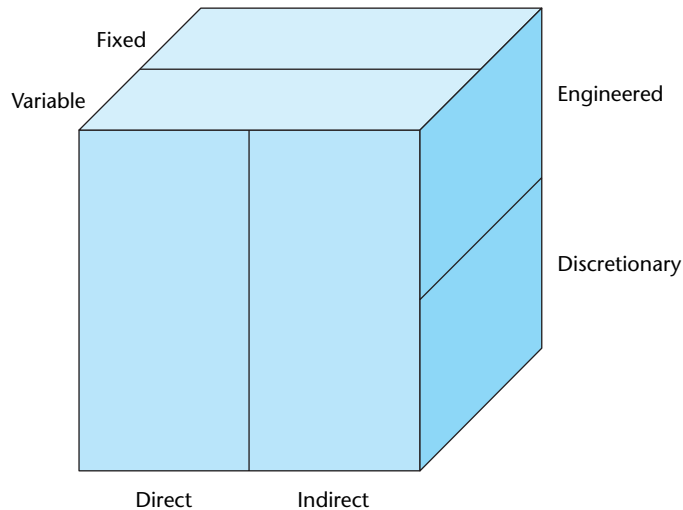
The important point here is that the total cost is constant: it is the ways we *analyse* that cost that are different. Why analyse it in different ways? To gain better information about our cost basis so that we can manage the business better. Let us look in turn at each of these ways to cut the total cost cube.

### 3.2.1 Fixed/variable

One popular way of analysing costs is to consider the effect of *volume of activity* on them. Costs tend to respond differently as the volume changes:

- *fixed costs* tend to stay the same as volume of activity changes, or at least within a given volume range;
- *variable costs* change as the volume of activity changes.

Fixed costs include things such as warehouse rental, which is charged on a time basis (€/month). As volume of activity increases, additional warehouses may be added around Europe, and we get the familiar *stepped fixed costs*, as shown in Figure 3.3 opposite. The same relationship would apply if volumes were reduced and a warehouse closed.



**Figure 3.2** Three ways to cut the ‘total cost cube’

(Source: Courtesy of Sri Srikanthan)

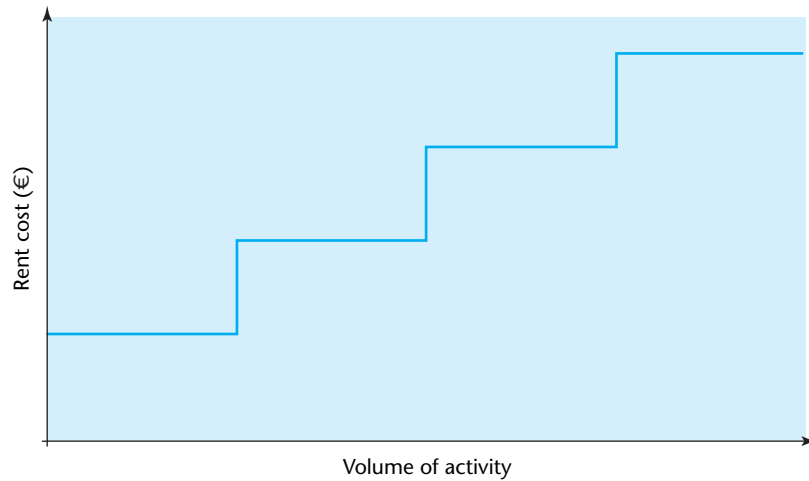
Variable costs include things such as direct materials, which are ordered in line with demand. If demand increases, we buy more. Starting with zero cost at zero activity, variable costs increase roughly in line with volume, as shown in Figure 3.4 opposite.

If we add the variable costs to the fixed costs against a given range of volume (so that the fixed costs remain completely fixed), and add in the sales revenue (which also increases in line with volume), we arrive at the break-even chart shown in Figure 3.5 overleaf. The sloping line that starts at O is the sales revenue. The total cost line starts at F, and represents the sum of fixed and variable costs. The point at which the sales revenue line crosses the total cost line is the break-even point. Below this point, a loss will be incurred; above it a profit will be made.

A helpful concept in evaluating break-even charts is that of contribution:

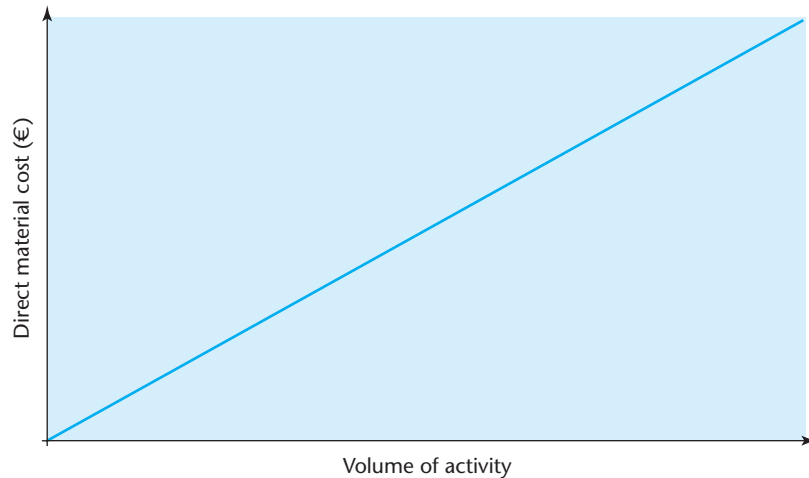
$$\text{Contribution} = \text{Sales less variable costs}$$

Therefore contribution is the fixed costs plus the profit. Contribution is useful in decision making. High contribution per unit indicates a more volatile business: that is, one that is more risky. Therefore we should expect a business with high contribution/unit to provide a higher return on investment in the longer term. Look at the two break-even charts in Figures 3.6 and 3.7 overleaf. What are the



**Figure 3.3** Rent cost against volume of activity

(Source: Courtesy of Sri Srikanthan)



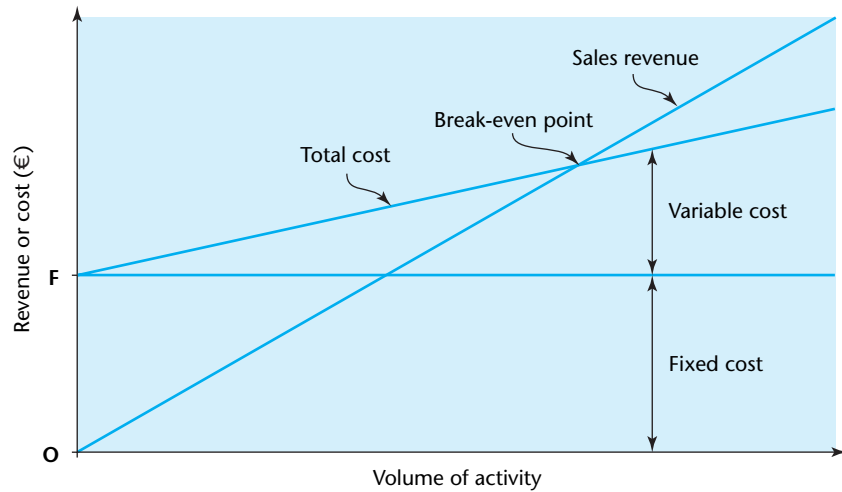
**Figure 3.4** Direct material costs against volume of activity

(Source: Courtesy of Sri Srikanthan)

differences between the two situations? What has happened to the break-even point, and why?

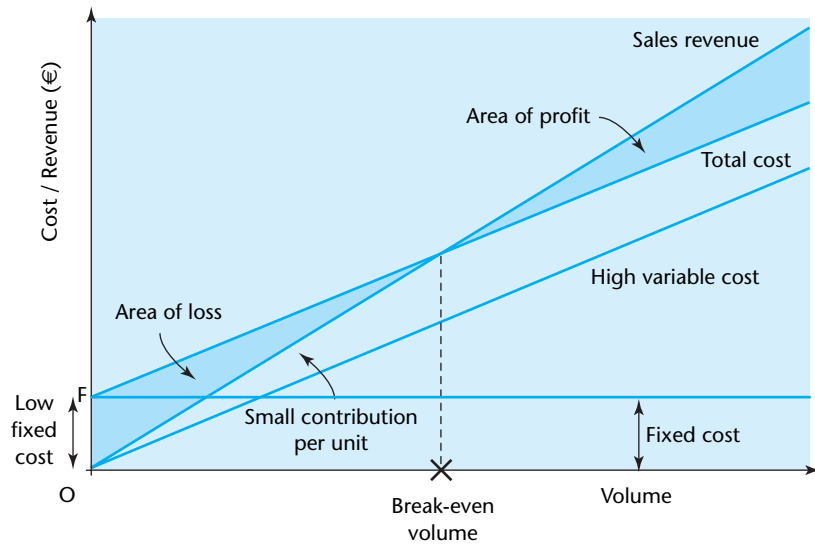
Chart A shows a situation with high variable costs and low fixed costs. In chart B, the situation is reversed. The break-even point has moved well to the right: that is, chart B requires a higher volume to break even than A. This is because a much higher volume of sales is needed to cover the high level of fixed costs.

Furthermore, additional volume has a small impact on chart A, whereas it has a much higher impact on chart B. So high fixed costs and low variable costs lead to greater volume sensitivity. Accordingly, profitability (the area above the break-even point) is affected much more by volume changes in chart B. In terms of contribution, chart A represents a situation with low contribution/unit, and therefore low risk in comparison with chart B.



**Figure 3.5** Break-even chart

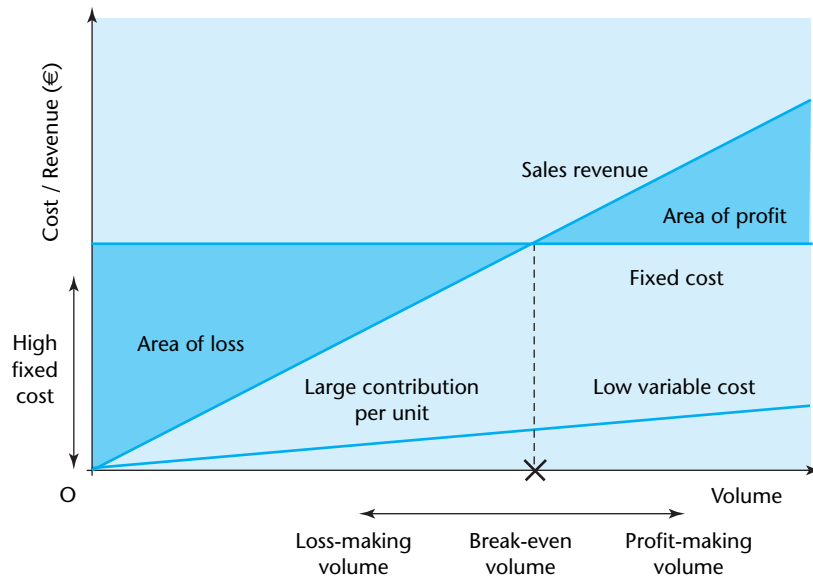
(Source: Courtesy of Sri Srikanthan)



**Figure 3.6** Break-even chart A

(Source: Courtesy of Sri Srikanthan)

The supply chain implications of such considerations are that we are most often faced with chart B situations. For example, core resources such as warehousing and distribution systems create little opportunity to reduce investments in line with reducing sales volumes other than the step changes shown in Figure 3.3. We are back to the advice for increasing ROI given in section 3.1.1 above: to increase sales and reduce costs. The reassuring point is that every 1 per cent increase in sales or 1 per cent reduction in costs has a leveraged effect on profits.



**Figure 3.7 Break-even chart B**

(Source: Courtesy of Sri Srikanthan)

### CASE STUDY 3.1

## Bond SA – a marginal costing example

Bond SA is planning to manufacture a new product with an initial sales forecast of 3,600 units in the first year at a selling price of €800 each. The finance department has calculated that the variable cost for each truck will be €300. The fixed costs for the manufacturing facility for the year are €1,500,000. Using the information provided by the sales forecast and the finance department it is now possible to calculate the planned profit, the contribution and the break-even point for this venture by leveraging the nature of fixed and variable costs.

Planned profit	€	Planned break-even point	€
Sales revenue	2,880,000	Fixed costs	1,500,000
Less variable costs	1,080,000	Contribution per unit	
Contribution	1,800,000	Sales value – variable cost	500
Less fixed costs	1,500,000	Break-even point (units)	
Profit	300,000	Fixed costs/contribution per unit	3,000

If Bond plc achieves its sales forecast of 3,600 units then the company will make a planned profit before tax of €300,000. Crucially the company's break-even point is 3,000 units, at which point Bond plc makes no profit but also no loss, because sales revenue (€2,400,000) equals all the variable costs (€900,000) and all the total fixed costs associated with production process (€1,500,000). Any additional unit sold after this point will provide Bond with profitable sales revenue. The difference between the planned profit and the break-even point is called the margin of safety. In the case of Bond SA, this equates to 600 units.

(Source: Simon Templar, Cranfield)

**Questions**

What happens to the break-even point if:

- 1 Fixed costs increase by 10 per cent?
- 2 The sales price reduces by 5 per cent?

**3.2.2 Direct/indirect**

Another way to cut up the total cost 'cube' is to analyse costs in terms of whether or not they can be directly allocated to a given product. Two further categories emerge:

- *Direct costs* can be tied to specific products. The most obvious examples are direct labour and direct materials. Thus we can allocate exactly the cost of bought-in parts to the products into which they are built.
- *Indirect costs* are whatever is left over after direct costs have been allocated. Indirect costs are also called 'overheads', and include everything from the managing director's salary to the rent rates paid for the distribution centre – anything that cannot be allocated directly to a given product.

*Directness* of costs is concerned with the extent to which costs can be allocated directly to given products. This is a completely different concept from that of fixed/variable costs. While there is a tendency to associate fixed costs with indirect and variable with direct, there is no necessary relationship at all. Thus direct labour costs tend to be fixed, at least in the short term.

As stated above, the reason for analysing costs differently is *to gain better information about our cost basis so that we can manage the business better*. Direct and indirect costs help us to decide the full cost of a product or service when more than one is offered. If there were just a single product, life would be easy, because all of the costs could be allocated to that one product. Most businesses are much more complex than that, and are faced with the issue of how indirect costs should be apportioned to products. The most popular way to spread indirect costs is on the basis of direct labour. This is not the 'correct way', nor is it the only way.

One way in which to get a closer view of how fixed costs behave by product is to use a method called *direct product profitability* (DPP). This method has been widely used in the retail industry to understand the way in which logistics costs behave for each product. The understanding is achieved by allocating fixed costs by making assumptions about how these are incurred by a product as it moves through the logistics system.

A good DPP system should take account of all the significant differences in the ways products are developed, sourced, produced, sold and distributed. In order to make this analysis practical, products will normally need to be grouped together. Product groups need to recognise shared technologies, processes, fixed assets, raw material inputs and packaging methods. The key objective of product groupings

is to remove the need for apportioning costs, and thereby not to apportion profit across the products.

An example DPP is shown for a manufacturing company in Table 3.2. Note that not all of the fixed costs have been assigned. DPP assumes that only those costs that can rationally be allocated may be deducted. Thus DPP may be viewed as a development of direct/indirect costing in that it attempts to convert into direct costs logistics costs that would otherwise have been regarded as fixed. In this way, DPP seeks to provide more accurate information about which products are contributing most to profitability – and which are contributing least.

The principle at stake here is that good accounting and financial analysis force us to ask more questions about what is going on in our business. DPP can have a role to play here: it attempts to allocate logistics costs more specifically to products (and, in this case, orders as well) than is possible by spreading ‘fixed’ costs on the basis of an assumption such as direct labour. The assumption would otherwise be that direct labour actually ‘drives’ the overheads, which is highly doubtful.

**Table 3.2 Direct product profitability (DPP)**

	€	€
Gross sales for product group		X
● Less product-specific discounts and rebates		<u>X</u>
Net sales by product		X
● Less direct costs of product		<u>X</u>
Gross product contribution		X
● Less product-based marketing expenses	X	
Product-specific direct sales support costs	<u>X</u>	
● Less product-specific direct transportation costs:		
Sourcing costs	X	
Operations support	X	
Fixed-assets financing	X	
Warehousing and distribution	X	
Inventory financing	X	
Order, invoice and collection processing	X	<u>X</u>
● Less product-attributable overheads		X
Direct product profitability		<u>X</u>

(Source: Courtesy of Sri Srikanthan)

## CASE STUDY 3.2

### Direct product profitability

Filmco makes two thin film (gauge = 12µm) products for packaging applications in the food industry. Product A is coated so that it can subsequently be printed on; product B is uncoated. There is no changeover time on the production line, because all that needs to happen is that the coating drum is switched on or off. Once produced on the film-making lines, the film is slit to width and to length to customer order. Roughly 40 per cent of Filmco’s output is A, and 60 per cent B, and film-making takes



place 360 days/year on a continuous basis because of the high capital cost of the process.

A DPP study was carried out at Filmco to determine the relative profitability of the two products A and B by major customer. The method was adapted from that shown in Table 3.1 because Filmco is a manufacturing environment. Here is how it was done:

- a Invoice price: this was the total sales value invoiced to the customer.
- b Cost of placing orders: the total cost of the sales office (salaries, etc.) was divided by the number of orders dispatched that month. This cost per order (€150) was allocated to each order placed by each customer.
- c Manufacturing cost: a variable cost for each product was found by collecting raw material, labour, power, packaging and waste costs. Manufacturing overheads (fixed costs) were allocated on the basis of direct labour. Because of the small difference in manufacturing methods, the manufacturing costs for the two products were similar. They were €2,107 for A and €2,032 for B.
- d Storage costs: the total cost of the warehousing operation is €800k/year. There are 8,300 pallet locations, and the cost/day for a pallet was calculated as €0.30 assuming 360 working days. The storage cost for a given order was calculated as the number of pallets  $\times$  the number of days  $\times$  €0.30.
- e Opportunity costs: orders must wait in the warehouse until the last reel has been produced. An order with a value of €3,000 that stays for seven days in the warehouse with an interest rate of 14 per cent is said to have an opportunity cost of €8.20.
- f Transport cost: this was based on a price per tonne delivered to a given customer.
- g Total cost: this was the sum of b to f for a given order.
- h DPP: this was sales price less total cost g.

Table 3.3 gives a sample of the DPPs for four orders for customer P. The average DPP for customer P over all orders shipped over a given month was 19.6 per cent, while that for customer Q was 23.1 per cent and customer R was 33.0 per cent.

**Table 3.3** DPP for customer P for a sample of four orders in a given month

Order no.	Film	Weight (t)	a	b	c	d	e	f	g	h(%)
186232	A	482	1,210	150	876	1.08	1.88	79	1,108	8.4
185525	A	2,418	5,997	150	4,344	7.83	9.33	190	4,702	21.6
185187	B	4,538	13,000	150	8,402	20.80	30.33	343	8,946	31.2
185351	B	2,615	7,576	150	4,897	14.58	17.68	198	5,277	30.3

### Question

- 1 What can we tell from the above analysis in Table 3.3 and the average DPPs per customer? (Consider in particular the differences in DPP between the four orders shown, and between the three customers P, Q and R.)

## 3.2.3 Engineered/discretionary

A third way of analysing costs is to consider *the ease of allocating* them. Some things are easy to cost; others may require considerable thought and analysis

because they are difficult to cost under current methods. This line of thinking creates a third way of cutting the total cost cube:

- *Engineered costs* have a clear input–output relationship. In other words, the benefit of a given cost is measurable. For example, if it takes 10 hours to produce 10 boxes of product A in the factory, then we have a clear output benefit (1 box) for the cost of each hour of input.
- *Discretionary costs* do not have a clear input–output relationship. Here, the input cost is clear but the output benefit is unclear. For example, the cost of the contract cleaners who clean the factory is clear, but the benefit they produce is not easily quantifiable.

The challenge is to convert discretionary costs into engineered costs, so that we can quantify better the competitive impact of a given course of action. A classic example of converting discretionary costs into engineered costs has been the conversion of ‘quality’ as a discretionary concept into engineered ‘quality costs’ (Dale and Plunkett, 1995). This was achieved by breaking down the concept of quality into three cost drivers:

- *Prevention*. This comprises the costs of measures to prevent defects from taking place, such as training and process capability studies.
- *Appraisal*. This comprises the costs incurred in detecting defects, which would include testing and inspection.
- *Internal and external failure*. Internal costs are scrap, rework and the associated costs of not getting it right the first time. External failure costs are rectification after products have reached the final customer, such as warranty claims, returns and repairs.

In this case, it was argued, greater investment in prevention would result in the overall cost of quality being reduced over time.

The principle is to convert discretionary costs into engineered costs where possible. As indicated in the above examples, it is usually possible to make an estimate of what the engineered costs are, perhaps accompanied by a sensitivity or risk analysis. Without such guidelines, decisions would have to be taken on ‘gut feel’ – or, as usually happens, not taken at all! In other words, the logistics team may have an excellent project for increased flexibility in the distribution centre, but because they have not quantified the savings (outputs) the application for funding is rejected.

### CASE STUDY 3.3

## Glup SA

Glup SA supplies a range of household soaps to supermarkets in northern Europe. There are 12 stock-keeping units (skus) in the range. The logistics manager has determined that an investment of €0.5 million on improved material-handling equipment would convert the main distribution centre into a more flexible facility. A number of benefits in improved product availability have been identified – but current information is largely in the form of discretionary costs. Glup’s assessment of the

benefits and its plans to convert the justification into engineered costs are outlined below.

### Improved in-store availability

This is the percentage of time for which a product is available on the shelf. If the product is not available on the shelf, then it will lose sales to competitive products that are available, such as supermarket own brands. (Availability is a classic 'order losing sensitive' qualifying criterion as described in section 1.3, Chapter 1.) Current available data at Glup are scant, but suggest that average in-store availability is as low as 85 per cent for a given stock-keeping unit (sku). In order to convert this discretionary benefit into an engineered cost, Glup intends to measure the time for which each of the 12 product lines is unavailable each week. One way to do this is to use a market research agency to conduct sample studies of product availability in selected stores at random times across the working week. This will yield an availability guide, such as the 85 per cent figure referred to. The new system will, it is believed, reduce this unavailable time. Glup then plans to model the new material-handling equipment methods using simulation, and to calculate the new in-store availability. The reduced non-availability time could then be converted into additional contribution for each sku to give an engineered cost saving.

### Reduced transportation costs

The new equipment would also allow lower transportation costs, because trays of different skus could be mixed together on the same pallet. Glup again intends to use simulation modelling to identify the opportunities for savings using this method. It is considered that this will offer the opportunity to reduce overall transport costs by more flexible loading of the trailers used to distribute the products to Glup's customers.

### Promotions and new product launches

It is considered that the new equipment will enable promotions and new product launches to be delivered to selected stores more accurately and more quickly. Demand uncertainty in such situations is very high: for example, a recent 'three for the price of two' promotion created a fivefold increase in sales. In order to launch a new product it is first necessary to drain the pipeline of the old product, or to 'write it off' as obsolete stock. If the more flexible warehouse system can reduce the length of the pipeline from factory to supermarket, it is argued, then a real saving in time or obsolete stock is possible. Glup again intends to measure this by simulation. It will then be necessary to determine by how much sales will increase as a result of the new product advantages. This will be estimated by Glup marketing people, who will use experience of previous promotions and new product launches. The engineered cost will be the additional time for which the new product is available multiplied by the additional estimated sales volume multiplied by the contribution per unit. Alternatively, it will be the reduction in obsolete stocks multiplied by the total cost per product plus any costs of double handling and scrapping.

### Question

- 1 Comment on Glup's plans to create engineered costs from the perceived benefits of the new material-handling equipment.

### 3.3 Activity-based costing (ABC)

**Key issues:** What are the shortcomings of traditional cost accounting from a logistics point of view? How can costs be allocated to processes so that better decisions can be made?

The driving force behind activity-based costing (ABC) is that the traditional way of allocating indirect costs by spreading them to products on the basis of direct labour is becoming difficult to manage. While direct labour used to constitute a substantial portion of product costs, today that rarely applies. Therefore overhead rates of 500 per cent on direct labour are not uncommon. Just a small change in direct labour content would lead to a massive change in product cost.

Cooper and Kaplan (1988) explain the problem by referring to two factories, which we here refer to as Simple and Complex. Both factories produce 1 million ballpoint pens each year; they are the same size and have the same capital equipment. But while Simple produces only blue pens, Complex produces hundreds of colour and style variations in volumes that range from 500 (lavender) to 100,000 (blue) units per year. A visitor would notice many differences between the factories. Complex has far more production support staff to handle the numerous production loading and scheduling challenges, changeovers between colours and styles, and so on. Complex would also have more design change issues, supplier scheduling problems, and outbound warehousing, picking and distribution challenges. There would be much higher levels of idle time, overtime, inventory, rework and scrap because of the difficulty of balancing production and demand across a much wider product range. Because overheads are allocated on the basis of direct labour, blue pens are clobbered with 10 per cent of the much higher Complex overheads. The market price of blue pens is determined by focused factories such as Simple, so the blue pens from Complex appear to be unprofitable. As a result, the management of Complex considers that specialist products such as lavender – which sell at a premium – are the future of the business, and that blue pens are low priority. This strategy further increases overheads and costs, and perpetuates the myth that the unit cost of each pen is the same. Traditional cost systems often understate profits on high-volume products and overstate profits on low-volume, high-variety products. ABC principles would help the management of Complex to make more informed product decisions. The management of Simple has no need for another costing system; the current one works well for them.

ABC recognises that overhead costs do not just happen, but are caused by activities, such as holding products in store. ABC therefore seeks to break the business down into major processes – such as manufacture, storage and distribution – and then break each process into activities. For example, the distribution process would include such activities as picking, loading, transport and delivery. For each of these activities, there must be one cost driver: what is it that drives cost for that activity? For example, the cost driver for the storage activity may be the volume of a case, whereas the transport activity may be driven by weight. Once we know the cost driver, we need to know how many units of that cost driver are incurred for that activity, and the cost per unit for the cost driver.

For example, the cost driver for the transportation activity may be the number of kilometres driven, and the cost per kilometre would be the cost per unit of the cost driver. This yields the cost of the activity and, when summed across all of the activities in a process, the total cost of that process.

ABC is difficult to implement because we need first to understand what the discrete processes are in a business where the existing links between functions are not well understood. There is then the issue of identifying the cost driver, which requires a fresh way of looking at each activity. For example, the cost driver for a warehouse fork-lift operator would be the number of pallets moved. The cost driver for stocking shelves would be the number of pieces that must be stacked in a given time period. A further problem occurs if there is more than one cost driver for a given activity. You are then faced with the same problem as with overhead allocation: on what basis should the cost drivers be weighted? Usually, this problem shows that activities have not been broken down into sufficient detail, and that more analysis is needed. ABC can therefore become complex to implement.

In spite of the implementation challenges, logistics and ABC go hand in hand (van Damme and van der Zon, 1999). It is a very rational way to analyse costs, and logistics practitioners recognise that providing a service is about managing a sequence of activities. Logistics or supply chain managers are particularly well placed to understand, analyse and apply ABC. They understand business processes and the activities that go with them. Theirs is a cross-functional task. The value chain stares them in the face.

The procedure of determining cost drivers is often considered to be more valuable than the ABC system itself. Activity-based management enables the cost structure of a business to be examined in a new light, allowing anomalies to be resolved and sources of waste highlighted. It may also help in better targeting investment decisions.

### 3.3.1 ABC example

Komplex GmbH has four production lines, which each operates for 8,000 hours a year. Each line makes a number of products, which are based on size and colour. Many changeovers are therefore required, each incurring set-up and maintenance costs. Traditionally the maintenance costs have been allocated on the basis of machine hours, so each production line is charged equally. This year, the maintenance budget of €1 million has been divided into four, so each line is charged with €250,000.

Sales and marketing are concerned that certain products are losing market share, and this is due to prices relative to the competition. All departments have been instructed to investigate costs and to suggest improvements. How can activity-based costing improve this situation? By identifying the cost driver for maintenance, in this case the number of changeovers, costs can be allocated to each production line on this basis. Costs are then matched to the activity that generates them, so avoiding cross-subsidies.

The results are illustrated in Table 3.4. Maintenance costs have now been transferred to the production lines that incur the activity. For example, costs on line

A have doubled to €500,000, while costs on line D have reduced to €50,000. ABC in this example has not taken cost out of the process, but has reallocated the costs to give a better understanding of the cost base. Complex is now in a better position to make decisions that affect the cost competitiveness of the product range.

**Table 3.4** Different ways of allocating maintenance costs

Production lines	A	B	C	D	Total
Machine hours	8,000	8,000	8,000	8,000	32,000
No. of changeovers	50	30	15	5	100
Equal allocation	250,000	250,000	250,000	250,000	1,000,000
Allocation by activity	500,000	300,000	150,000	50,000	1,000,000
Difference	250,000	50,000	-100,000	-200,000	0

### 3.3.2 Cost-time profile (CTP)

A key benefit of being able to cost logistics processes is that cost information can be used in conjunction with time information. The synergies of the two can then provide opportunities for identifying activities which create either value or waste.

The cost-time profile (CTP) (Bicheno, 2004) is a graph, which plots cumulative time against cumulative cost for a set of discrete activities that together form a process or a supply chain. The CTP utilises outputs from two sources:

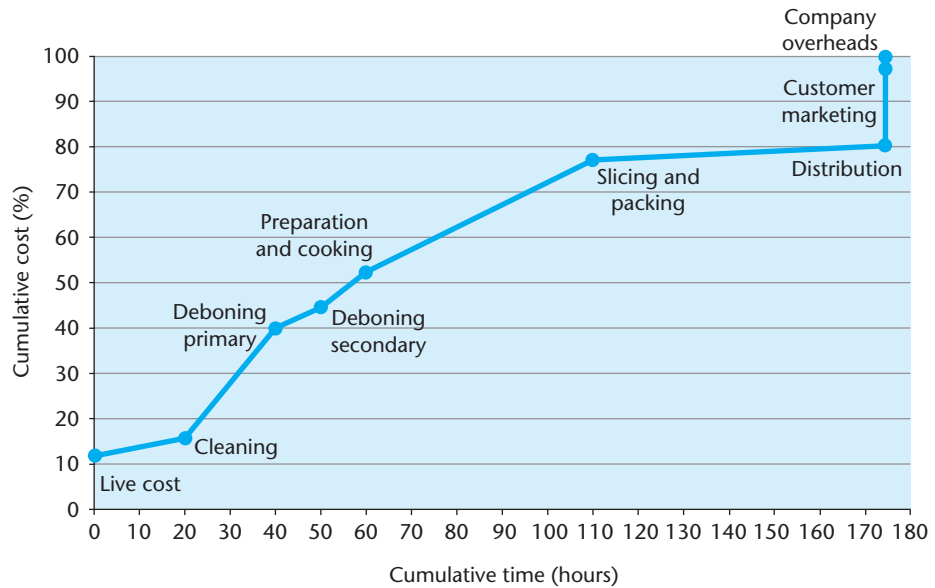
- *activity times*: from the time-based process mapping (TBPM) process time recording system (see Chapter 5);
- *activity costs*: from a process costing system that is underpinned by activity-based costing.

As discussed earlier, ABC strives to achieve an equitable distribution of overhead costs to activities. Table 3.5 illustrates cumulative time and cost for a process comprising six activities.

**Table 3.5** Cumulative time and cost data by activity

Activity	A	B	C	D	E	F
Cumulative time (%)	14	64	65	67	97	100
Cumulative cost (%)	25	45	83	85	95	100

Such data can be used to construct a *cost-time profile*. Bernon *et al.* (2003) record the process in terms of time and cost for a poultry product from receipt of live bird to delivery of finished product to the retailer. Overall, the process takes an average of 175 hours to complete. The profile shows areas that consume time and cost within the supply chain, highlighting those for future investigation that could yield savings. For example, distribution accounts for 35 per cent of process time, but only 3 per cent of total cost. Slicing and packaging are more in line, since they account for 25 per cent of total cost and are responsible for 28 per cent of the total process time. Figure 3.8 shows the time-cost profile for this process.



**Figure 3.8** Cost-time profile for poultry product

(Source: After Bernon *et al.*, 2003, reprinted by permission of EIASM)

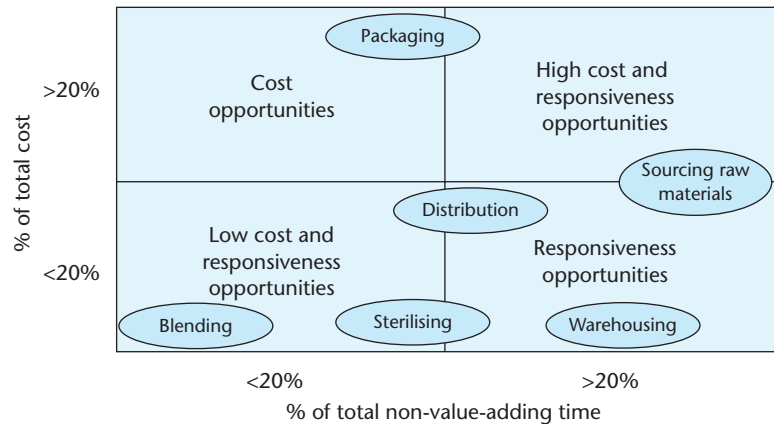
The profile shows that time and cost are *not related linearly*. Bicheno (2004) stresses the importance of interpreting both the horizontal and vertical lines of the CTP:

- *Long, horizontal lines* tend to occur when there is a relatively small increase in total cost as a result of an activity that runs over a relatively long period of time. An example is storage of finished product after slicing and packing.
- *Steep, vertical lines* tend to occur when costs are consumed over a relatively short period of processing time. An example is deboning, where the cumulative cost rises sharply.

A focus on the long, horizontal sections of the CTP graph may help reduce cumulative time (see Chapter 5). A focus on steep, vertical lines may help reduce cumulative cost. The CTP can be used to prioritise improvement processes, as shown in Figure 3.9:

Processes in the top right-hand box are prime candidates for savings in both time *and* cost. Processes in the bottom left-hand box are low on the list of priorities.

A further conclusion of the Cranfield study shown in Figure 3.8 was that decisions to optimise cost in one area could have a detrimental effect downstream (Whicker *et al.*, 2006). Large batch sizes reduced the need for machine changeovers in manufacturing. But this meant that the NDC was often running over capacity, and that overspill inventories had to be extracted and sent to third-party warehouses. Savings in manufacturing efficiency were causing extra costs and lead times in distribution.



**Figure 3.9** Cost–time grid

Source: (Whicker *et al.*, 2006)

## 3.4 A balanced measurement portfolio

**Key issues:** Who are the key stakeholders in a business, and what needs to be achieved in order to satisfy them? How can a balanced set of measures of performance be developed in order to address stakeholder satisfaction and stakeholder contribution?

Many organisations have suffered from undue emphasis on particular measures of performance within the firm. For example, a preoccupation with labour productivity may lead to excessive stocks of inbound parts ('Do not run out of raw materials otherwise bonuses will suffer'). Such a preoccupation may also lead to excessive stocks of outbound products, because the most important priority is to keep workers busy, whether the product can be sold or not. While this priority may be good for productivity, it may well disrupt flow in the supply network: inbound parts are ordered too early, and outbound products are made too early. What is good for one measure (productivity in this case) is bad for others (inventories and material flow).

In reality, management today is faced with the challenge of performing across a whole range of objectives. Different groups of stakeholders in a firm include shareholders, employees, customers, suppliers, the local community and government. This is not a comprehensive list, and industries such as pharmaceuticals have other important stakeholders, including regulators such as the Drug Enforcement Agency. The challenge for the directors of a firm is to *balance* the diverse interests of these groups of stakeholders. We review the interests of each group in turn:

- *Shareholders* typically have a passing interest in a firm in which they invest. They will keep their shareholding as long as it provides a return that is competitive with other investments. Shareholders are impressed by high dividends and share appreciation resulting from profitability and growth of the business. Failure to deliver adequate returns often turns shareholders against the management of the day.

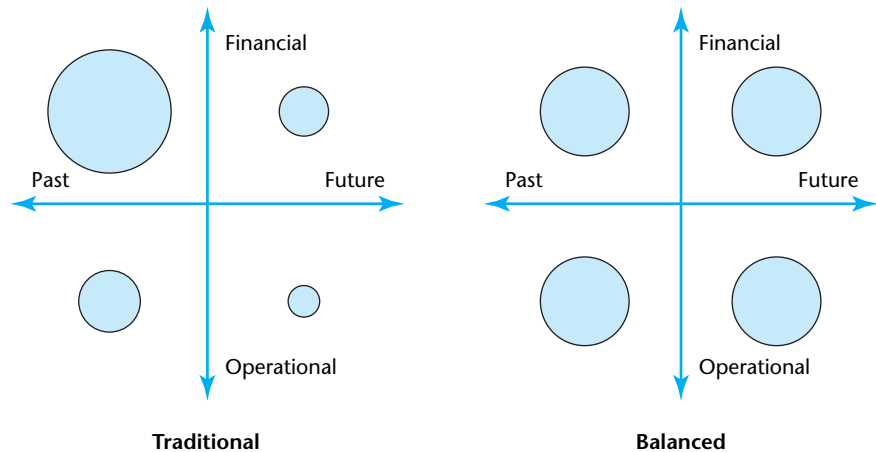


- *Employees* often have a long-term commitment to a firm, and are concerned with employment stability, competitive wages and job satisfaction. Failure to deliver on such goals may create negative reactions such as loss of motivation and loyalty, difficulty in recruitment, and various forms of industrial action.
- *Customers* are in theory the most important stakeholders in a free market economy. It is their demand that draws material through the supply network. Customers can choose from whom they buy, and failure to keep them satisfied creates the risk of loss of business.
- *Suppliers* are interested in such benefits as long-term business, involvement in new product development, and of course payment on time. Failure to meet such benefits leads to sanctions such as disruption of supply and higher prices.
- *Local community*. Here, the interests are in the firm as a local employer, with a reputation for civic responsibility and long-term commitment to the region as an employer and as a ratepayer. Failure to deliver against such interests may lead to environmental disputes and difficulty in obtaining planning permission.
- *Government* is interested in the firm as a contributor to employment and value creation in the economy, and as a source of revenues. Failure to meet government laws, on the other hand, may lead to prosecution or even closure of the business.

Thus the directors of a business are faced with the need to manage the potentially conflicting interests of the stakeholders, keeping each within what Doyle (1994) refers to as a *tolerance zone*. Each stakeholder has a limit beyond which the risk of disruption to the business increases rapidly. An upper limit exists as well. For example, a preoccupation with profits may please shareholders for the time being, but may result in negatives from labour exploitation and low levels of investment. While bumper profits appear in year 1, these are rapidly eroded as the negatives cut in during later years. In the end, the whole business suffers. And customers can disrupt the business too: a preoccupation with customers at the expense of everything else can lead to shrinking margins and loss of focus. The challenge for the directors is to keep all stakeholders just satisfied, keeping each within the tolerance zone.

### 3.4.1 Balanced measures

While balance between stakeholders is one issue, another is the balance between financial and operational measures of performance, and between history and the future. Kaplan and Norton (1996) point to the shortcomings of traditional cost accounting systems. Traditional systems are geared to the needs of the stock market, and are essentially historical and financial in emphasis. Modern systems, they argue, need to be balanced between financial and operations, and between history and the future. A way of showing the relative emphasis between traditional measures and balanced measures is to show relative priorities by means of circles, where larger circles imply a greater priority and number of measures in use, as shown in Figure 3. 10.



**Figure 3.10** Traditional and balanced priorities

In developing a modern performance measurement system it is necessary to take all of these factors into account, and to create a balanced performance measurement system. That is the objective of the ‘balanced scorecard’.

In practice, Kaplan and Norton propose that the balanced scorecard should balance the financial perspective (goals for future performance and measures of past performance) with similar goals and measures for the underlying drivers of long-term profitability. These drivers are identified as the business process perspective, the innovation and learning perspective and the customer perspective.

### 3.4.2 Supply chain management and the balanced scorecard

Extending the balanced scorecard into the context of the supply chain, Brewer and Speh (2000) consider that performance measurement systems must be aligned to supply chain practices:

**If firms talk about the importance of supply chain concepts, but continue to evaluate employees using performance measures that are . . . unaffected by supply chain improvements, then they will fail in their supply chain endeavours.**

Traditional performance measurements within a focal firm have a number of significant deficiencies. They often track individual activities within functions: this can promote the optimisation of the function rather than of the supply network as a whole.

As a general rule, effective cross-supply chain measures should have the following characteristics (Derocher and Kilpatrick, 2000):

- simple to understand;
- no more than 10 in total number;
- representative of a significant causal relationship;
- have an associated target;
- capable of being shared across the supply chain.

Here are eight such measures, which can be adapted to focus on specific sectors:

- *on time in full, outbound*: a measure of customer orders fulfilled, complete and on time, conforming to specification;
- *on time in full, inbound*: a measure of supplier deliveries received, complete and on time, conforming to specification;
- *internal defect rates*: a measure of process conformance and control (rather than inspection);
- *new product introduction rate*: a measure of supply chain responsiveness to new product introduction;
- *cost reduction*: a measure of sustainable product and process improvement;
- *stock turns*: a measure of supply chain goods flow. This measure is useful when applied to supply chains focused on segments: as a 'blanket' measure, it can be misleading;
- *order to delivery lead time*: a measure of supply chain process responsiveness;
- *financial flexibility*: a measure of how easy it is to structure the supply chain for financial advantage (with international supply chains, channelling operations through low-tax locations for purposes of gaining supply chain cost benefits should be considered).

The main benefits of these measures are that they can be applied to all partners in a supply chain, and can thereby help to improve visibility and control.

Brewer and Speh (2000) have developed a supply chain framework that links the four perspectives of the balanced scorecard to corresponding supply chain management goals, as illustrated in Figure 3.11.

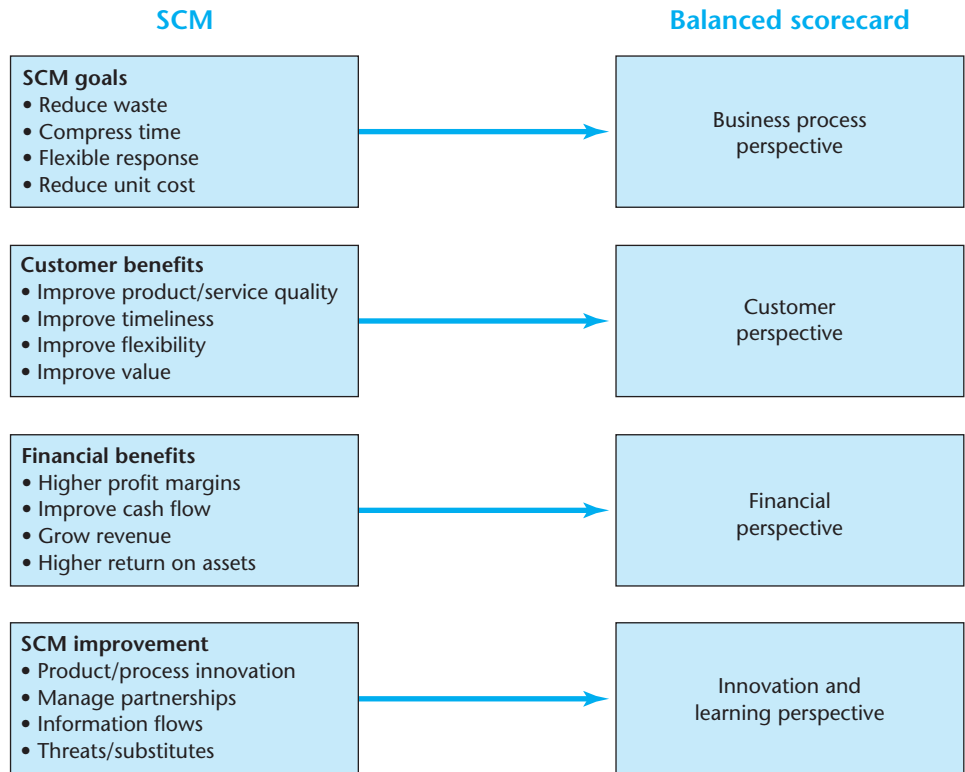
Consistent with our view that different supply strategies are needed to support different product needs in the marketplace, the aim should be to identify consistent groups of measures that support particular supply strategies.

### 3.4.3 Supply chain financial model

Similar arguments can be made about linking supply chain practices to financial performance. We have been working on a model which links decisions about the supply chain (such as inventory holding, outsourcing and supplier reduction) with a focal firm's financial performance (Johnson and Templar, 2007). The model is shown in Figure 3.12, and starts off with two ratios for a given financial period. These are adaptations of the ROI model we considered in 3.1.1 above (see for example Ellram and Liu, 2002):

- *cash generation* is the net cash inflow (operating profit before deducting depreciation) adjusted for changes in working capital divided by sales;
- *asset efficiency* is the sales divided by the value of the firm's total assets less current liabilities.

The product of these two ratios is the *supply chain ratio*.



**Figure 3.11** Linking supply chain management to the balanced scoreboard

(Source: After Brewer and Speh, 2000)

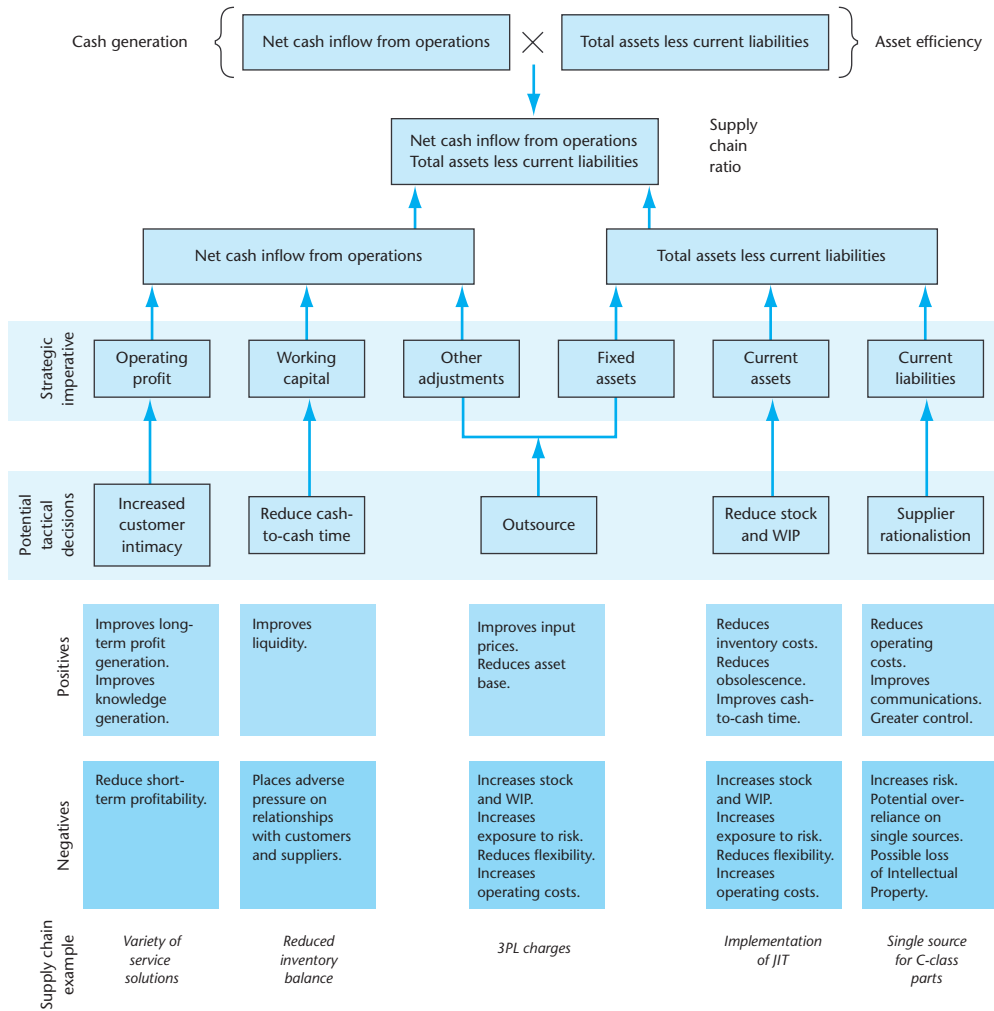
Any tactical decision in the supply chain (five are shown) influences these ratios either positively or negatively. As a result, we can predict the impact of tactical supply chain decisions on financial performance. Equally, we can use the model to predict the impact of top down decisions (for example ‘cut working capital’, or ‘increase sales through promotions’) on supply chain positives and negatives.

## 3.5 Supply chain operations reference model (SCOR)

**Key issues:** How can process thinking be applied to measures across the supply chain? What is the supply chain operations reference model, and how is it constructed?

The previous two sections looked at process-based performance measures within an organisation. This section reviews a model that places a focal firm in the context of the supply chain. In order to help companies to understand their supply chain performance and opportunities for improvement, a cross-industry framework has been developed by the Supply Chain Council. You can visit the council website at [www.supply-chain.org](http://www.supply-chain.org).

This section gives an introduction to SCOR based on publicly available material; in order to obtain detailed benchmarking data from the model, your



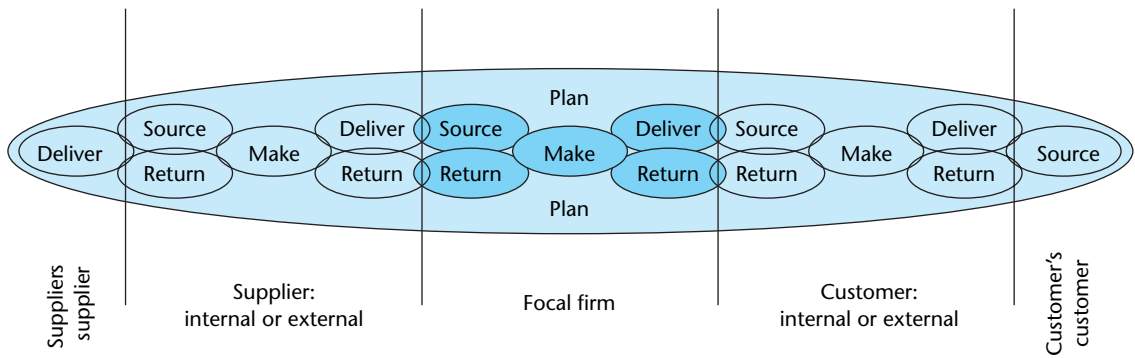
**Figure 3.12** Supply chain financial model

(Source: © Cranfield and PA Consulting Group)

organisation would need to become a member. In common with ABC, the SCOR model uses a process-based approach to the supply chain.

The supply chain operations reference model (SCOR) is founded on five distinct management processes. The supply chain is viewed in terms of overlapping management processes – source, make, deliver and return – within an integrated planning framework that encompasses all of the organisations in the chain, as shown in Figure 3.13. It is a process-based version of Figure 1.1 in Chapter 1. The management processes of the ‘focal firm’ are seen as linked with corresponding processes within supplier and customer organisations. The five distinct management processes can be described as follows:

- **Plan:** the tasks of planning demand and supply set within an overall planning system that covers activities such as long-term capacity and resource planning.



**Figure 3.13** Five distinct management processes

(Source: After Supply Chain Council, [www.supply-chain.org](http://www.supply-chain.org))

- *Source*: the task of material acquisition, set within an overall sourcing system that includes activities such as vendor certification and vendor contracting.
- *Make*: the task of production execution, set within an overall production system that includes activities such as shop scheduling. Any added value activity (e.g., material repackaging at a distribution centre; quality control at a production line) falls under this process type as well.
- *Deliver*: the day-to-day tasks of managing demand, orders, warehouse and transportation, and installation and commissioning. These tasks are set within an overall delivery management system that includes order rules and management of delivery quantities.
- *Return*: the return of non-conforming goods for replacement or rectification, and the recycling of materials no longer needed by the customer.

There are three levels to the SCOR model:

- *Level 1*: a broad definition of the plan, source, make, deliver, and return management processes, which is used to set competitive objectives.
- *Level 2*: defines core process categories that are possible scenarios of a supply chain (e.g., make to stock; make to order; engineer to order).
- *Level 3*: provides the process breakdown needed to describe each element that comprises the level 2 categories. Detailed performance metrics are set at this level.

Table 3.6 shows 13 metrics at level 1 in the SCOR model, and is taken from the SCOR website ([www.supply-chain.org](http://www.supply-chain.org)). As with processes, the model's hierarchical structure is repeated also for the metrics. That means that the SCOR model provides a breakdown of level 2 and level 3 subcomponents of the level 1 performance metrics. The intention is that an individual company should not attempt to be 'best in class' in all areas. Rather, a given company should target its strength in four to six selected areas to create differentiation in the marketplace. The company will also need to ensure that it stays competitive in the other areas.

Note that the customer-facing measures are what we referred to in section 3.2 as ‘discretionary costs’, while the internal-facing measures are ‘engineered costs’. By drilling down into levels 2 and 3 of the SCOR model, the aim is to identify the cost drivers and so convert discretionary costs into engineered costs: that is, to convert supply chain performance directly into revenue, cost and margin. Also note that the internal-facing metrics encourage improvement of ROI (section 3.1) by reducing costs and maximising asset turns. Participating companies in the Supply Chain Council may obtain benchmarking information on how their organisation’s performance compares with others: see the website given above.

**Table 3.6** Supply chain performance is tied to measurements that can be benchmarked

SCOR Level 1 Supply chain management	Customer-facing		Internal-facing	
	Supply chain reliability	Flexibility and responsiveness	Cost	Assets
Delivery performance	◀			
Order fulfilment performance	◀			
Fill rate				
Order fulfilment lead time				
Perfect order fulfilment	◀			
Supply-chain response time		◀		
Production flexibility		◀		
Total logistics management cost			◀	
Value-added productivity			◀	
Warranty cost or returns processing cost			◀	
Cash-to-cash cycle time				◀
Inventory days of supply				◀
Asset turns				◀

(Source: www.supply-chain.org)

In order to illustrate how such concepts could be applied in practice, Table 3.7 shows actual performance against the SCOR level 1 metrics for a given company. It also shows how those metrics compared with the SCOR database in terms of what was needed to achieve parity with the ‘competitive population’, what was needed to gain advantage, and what was needed to show superior performance. Where is this supply chain positioned in terms of its competitive performance? Not very well, it seems! *All* of the level 1 metrics are below parity with the exception of order fulfilment lead times. External metrics such as delivery performance and perfect order fulfilment are seriously adrift. Production flexibility is way behind the competitive population, suggesting that the master schedule is ‘fixed’ for too long a period – and there will no doubt be underlying causes of that. Internal measures are not in good shape either, with a poor cost performance and a seriously uncompetitive asset utilisation record.

**Table 3.7** Supply chain performance evaluated within the context of the competitive environment

	Supply chain scorecard v. 3.0			Performance versus competitive population		
	<b>Overview metrics</b>	<b>SCOR level 1 metrics</b> Delivery performance to commit date	Actual 50%	<b>Parity</b> 85%	<b>Advantage</b> 90%	<b>Superior</b> 95%
<b>EXTERNAL</b>	<b>Supply chain reliability</b>	Fill rates Perfect order fulfilment (on time in full) Order fulfilment lead times (customer to customer)	63% 0% 7 days	<b>94%</b> <b>80%</b> <b>7 days</b>	<b>96%</b> <b>85%</b> <b>5 days</b>	<b>98%</b> <b>90%</b> <b>3 days</b>
	<b>Flexibility and responsiveness</b>	Production flexibility (days master schedule fixed)	45 days	<b>30 days</b>	<b>25 days</b>	<b>20 days</b>
<b>INTERNAL</b>	<b>Cost</b>	Total logistics management costs as % of revenues Warranty cost, returns and allowances Value-added per-employee productivity	19% NA \$122K	<b>13%</b> <b>NA</b> <b>\$156K</b>	<b>8%</b> <b>NA</b> <b>\$306K</b>	<b>3%</b> <b>NA</b> <b>\$460K</b>
	<b>Assets</b>	Inventory days of supply Cash-to-cash cycle time Net asset turns (working capital)	119 days 196 days 2.2 turns	<b>55 days</b> <b>80 days</b> <b>8 turns</b>	<b>38 days</b> <b>46 days</b> <b>12 turns</b>	<b>22 days</b> <b>28 days</b> <b>19 turns</b>

## Summary

### *What is 'value' in the context of the supply chain?*

- Return on investment (ROI) is a widely used method for measuring shareholder value. ROI encourages logistics management to control costs, working capital and fixed assets.
- Logistics is increasingly concerned with funds flow as well as material flow and information flow (Chapter 1). It is a cross-functional discipline that addresses management processes of plan, source, make, deliver and return. These processes are repeated across the supply chain.



- Traditional cost accounting is unhelpful in making logistics-related decisions because it is insensitive to processes and to cost drivers. Traditional cost accounting tends to understate profits on high-volume products and to overstate profits on low-volume/high-variety products.

### *How can logistics costs be better represented?*

- Logistics costs can be better described by using a variety of methods of allocating costs to products. The purpose of such a variety of allocations is to gain better information about the cost base of logistics operations, and hence to take better decisions. For example, direct product profitability (DPP) attempts to allocate logistics costs more specifically to products by considering how they use fixed resources. Another principle is to convert discretionary costs such as product availability into engineering costs such as profit contribution from increased sales.
- Activity-based costing (ABC) seeks to understand what factors drive costs, and how costs are incurred by logistics processes that span the organisation – and the supply chain in general. It is essentially a process-based view of costing, and again seeks to enhance the quality of logistics decision making.
- Financial measures that are rooted in the past are insufficient for taking logistics decisions in today's fast-moving environment. A balanced measurement portfolio is called for, one that takes into account the needs of different stakeholders in a business. A balanced measurement portfolio is extended into the supply chain by means of the supply chain operations reference model (SCOR).

## Discussion questions

- 1 Explain what is meant by the term *value* in a supply chain. How can value best be measured in a supply chain context?
- 2 Why are processes important in terms of managing logistics? Suggest how the processes of plan, source, make, deliver and return might differ in the case of the two factories Simple and Complex described in section 3.3.
- 3 What are the advantages of cutting the 'total cost cube' in different ways? Summarise the different perspectives on logistics costs provided by fixed/variable, direct/indirect and engineered/discretionary costs, and by activity-based costing.
- 4 Suggest balanced measurement portfolios for the two factories Simple and Complex described in section 3.3. In particular, suggest key performance measures in the areas of strategy, process and capability.

## References

- Atrill, P. and McLaney, E. (2007) *Management Accounting for Non-Specialists*, 5th edn. Harlow: Financial Times/Prentice Hall.
- Bernon, M., Mena, C., Templar, S. and Whicker L. (2003) 'Costing waste in supply chain processes: a European food drink industry case study', *Proceedings of the 10th International EurOMA Conference, Copenhagen, June 2003*, Vol. 1, pp. 345–54.
- Bicheno, J. (2004) *The 'New' Lean Toolbox*. Buckingham: Picsie Books.
- Brewer P.C. and Speh, T.W. (2000) 'Using the balanced scorecard to measure supply chain performance', *Journal of Business Logistics*, Vol. 21, No. 1, pp. 75–93.
- Christopher, M. (2005) *Logistics and Supply Chain Management: Strategies for reducing cost and improving service*, 3rd edn. London: Financial Times Pitman.
- CIMA (1989) *Management Accounting, Official Terminology*. London: CIMA.
- Cooper, R. and Kaplan, R.S. (1988) 'Measure costs right: make the right decisions', *Harvard Business Review*, September/October, pp. 96–105.
- Dale, B.G. and Plunkett, J.J. (1995) *Quality Costing*, 2nd edn. London: Chapman & Hall.
- Derocher, R. and Kilpatrick, J. (2000) 'Six supply chain lessons for the new millennium', *Supply Chain Management Review*, Vol. 3, No. 4, pp. 34–40.
- Doyle, P. (1994) *Marketing Management and Strategy*. New York: Prentice-Hall.
- Ellram, L.M. and Liu, B. (2002), 'The financial impact of supply management', *Supply Chain Management Review*, Vol. 6, pp. 30–37.
- Johnson, M. and Templar, S. (2007) *The influence of supply chains on a company's financial performance*, PA Consulting Group, London.
- Kaplan, R. and Norton, D. (1996) *The Balanced Scorecard*. Boston, MA: Harvard Business School Press.
- van Damme, D.A. and van der Zon, F.L. (1999) 'Activity based costing and decision support', *International Journal of Logistics Management*, Vol. 10, No. 1, pp. 71–82.
- Whicker, L., Bernon, M., Templar, S. and Mena, C. (2006) 'Understanding the relationships between time and cost to improve supply chain performance', *International Journal of Production Economics* (forthcoming).



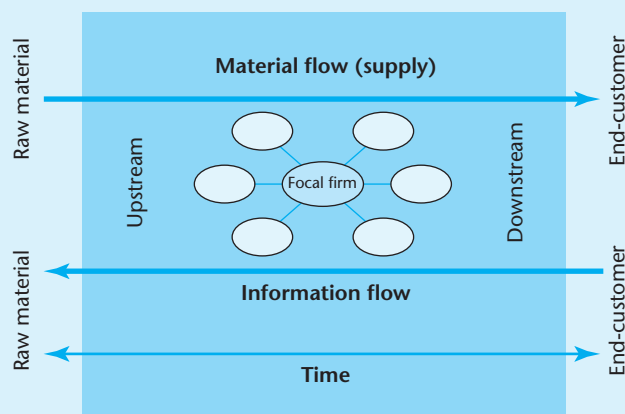
# Part Two

## LEVERAGING LOGISTICS OPERATIONS

Part Two uses the basic understanding of logistics management and strategy developed in Part One to focus in on critical roles for logistics operations. This covers the centre panel of logistics model: the flow of materials, lead times and the network in a global context.

Despite its role in corporate success, the logistics task ultimately boils down to orchestrating the flow of materials and information in the supply chain. The aim is to support products and services in the marketplace better than competitors. You could say that the logistics task is about making strategic objectives a reality by executing against demand and making value propositions to customers a reality.

Chapters 4 and 5 look at the basic dimensions of logistics operations: their international reach and their contribution to a timely response to demand. Chapters 6 and 7 then take that thinking a level higher by introducing key managerial concepts that support logistics operations. Chapter 6 addresses the immense amount of detail that is needed to plan and control material flow – both in the focal firm and more broadly in the supply chain. We continue by considering the role of just-in-time and lean thinking, which have become important ways of coordinating material movements in an efficient manner. The agile supply chain (Chapter 7) is a more recent concept that focuses on leveraging responsiveness to customer demand. Here, logistics plays a crucial role in aligning material flow across the supply network with customer demand, and in ensuring execution in a flexible and customised manner.





## CHAPTER 4

# Managing logistics internationally

### Objectives

*The intended objectives of this chapter are to:*

- identify challenges that internationalisation presents to logistics management;
- consider the structure and management of a global logistics network.

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

- understand the trends towards international logistics;
- understand challenges of international logistics networks;
- understand how to begin to balance these in organising for international logistics.

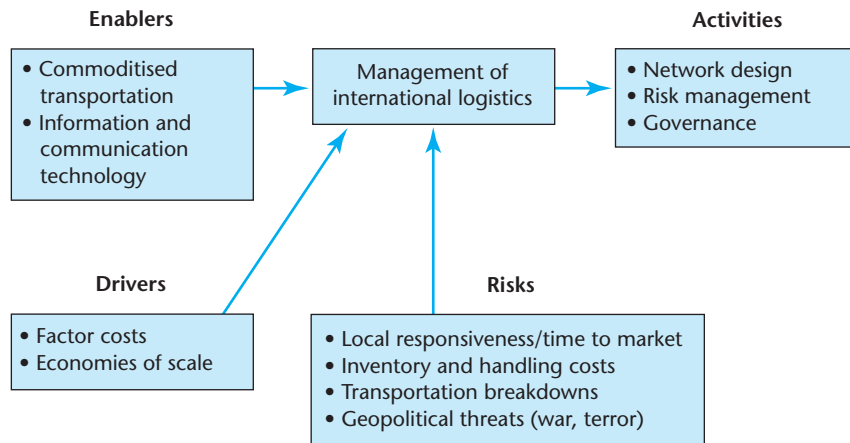
### Introduction

The early roots of logistics are in international transport, which was a central element of many fundamental models in economic theory. In traditional location theory, for example, transport costs were optimised in relation to distance to market and production locations. The origins of internationalisation can be traced back to the expanding trade routes of early civilisations. Discoveries made in excavations from Europe, Asia, Africa and the Americas reveal artefacts made hundreds or even thousands of miles away from the site, at the edges of their respective known worlds. Developments in transport, navigation and communication have progressively expanded horizons. Measured in transport time and costs the world has shrunk to the dimensions of a 'global village'. Many take for granted the availability of products from around the world and safe, fast inter-continental travel on container carriers and aircraft. It is in this context that a clear link exists between logistics and economic development. The connectivity of all regions of the world is essential for international trade. As a result, many projects aimed at supporting regional economic development focus on the infrastructure needed to support integration into the global economy. Much of the infrastructure to support international trade and business is founded on logistics operations.

The logistics dimension of internationalisation conjures up a vision of parts flowing seamlessly from suppliers to customers located anywhere in the world, and a supply network that truly spans the entire globe. Often basic products such

as deep-freeze pizzas combine a multitude of locations from which ingredients are sourced, and an international transport network that links production locations to warehouses and multiple stores. The enormous geographical span of this logistics system cannot be recognised in the price of the product. This can be explained by transport having become just a commodity in the global village. At the micro level of the individual company, however, the reality is that there are few examples of truly global supply chains. There are many barriers to such a vision. For example, local autonomy, local standards and local operating procedures make the integration of information flow and material flow an uphill task. Local languages and brand names increase product complexity. Global supply chains are made more complicated by uncertainty and difficulty of control. Uncertainty arises from longer lead times and lack of knowledge over risks and local market conditions. Coordination becomes more complex because of additional language and currency transactions, more stages in the distribution process, and local government intervention through customs and trade barriers. Additionally, there are many instances in which a truly globalised logistics system is not necessary, and where ‘internationalisation’ is a more accurate description. Internationalisation certainly is an increasing feature of the majority of supply chains. International sourcing of component parts and international markets for finished goods are extending as world trade increases.

Within the context of this changing global landscape for logistics the overall aim of this chapter is to analyse the internationalisation of logistics, and to explore how to begin to organise international supply chains. Figure 4.1 shows the frame for this chapter; drivers and enablers need to be balanced out with risk factors in organising logistics internationally. Essentially, this means developing and designing an international logistics network, managing risks and developing international governance structures.



**Figure 4.1** Decision framework for international logistics

### Key issues

**This chapter addresses seven key issues:**

**1 Drivers and logistics implications of internationalisation:** the trade-off facing internationally operating businesses.

- 2 **The tendency towards internationalisation:** three strategies for improving the transition to global supply chains.
- 3 **The challenges of international logistics and location:** barriers to international logistics.
- 4 **Organising for international logistics:** proposes principles by which international logistics networks should be organised, including offshoring considerations.
- 5 **Reverse logistics:** developing the 'returns' process in the SCOR model in section 3.5.
- 6 **Managing for risk readiness:** two levels of risk readiness and several specific steps to take.
- 7 **Corporate social responsibility in the supply chain:** the need to include social responsibility in supply chain design.

## 4.1 Drivers and logistics implications of internationalisation

*Key issue: What are the trade-offs between responsiveness to local markets and economies of scale?*

Despite the general trend towards internationalisation, the business approach is not taking place by means of any universal patterns. In assessing the nature of cross-border interfaces in logistics, three questions can be asked:

- Does internationalisation imply a universal global approach of the supply chain?
- Does internationalisation require a 'global' presence in every market?
- Does internationalisation distinguish between the companies that globally transfer knowledge and those that do not?

The arguments presented in this section suggest that the answer to each of these questions is 'no'.

The 'single business' concept of structuring the supply chain in the form of uniform approaches in each country is losing ground. 'McColonisation' was effectively abolished when McDonald's announced localisation of its business in such areas as marketing and local relations. In response to local crises in quality, and suffering from local competition, the corporate headquarters were down-sized to help empower the local organisation. The same applies to the Coca-Cola Company, which has abandoned 'CocaColonisation' – based on a universal product, marketing, and production and distribution model – for the same reasons. In favour of local brands and product varieties, Procter & Gamble is doing the same. In supply chains we find regional variations in the application of international principles.

This does not mean to say that localisation is the new mainstay. Unilever, a traditionally localised competitor of Procter & Gamble, has announced a decrease in the number of brands, and has rationalised operations away from strict localisation over the past decade, and probably will continue to do so for a while.



Somewhere between local and global extremes, Procter & Gamble and Unilever will meet each other in a new competitive area.

Looking at the different drivers of internationalisation, three basic global shifts in international investment and trade have been identified, with a possible fourth coming to the forefront in modern markets, as listed in Table 4.1. Such shifts of course have an impact on international trade and the flow of goods. In particular, destinations change as well as logistics requirements. The ‘fourth generation’ recognises the logistics trade-off between responsiveness to local markets and internationalisation.

At a company level, generic drivers of internationalisation include:

- a search for low factor and supply costs (land, labour, materials);
- the need to follow customers internationally in order to be able to supply locally and fast;
- a search for new geographical market areas;
- a search for new learning opportunities and exposure to knowledge (such as by locating in Silicon Valley – a ‘hot spot’ in development of international electronics, software and Internet industries).

The importance of these drivers varies by company and with time. Considering the sequence of global shifts, proximity to production factors such as labour and low material costs can be considered more basic than market- or even knowledge-related drivers. Furthermore, the importance of the respective drivers is dependent upon the internationalisation strategy of the company involved. Table 4.2, overleaf, provides examples of strategic contexts, and – in the bottom row – the logistics implications of those strategies. The multi-domestic and global strategies represent two extremes, while the integrated network strategy represents a balance between them. The consequences of this ‘balancing act’ for logistics are analysed below.

An example of a focal firm that announced its global organisation structure is provided by Cadbury Schweppes, summarised in Case study 4.1 overleaf.

### 4.1.1 Logistical implications of internationalisation

Internationalising logistics networks holds consequences for inventory, handling and transport policies.

#### *Inventory*

Centralising inventories across multiple countries can hold advantages in terms of inventory-holding costs and inventory levels that are especially relevant for high-value products. On the other hand, internationalisation may lead to product proliferation due to the need for localisation of products and the need to respond to specific local product/market opportunities.

**Table 4.1** The fourth-generation global shift in Europe

Generation	First	Second	Third	Fourth
Period	1950s–60s	From 1960	From 1980	Emerging now
Primary drivers	Labour shortage	Labour costs and flexibility	Market entrance	Responsiveness to customer orders
Shift of labour and investment towards	European countries without labour shortage	Newly industrialised countries, low labour cost countries	Eastern Europe, China, Latin America	Western Europe
Transport routes	Still significantly continental	Increasingly intercontinental	Adding additional destination regions	Beginning to refocus on continental
Nature of international flow of goods	Physical distribution of finished products from new production locations	Shipping parts to production locations and exporting finished products	Physical distribution towards new market regions	Shipping semi-finished products to Europe, where they are finalised in response to customer orders, while within the logistics system

### Handling

Logistics service practices may differ across countries as well as regulation on storage and transport. Adjusting handling practices accordingly is a prerequisite for internationalisation. Furthermore, the opportunity to implement best practice across various facilities may also be possible. Both of these practices assist the process of internationalisation.

### Transport

Owing to internationalisation, logistics pipelines are extended and have to cope with differences in infrastructure across countries, while needing to realise delivery within the time-to-market. This may drive localisation. On the other hand, the opportunity for global consolidation may drive international centralisation.

Within this final, central, consideration in the globalise–localise dimension of logistics, global businesses face a challenge that can be summarised in terms of a simple trade-off between the benefits of being able to consolidate operations globally on the one hand, and the need to compete in a timely manner on the other.

**Table 4.2** Dimensions of different internationalism strategies

Dimension	Setting in a pure multi-domestic strategy	Setting in a pure global strategy	Setting in an integrated network strategy
Competitive moves	Stand-alone by country	Integrated across countries	Moves based on local autonomy and contribution of lead subsidiaries, globally coordinated
Product offering	Fully customised in each country	Fully standardised worldwide	Partly customised, partly standardised
Location of value-adding activities	All activities in each country	Concentration: one activity in each (different) country	Dispersal, specialisation, and interdependence
Market participation	No particular pattern; each country on its own	Uniform worldwide	Local responsiveness and worldwide sharing of experience
Marketing approach	Local	Integrated across countries	Variation in coordination levels per function and activity
Logistical network	Mainly national; sourcing, storage and shipping on a national level and duplicated by country	Limited number of production locations that ship to markets around the globe through a highly internationalised network with limited localised warehouse and resources	Balanced local sourcing and shipping (e.g. for customised products and local specialities) and global sourcing and shipping (for example for commodities)

(Source: Based on Yip, 1989, and Bartlett and Ghoshal, 1989)

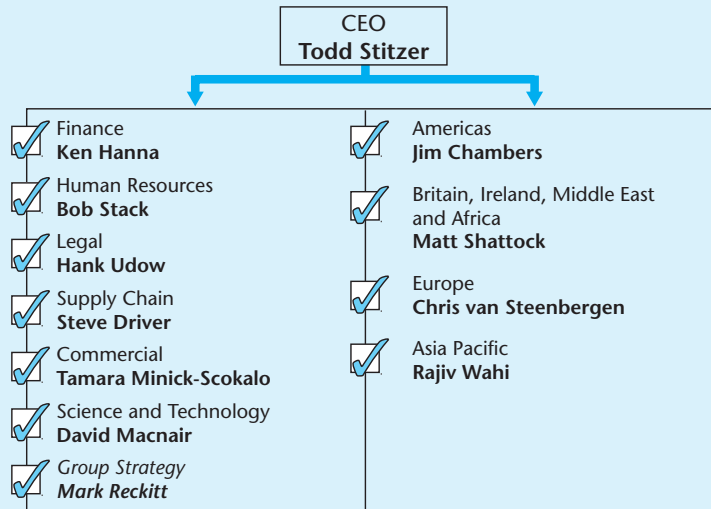
## CASE STUDY 4.1

### Structure and organisation at Cadbury Schweppes

Our confectionery business is organised into four business segments which we call regions, and six global functions, as depicted in Figure 4.2.

Each region is focused on commercial operations in its geographical and product area, and also maintains teams from each of the six functions. The four regions are: Britain, Ireland, Middle East and Africa (BIMA); Europe; Americas and Asia Pacific. On 15 March 2007, we announced that we intended to separate our Americas Beverages and confectionery businesses, and this process is currently underway.

The functions are Global Supply Chain, Global Commercial, Science & Technology, Human Resources, Finance and Information Technology, and Legal and Secretariat. Each function has a small central team and regional presences which are coordinated by the central team. The role of Global Supply Chain is to ensure the reliable supply of product to satisfy our customers' expectations whether manufactured by us or by a third party. Supply Chain's role encompasses sourcing of ingredients and packaging materials, planning, manufacturing, distribution and customer services. The function is



**Figure 4.2** Cadbury Schweppes regions and global functions

Source: Cadbury Schweppes

responsible for managing the fixed assets of nearly 100 manufacturing facilities and over 250 warehouses. Supply Chain is structured to enable shared accountability at the regional level for results and strategy execution day-to-day, while ensuring that cross-regional and step-change supply opportunities are pursued at the functional level. The function is led centrally by the President, Global Supply Chain, supported by the four regional heads of supply chain. Key functional activities are managed centrally and operate on a global basis. They are focused on Technology and Manufacturing Development; Logistics and Customer Operations; Quality, Environment, Health and Safety; Procurement and Ethical Sourcing.

This structure enables us to focus on delivering our commercial agenda and top-line growth, and allows the functions to develop and drive global strategies and processes towards best in class performance, while remaining closely aligned to the regions' commercial interests.

Source: <http://www.cadburyschweppes.com/EN/AboutUs/CompanyOverview/OrganisationStructure/>

### Question

1 Suggest how global and regional supply chain groups work together.

## 4.1.2 Time-to-market

Time-to-market has particular significance for the management of the global logistics pipeline. The subject of time is considered in depth in Chapter 5, although we shall touch on the following issues here:

- product obsolescence;
- inventory-holding costs.

### *Product obsolescence*

The extended lead time inherent in international logistics pipelines means that products run the risk of becoming obsolete during their time in transit. This is

especially true for products in industries with rapid technological development, such as personal computing and consumer electronics, and for fashion goods such as clothing and footwear.

### *Inventory-holding costs*

Lead time spent in the logistics pipeline increases the holding cost of inventory. In addition to the time spent in physical transit, goods travelling internationally will incur other delays. These occur at consolidation points in the process, such as in warehouses where goods are stored until they can be consolidated into a full load, such as a container. Delay frequently occurs at the point of entry into a country while customs and excise procedures are followed.

## 4.1.3 Global consolidation

Global consolidation occurs as managers seek to make the best use of their assets and to secure the lowest-cost resources. This approach leads to assets such as facilities and capital equipment being used to the fullness of their capacity and economies of scale being maximised. Resources are sourced on a global scale to minimise cost by maximising purchasing leverage and again to pursue economies of scale. The types of resource acquired in this way include all inputs to the end product, such as raw materials and components, and also labour and knowledge. Familiar features of global consolidation include:

- sourcing of commodity items from low-wage economies;
- concentration at specific sites;
- bulk transportation.

### *Sourcing commodity items from low-wage economies*

Two sourcing issues are used by internationally operating organisations:

- consolidation of purchasing of all company divisions and companies;
- sourcing in low-wage economies.

Internationally operating organisations seek to consolidate the purchasing made by all their separate divisions and operating companies. This allows them to place large orders for the whole group, which enables them to minimise costs by using their bargaining power and seeking economies of scale. At its extreme, a company may source all of its requirements from its range of a given commodity, such as a raw material or component, from a single source.

Internationally operating companies are on a constant quest to find new, cheaper sources of labour and materials. This trend led to the move of manufacturing from developed industrial regions to lower-cost economies. Examples of this are:

- Western Europe to Eastern Europe;
- USA to Mexico;
- Japan to China, India and also Vietnam.

These developing economies have seen impressive growth over recent years. This has led to increased prosperity for their people and rising standards of living. However, these advances in social standards raise the cost of labour and other resources. Therefore, the relentless search for the lowest production cost has led to some companies re-sourcing commodity items to lower-wage countries in Asia, North Africa and South America.

In some cases this movement of facilities around the globe has come full circle, with Asian companies setting up plants in the UK not only to gain access to the EU market but also to take advantage of lower overall costs.

## CASE STUDY 4.2

### Logistics in the news

*The subject of air miles appears regularly in media headlines today. Here are two contrasting views of what is happening.*

Supermarkets and food producers are taking their products on huge journeys, despite pledging to cut their carbon emissions. Home grown products are being transported thousands of miles for processing before being put on sale back in Britain. Jason Torrance, campaigns director of Transport 2000, the environmental transport group, said 'we are producing food in one corner of the world, packing it in another and then shipping it somewhere else. It's mad'.

Dawnfresh, a Scottish seafood company that supplies supermarkets and other large retailers, cut 70 jobs last year after deciding to ship its scampi more than 8,000 km to China to be shelled by hand, then shipped back to Scotland and breaded for sale in Britain. The company said it was forced to make the move by commercial pressures. 'This seems a bizarre thing to do but the reality is that the numbers don't stack up any other way', says Andrew Stapley, a director. 'We are not the first in the industry that has had to do this. Sadly, it's cheaper to process overseas than in the UK, and companies like us are having to do this to remain competitive.'

(Source: Jon Ungeod-Thomas, *Sunday Times*, 20 May 2007)

Commissioned by World Flowers, a study was carried out by Adrian Williams of Cranfield University's Natural Resources Department to establish the actions needed to reduce Sainsbury's [a retailer] carbon footprint regarding Kenyan roses. Results have provided a fresh challenge to much current thinking on local sourcing and the impact of air freight. The high environmental cost of heating and lighting for growing roses in the Netherlands outweighed emissions caused by flying them in from Kenya, with its naturally warm all-year temperatures. It also indicated that carbon dioxide (CO<sub>2</sub>) emissions from Kenyan roses were just 17% of Dutch roses, including the larger impact of CO<sub>2</sub> emissions to high altitude by air freighting. The study found that 6kg of CO<sub>2</sub> was produced per dozen Kenyan roses, as opposed to 35kg for production in the Netherlands. Whereas 99% of the Dutch emissions were caused by producing the roses, only 7% of the emissions emitted by the Kenyan flowers were accounted for by

growing them there. In contrast, nearly 99% of the CO<sub>2</sub> emissions from the Kenyan roses were accounted for by the 6,000km clocked up by air freighting them to the UK. (Source: [www.cranfield.ac.uk/cww/perspex](http://www.cranfield.ac.uk/cww/perspex))

### Question

1 What are the pros and cons of sourcing commodity items in low wage economies?

### Concentration at specific sites

Consolidation of purchasing applies not only to commodity goods but also to high-value or scarce resources. Research and development skills are both high value and scarce. Therefore there is an incentive to locate at certain sites to tap into specific pools of such skills. Examples of this are ‘Silicon Valley’ in California and ‘Silicon Fen’ near Cambridge as centres of excellence in IT. Companies originally located in these areas to benefit from research undertaken in the nearby universities.

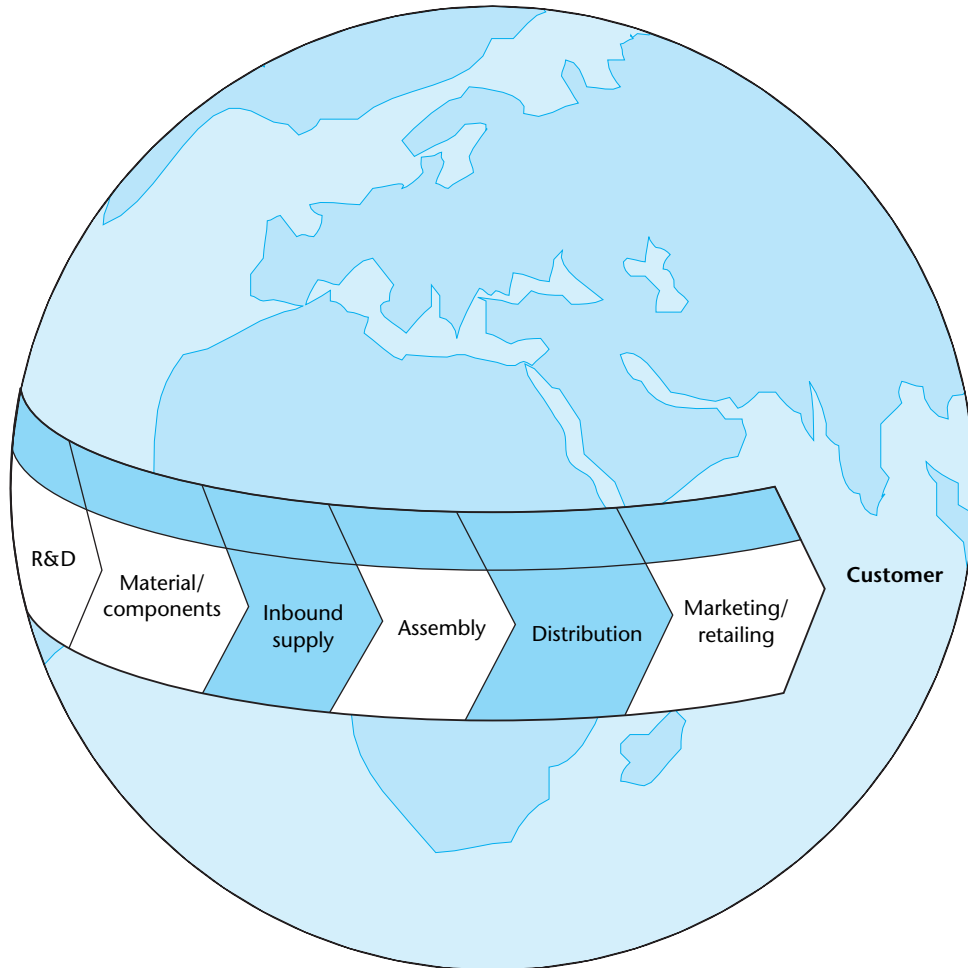
Companies become more influential in directing such research and benefiting from it if they have a significant presence in these locations. This is helped if global research is consolidated onto a single site. While this may mean missing out on other sources of talent, consolidated R&D gives a company a presence that helps to attract the bright young minds that will make their mark in these industries in the future, and it allows synergies to develop between research teams.

### Activity 4.1

The international logistics pipeline, shown in Figure 4.3, is made up of the same basic elements as any other pipeline. However, this pipeline has a number of special characteristics. Use Table 4.3 to make a list of the characteristics that you believe make a global logistics pipeline different from one that operates only nationally.

**Table 4.3** Characteristics of the international pipeline

Elements of the pipeline	Special characteristics of the international pipeline
Research and development	
Material/component sourcing	
Inbound supply	
Assembly	
Distribution	
Marketing/retailing	



**Figure 4.3** The international logistics pipeline

### *Bulk transportation*

One of the more obvious advantages of operating a company in a global manner is the cost advantage of consolidated transportation. Taking Procter & Gamble as an example, 350 ship containers, 9,000 rail car and 97,000 truck loads are transported every day. The opportunity for cost saving by coordinating these movements and maximising utilisation is significant.

#### **4.1.4 Risk in international logistics**

In addition to time-to-market and inventory risks, events of recent years have forced companies to adapt to the new supply chain reality of expecting the unexpected. Companies are not only responding to current volatility and geopolitical



risks, they are also developing new risk management approaches based upon the realisation that decades of globalising supply chains has come at a price: a heightened and different risk profile.

### *Geopolitical threats*

The 2003 SARS crisis and the second Gulf War were major events in and of themselves; they were also consecutive and had huge impacts on supply chain continuity and execution feasibility. Major trade routes had to be altered and global travel was limited. In addition, structurally heightened government security measures and screening are indicators of risks involved in international logistics. Logistics making the global economy a reality can never be a given and a non-issue that deserves no second thought.

### *Transportation breakdowns*

Transportation may be a commodity, that does not mean that nothing can go wrong. A several-week strike in the US west coast ports in 2002 lasted long enough to almost cripple the US economy. With hundreds of cargo ships floating outside the ports, shipments were not arriving at US destinations. This meant that factories were shut down and stores were emptying. It also had a ripple effect on global trade overall. For example, return shipments were delayed because no ships were leaving the ports either. In addition, with so many ships and containers tied up other routes could not be served. And in fact a resulting global shortage of containers caused a slowdown of shipments in many other port regions. So shipments on other routes, in different harbours and even shipments using different modalities were affected.

Risk and security concerns are not a one-time issue but require continuous risk management. Helferich and Cook (2002) found that this is necessary because, for example:

- only about 61 per cent of US firms have disaster recovery plans;
- those that do typically cover data centres, only about 12 per cent cover total organisational recovery;
- few plans include steps to keep a supply chain operational;
- only about 28 per cent of companies have formed crisis management teams, and even fewer have supply chain security teams;
- an estimated 43 per cent of businesses that suffer a major fire or other major damage never reopen for business after the event.

According to Helferich and Cook (2002) this can partially be explained by the fact that there are competing business issues, managers might not recognise their vulnerability and might assume that the government will bail them out. Peck (2003) has published a self-assessment for supply chain risk and an operational-level tool kit.

## 4.2 The tendency towards internationalisation

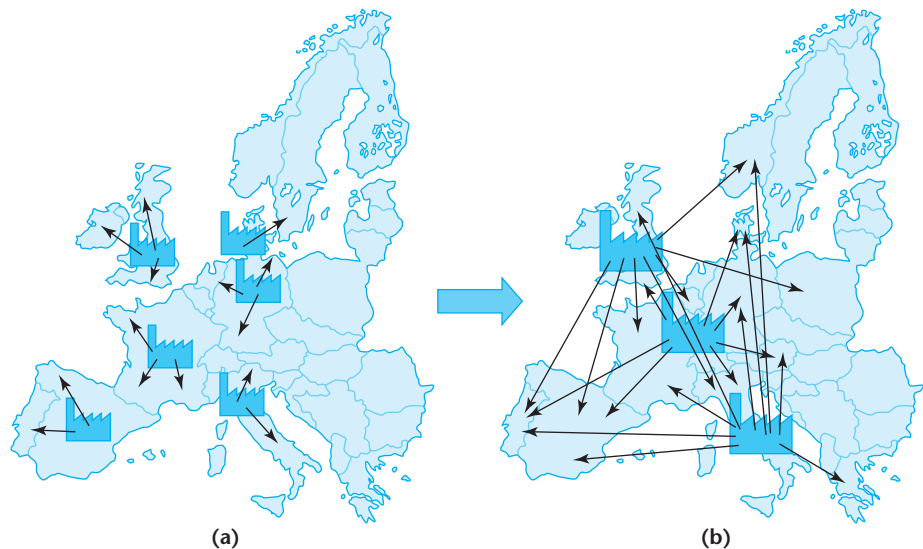
**Key issue:** How can we picture the trade-offs between costs, inventories and lead times in international logistics?

In order to remain competitive in the international business environment, companies seek to lower their costs while enhancing the service they provide to customers. Two commonly used approaches to improve the efficiency and effectiveness of supply chains are focused factories and centralised inventories.

### 4.2.1 Focused factories: from geographical to product segmentation

Many international companies, particularly in Europe, would have originally organised their production nationally. In this situation, factories in each country would have produced the full product range for supply to that country. Over time, factories in each country might have been consolidated at a single site, which was able to make all the products for the whole country. This situation, in which there is a focus on a limited segment of the geographical market, is shown in Figure 4.4(a).

The focused factory strategy involves a company's consolidating production of products in specific factories. Each 'focused factory' supplies its products internationally to a wide market and focuses on a limited segment of the product assortment. This situation is shown in Figure 4.4(b).



**Figure 4.4** (a) Focused markets: full-range manufacture for local markets  
(b) Focused factories: limited range manufacturing for all markets

Traditional thinking is that this organisational strategy will deliver cost advantages to a global company. While this is true for production costs, the same is not necessarily true for inventory-holding costs and transport costs.

**Activity 4.2**

Focused factories have an impact on the important trade-off between cost and delivery lead time. Make a list of the advantages and disadvantages of focused factories. One example of each has been entered in the table below to start you off.

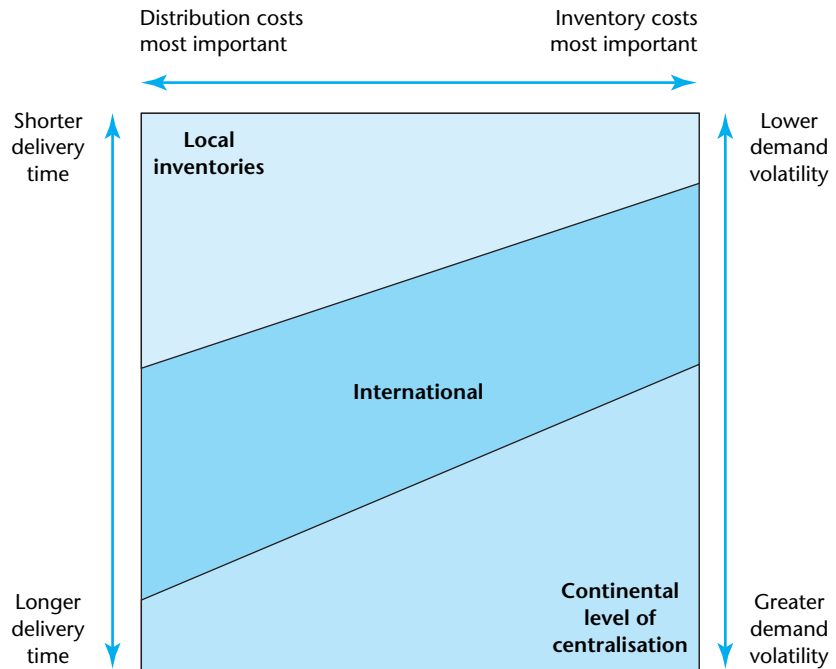
	<b>Cost</b>	<b>Lead time</b>
<b>Advantages</b>	<i>Lower production costs through economies of scale</i>	<i>Specialised equipment may be able to manufacture quicker</i>
<b>Disadvantages</b>	<i>Higher transport cost</i>	<i>Longer distance from market will increase lead time</i>

### 4.2.2 Centralised inventories

In the same way that the consolidation of production can deliver cost benefits, so can the consolidation of inventory. Rather than have a large number of local distribution centres, bringing these together at a small number of locations can save cost. Savings can be achieved in this way by coordinating inventory management across the supply pipeline. This allows duplication to be eliminated and safety stocks to be minimised, thereby lowering logistics costs and overall distribution cycle times. Both may sound contrary to the fact that the transport pipeline will extend, owing to the longer distribution legs to customers from the central warehouse in comparison with a local warehouse. Nevertheless, through centralising inventory major savings can be achieved by lowering overall speculative inventories, very often coupled with the ability to balance peaks in demand across regional markets from one central inventory. Figure 4.5 characterises the different operating environments where centralised inventory may be a more relevant or a less relevant consideration, based upon logistics characteristics.

In product environments where inventory costs are more important than the distribution costs, centralised inventories are a relevant concern. This is typically the case for products of high value (measured in costs per volume unit). Microchips are an extreme example: these products are of such high cost per volume unit that distributing from the moon could still be profitable! Distribution costs have a marginal impact on logistics costs per product, assuming of course that transport costs are mainly a function of volume and weight. Products that require special transport, such as antiques, art, confidential documents or dangerous chemicals, may represent a different operating environment.

A second dimension that needs to be taken into consideration is that of distribution lead times. Here, we focus on physical distribution from warehouse to customer, and not on the inbound pipeline. Centralising inventory may lead to lower factory-to-warehouse distribution costs because shipments can be consolidated into full container loads. Where service windows to customers are very compressed there may not be sufficient time to ship products from a central warehouse and allow for the required transit time within the service window.

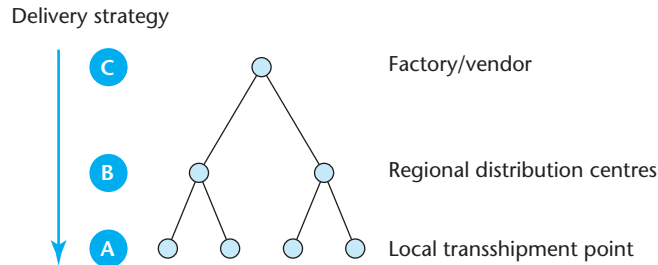


**Figure 4.5** Inventory centralisation against logistics costs and service dimensions

This is why, for example, hospitals and pharmacies retain in-house stocks of products, almost irrespective of their inventory costs. Critical medicines and surgical appliances need to be available instantly and locally, regardless of inventory costs.

In general transport, costs have continued to decline over time as a relative cost item because of innovations in transport technology, the commoditisation of transport (such as container ships), and the oversupply of transport capacity for basic transport. These factors in themselves contribute to the increasing internationalisation of logistics: physical distance becomes less important, even for bulky products. However, the lead-time dimension loses some of its relevance, from a transport point of view. Customer demand can be very volatile and unpredictable. *Accuracy* of delivery (the right quantity) can therefore be a more demanding challenge than *speed* (the right time). Speed is available through different transport modes (container ship, air cargo, express, courier, for example) at reasonable prices. In very volatile markets, control over international inventories by means of centralised inventories can be crucial. Overall delivery reliability ('on time in full') tends to increase significantly, to the benefit of an organisation's performance in terms of service requirements. The ability to balance peaks across market regions from a central inventory is among the additional advantages. Different levels of inventory centralisation can be applied according to different dimensions. Taking the European market as an example, the range is from local inventories (by country or even by location) through international (a selection of countries) to the complete continent. Many companies now include the Middle East and Africa as a trading bloc (Europe, Middle East and Africa – EMEA).

Centralised inventory management and focused factories enable different delivery strategies to be combined. Figure 4.6 depicts a simple distribution network that enables three different delivery strategies (listed in Table 4.4) to be applied as appropriate. For example, an opportunity to think globally arises where the key product relies more on the designer label and its promotion and marketing and less on its manufacturing origins. The key to success in clothing is often about fashionable design and labelling. Low labour costs (rather than material costs) of production can then be achieved by outsourcing to low-wage economies, often in the Far East.



**Figure 4.6** Delivery strategies in a global network

**Table 4.4** Three different delivery strategies

Delivery strategy	Description	Pros	Cons
A	Direct shipment of fast-moving, predictable lines. Held locally, probably pre-configured	Short lead time to customer	Multiple inventory points leading to duplication of stocks
B	Inventory of medium velocity, less predictable demand lines held at generic level awaiting final configuration	Lower overall levels of inventory, consolidated shipments to distribution centres and concentrated handling	Longer lead time to customers
C	Slowest-moving lines, least predictable. Perhaps one shared global inventory or make to order	Low overall inventory levels	Long lead time to customers

### CASE STUDY 4.3

## Centralised distribution at Nike:

### centralised and specialised, but not standardised

Nike has a central customer service centre (distribution centre) located at Laakdal in Belgium. The centre is 200,000 square metres in size and serves 45,000 customers in EMEA (Europe, Middle East and Northern Africa) with footwear, apparel and equip-

ment. The centre receives products from supplier factories around the world for distribution to retail clients both before the start of all four seasons each year, as well as during the season. Prior to the start of a season, when work is at a peak, the workforce stands at some 2,300 operational staff. Off peak, that drops to 1,350 staff. Deliveries are very time critical, given the seasonal nature of the business. Retailers demand in-store availability on day one of a new season. The centre is a clear example of a company deciding to centralise receiving, storage and shipment to customers at one location in Europe. The benefits including consolidation of inbound shipments, lower inventory levels and better delivery service (in comparison to fragmented warehouses scattered around Europe). This does not mean, however, that the logistics operations are standardised for all flows of goods and all customers.

Not every shipment is handled in a standard way through a single distribution pipeline:

- About a quarter of the volume of shipments is shipped to customers directly. These are larger shipments such as full pallets for larger customers – for which there is no need to consolidate with other shipments. As a result it is cheaper and quicker to make these shipments directly.
- New growth areas that are served from the centre are Russia, Turkey and South Africa. For Russia, the first satellite centre with small inventories was recently opened to enable faster local replenishment of selected products.
- Selected shipments to selected retailers are dealt with by a materials handling operation at the centre. This mainly involves labelling and re-packing operations.
- Some retailers share weekly point of sale data with Nike, enabling it to replenish inventories based upon actual sales.

#### Questions:

- 1 What are the reasons for a company, such as Nike, with a centralised distribution centre to ship some products directly to customers, not through the distribution centre?
- 2 What are the reasons to start satellite centres when a company such as Nike has a centralised distribution centre?
- 3 What are the pros and cons of locating materials handling operations such as labelling and packing in a distribution centre, as opposed to in the factory?
- 4 What are the pros and cons for a company such as Nike to take on these materials handling services as opposed to leaving them to retail customers?

## 4.3 The challenges of international logistics and location

**Key issues: What are the risks in international logistics in terms of time and inventories, and how can they be addressed?**

International logistics is complex, and different from localised logistics pipelines. The main differences that need to be taken into consideration are:

- extended lead time of supply;
- extended and unreliable transit times;
- multiple consolidation and break points;
- multiple freight modes and cost options.

Information technologies can help to circumvent these challenges in general, and the proper location of international operations in particular can help to resolve some of these challenges. Another key point is that the benefits of sourcing from low-cost locations could be lost by the operating costs and challenges of international logistics. Hence it is key to consider these prior to making decisions about global sourcing and offshoring.

### 4.3.1 Extended lead time of supply

In an internationally organised business most products produced in a particular factory will be sold in a number of different countries. In order to manage the interface between the production and sales teams in each territory, long lead times may be quoted. This buffers the factory, allowing it to respond to the local variations required in the different markets.

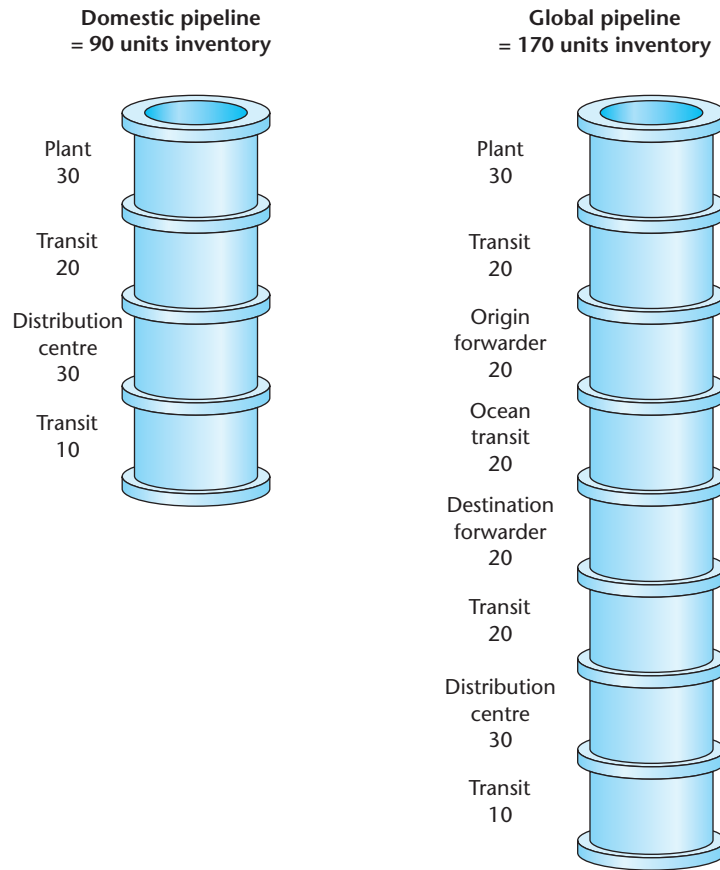
### 4.3.2 Extended and unreliable transit times

Owing to the length and increased uncertainty of international logistics pipelines, both planned and unplanned inventories may be higher than optimal. A comparison of the length of domestic and international product pipelines and their associated inventories is shown in Figure 4.7. Variation in the time taken for international transport will inevitably lead to increased holding of inventory with the aim of providing safety cover.

### 4.3.3 Multiple consolidation and break points

Consolidation is one of the key ways in which costs in pipelines can be lowered. Economies of scale are achieved when goods produced in a number of different facilities are batched together for transport to a common market.

The location of consolidation points depends on many factors that are not really appropriate to consider in a simple assignment such as this. That said, here is one solution. Products manufactured in India should be consolidated at the site on the east coast (near Madras) for shipping to Singapore. Here they are combined with the output from the Thai and Singapore factories and shipped to Hong Kong. Products are consolidated at a Chinese port, possibly Shanghai, and transported by rail or sea to Hong Kong. All the other manufacturing sites deliver direct to Hong Kong, where products from all the various facilities are consolidated and shipped to Los Angeles.



**Figure 4.7** Comparison of domestic and international logistics pipelines

(Source: After van Hoek, 1998)

It is worth noting that, after arrival in LA, this process runs in reverse. The consignment will be broken down at various 'break points' throughout North America and the goods distributed to market via hubs.

#### 4.3.4 Multiple freight modes and cost options

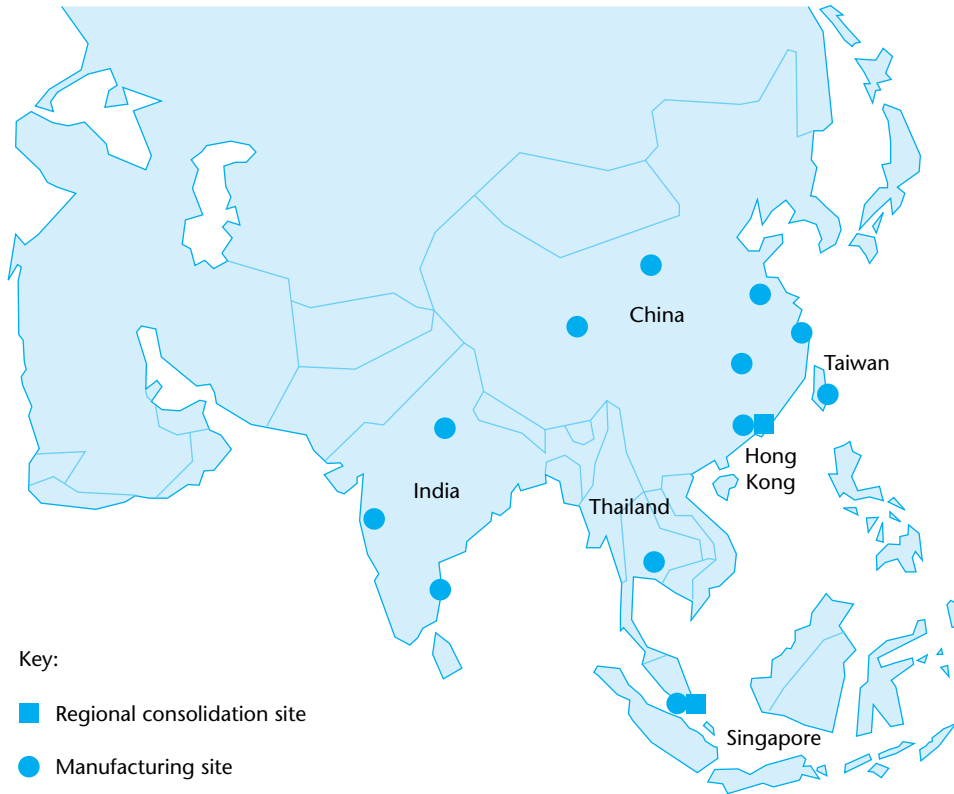
Each leg of a journey between manufacture and the market will have a number of freight mode options. These can be broken down in simplistic terms into air, sea, rail and road. Within each of these categories lies a further range of alternative options. Each of them can be assessed for their advantages and disadvantages in terms of cost, availability and speed. When the journey along the supply chain involves multiple modes, the interface between them provides further complication.



## Activity 4.3

A footwear company has a number of manufacturing facilities around Asia, as shown in Figure 4.8. There are five manufacturing sites in China, three in India, and one each in Thailand, Singapore and Taiwan. Singapore and Hong Kong also have the facility to act as regional consolidation sites.

Draw arrows on the map showing where the flow of exports to the North American market could be consolidated. Write a brief description that explains your reasons for choosing these consolidation points and the flows between them.



**Figure 4.8** Location of Asian facilities

### 4.3.5 Location analysis

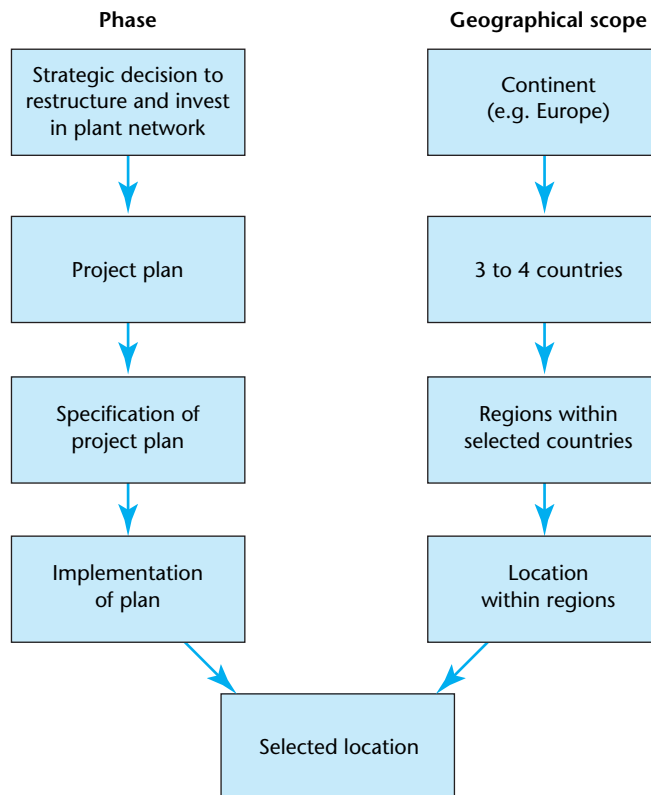
A structural component of international logistics pipeline design is the location design, or, in other words, deciding where operations are going to be performed. As Figure 4.9 shows, there is a sequence to the decision-making process involved that incorporates the business (left-hand side) and geographical decision making (right-hand side). Business decision making evolves from a strategic commitment through a decision support analysis project to implementation of the resulting plan at a selected location. In parallel, the location analysis starts at the level of relevant continent, through consideration of relevant countries and regions, to the selection of a location.

**Activity 4.4**

Consider each of the four freight modes in terms of their cost, speed and availability, and write in the respective box in the table 'high', 'medium' or 'low'. Explain your answers in the 'Rationale' box on the right.

Freight mode	Cost	Speed	Availability	Rationale
Air				
Sea				
Rail				
Road				

Note that these comparisons are fairly subjective, and your answers will reflect your experience of the different freight modes in your industry, product type and geographic location.



**Figure 4.9** Phases in the location selection process

The typical four-phase decision-making process can be structured using the following steps:

- 1 Deciding upon the appropriate level of centralisation–decentralisation using, for example, Figures 4.5 and 4.9.
- 2 Selecting relevant location criteria.
- 3 Selecting criteria weightings.
- 4 An economic trade-off analysis of structures and relevant locations.

Table 4.5 displays a representative trade-off table for two locations by relevant weighted criteria.

**Table 4.5** Trade-offs between two locations

Location criteria	Weight	Score region A	Score region B
Railways	1	4	1
Water connections	1	4	1
Road connections	2	2	4
Site availability	2	2	3
Central location	3	1	2
...	...		
Total		19	22

Key: Score on a five-point scale ranging from poor to excellent

## 4.4 Organising for international logistics

**Key issue:** How can supply chains be better organised to meet the challenges of international logistics?

There are at least three elements in organising for international logistics. These are:

- layering and tiering;
- the evolving role of plants;
- reconfiguration processes.

These will be outlined in the following subsections.

### 4.4.1 Layering and tiering

Internationalisation is often looked at from the point of view of asset centralisation and localisation. However, the wider organisational setting needs to be taken into account as well.

A commonly used maxim is *global coordination and local operation*, which relates to laying out the flow of information and coordination differently from the map

of the physical operations. For example, Hewlett-Packard (HP) operates a globally consistent and coordinated structure of product finalisation and distribution in contrast to its continental operations. The company runs a final manufacturing and central distribution operation in Europe, the United States and Asia for each continent. The operations are structured and run exactly the same, with the only difference being the regions and customers. Furthermore, including tiers of players in the supply chain, these operations are largely outsourced. Facilities are often owned and operated on a dedicated basis by a contract manufacturer and third parties. Hewlett-Packard only brings in some management to assure global coordination. Thus, although HP operates in a globalised way, its products are tuned to local markets by means of local logistics operations. Therefore developments in ICT do not eliminate the need for such local operations.

Another example can be found in the automotive industry. In this industry, major original equipment manufacturers (OEMs) structure their plant networks globally, while making suppliers build their plants in the immediate vicinity of the OEM plant. The distance or broadcasting horizon between the two plants is defined by the time between the electronic ordering of a specifically finalised single module on the on-line system and the expected time of delivery in sequence along the assembly line. Time horizons for order preparation, finalisation, shipment and delivery tend to be in the area of an hour and a half or less. This causes localisation of the supplier or co-location, while the OEM plant services a continental or even global market.

#### 4.4.2 The evolving role of individual plants

Ferdows (1989) projects the theories by Bartlett and Ghoshal (1989) onto the role of individual plants/factories in achieving the targeted international capabilities of global efficiency, local responsiveness and worldwide learning, or a combination of the three. Using the same type of approach, with location considerations on the horizontal axis and performed activities on the vertical axis, van Hoek (1998) adjusted the model for distribution centres. The model indicates the way in which the growth of performed activities changes the demands placed on the capabilities of the plant and changes the location requirements. Location is concerned with the response of governments to globalisation: adjusting local taxes, incentives and infrastructure to favour selection of their territory.

In Figure 4.10 a traditional warehouse is projected to possibly develop into a semi-manufacturing operation with product finalisation among its responsibilities and added value. This also contributes to the creation of a flexible facility for responding to local markets. The model also indicates a possible downgrading of the plant, with its two-way arrows showing development paths. These developments could be driven by poor location conditions, an inability to reach supply chain objectives, or the ability to reach the supply chain objectives more easily at other plants in the company's network. This suggests that the role of individual plants could be seen as an internal competitive issue for plant management. Most relevant, the evolutionary roles and functions of individual plants within the evolving supply chain are specific issues of concern for the realisation of global objectives.

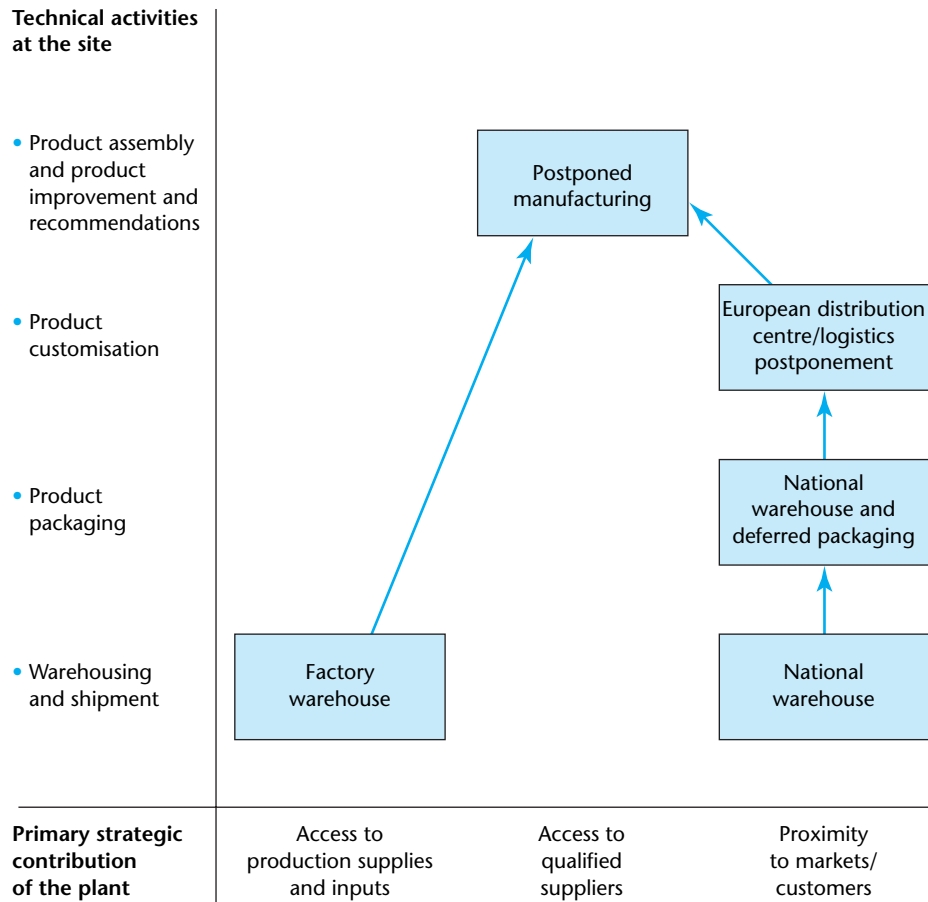


Figure 4.10 Changing role of distribution centres

### 4.4.3 Reconfiguration processes

Related to this last point, the achievement of the required changes in international logistics pipelines is a central issue. In the research presented in Figure 4.7 (van Hoek, 1998), it was found that, across companies, large differences can be found in reconfiguration paths. This was found even in cases where the same supply chain structure (a traditional factory warehouse, as displayed in Figure 4.10) was targeted. Differences included:

- *Supply chain scope/activities involved.* Was only final manufacturing relocated, or did sourcing undergo the same treatment?
- *Focus.* Were activities moved into the market, e.g. localised or centralised within the market? Did the move have a single or multiple focus?
- *Tendency.* Were activities moved out of the (European) market or vice versa, with single or multiple tendencies?
- *Timetable.* Was it a single-step process or did it involve various steps spanning out the process over a longer period of time?

- *Pace.* Was it an overnight change or the result of a gradually changing process?
- *Authority.* Was it directed from a global base (top down) or built up region by region (bottom up)?

The differences can be explained through differences in the supply chain characteristics of companies, among which are:

- *Starting point:* Is the base structure localised or globalised?
- *Tradition:* Does the company have a long preceding history with the baseline in the market, or can it be built up from scratch, in supply chain terms (brownfield or greenfield)?

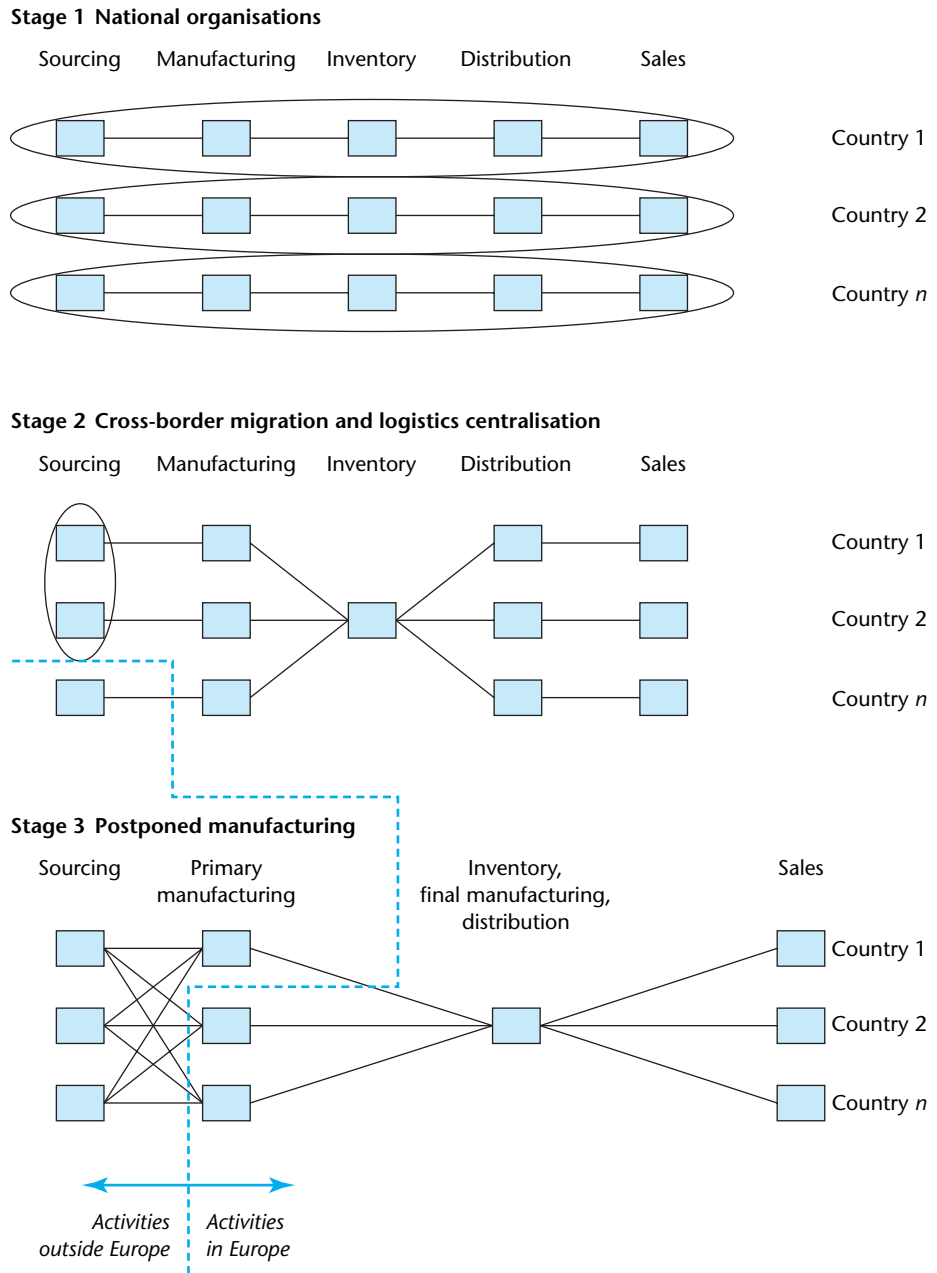
Table 4.6 summarises the differences found in companies implementing postponed manufacturing as an example of a reconfiguration process. The same argument could be applied to the difference between a central European warehouse and a country-based, localised distribution network.

Figures 4.11 and 4.12 represent the reconfiguration process from local distribution through logistics centralisation to postponed manufacturing (final manufacturing in the warehouse). The differences in the implementation path are based upon the different starting points. The path with a localised starting point goes through centralisation within Europe starting from autonomous, duplicated local structures. The path with a global starting point builds a small European presence and then migrates through the increase of European presence centrally (representing a further location into Europe, rather than a further centralisation from within Europe).

**Table 4.6** Differences in reconfiguration processes for companies depending upon starting point (global or local)

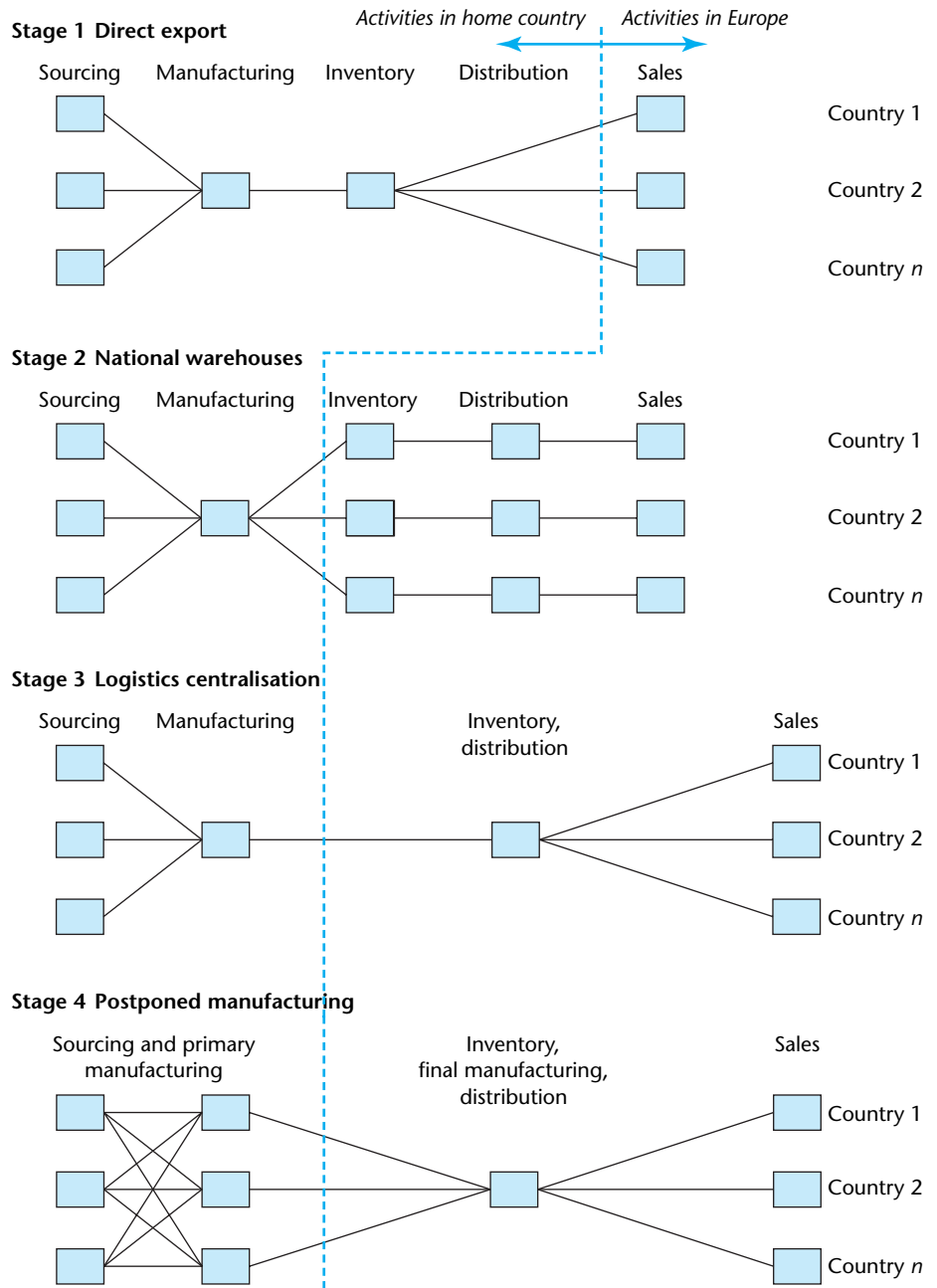
Starting point	Global structure	Localised structure
Heritage in market	Little, greenfield approach	Extensive, brownfield approach
Supply chain scope	Narrow, involving inventory and final manufacturing	Broad, involving inventory, manufacturing, and sourcing
Focus	Decentralising final manufacturing and inventory into market	Centralising inventory and final manufacturing at continental level and globalising manufacturing and sourcing
Tendency	Single, placing activities into market	Multiple, relocating within market and moving outside market
Timetable	Short (1–10 months)	Long (number of years)
Authority	Global, top-down directions	Local, bottom-up iterative process

Case study 4.4 explores issues and trade-offs found in developing competitive solutions when organising for international logistics.



**Figure 4.11** Stages in the implementation of postponed manufacturing: local starting point

Source: (van Hoek, 1998)



**Figure 4.12** Stages in the implementation of postponed manufacturing: global starting point

Source: (van Hoek, 1998)



**CASE STUDY**  
**4.4**

## Time v. Cost in global supply chains: lessons from the apparel industry

### Vertical integration v. outsourcing

The enormous success of vertical retailers like H&M, Zara, Gap and Next in the apparel industry in the last 10 years has forced manufacturers of brand labels like Esprit and Levi, and department stores like El Corte Ingles and Marks & Spencer, to speed up their supply chains. Partly, this has been achieved by integrating their processes and systems upstream (towards their suppliers) and downstream (towards their end-customers) in the supply chain.

The competitive environment in the apparel industry is increasingly tough. Retail prices are under pressure; competition is extending from products that were traditionally limited to upper, middle or lower segments of the market – and increasingly from the sports industry; gross margins are shrinking; retail store costs and personnel costs are going up. Those who do not manage their assortment planning and inventories well are continuously under pressure to mark down their merchandise. Vertical retailers have found an answer to this hostile environment by:

- increasing the probability of designing a bestseller product by dramatically shortening its time to market (see Chapter 5);
- piloting products in the stores and then replenishing the best-sellers within 14 days by new types of make-to-order processes;
- driving the inventory sales productivity (as measured by stock turn, sales per square metre and markdown percentage) by keen assortment and delivery planning;
- integrating the IT systems from point of sale back into garment production factories and from there towards fabric suppliers;
- focusing on quality of workmanship through fitting and process quality.

Brand label manufacturers traditionally do not own their retail stores, and department stores do not have their own factories. This easily leads to competitive disadvantage in comparison with the vertical retailers, who have their own retail stores and have tight control over their manufacturers. To survive in today's marketplace against the vertical retailers, brand labels and department stores need to integrate their processes and systems from point of sale back into the factory. How can this be done?

### Core competencies and time-to-market

Companies like Esprit have initiated strategies to become vertical retailers themselves. Elements of this strategy are to focus on core competencies and to offload all non-core activities to specialists who can perform such activities better and at a lower price. Another element of the strategy is to increase the number of collections from 4 to between 6 and 12 per year. This enables them to be closer to the market and thus to forecast and fulfil product demand more accurately. Of course, closeness to market increases the pressure on faster, timely product development and product delivery. The product life cycles of the individual collections are shorter, which leads to enhanced requirements for responsiveness on all supply chain partners. There can be no buffers, and deliveries have to be on time and in full. As a result of this, each partner in the chain has increased needs

for information, flexibility and transparency. Therefore, vertical retailers must have an excellent supply chain that is fast, flexible, reliable and which provides full transparency at low cost. That is in addition to having good products and closeness to market!

### Developing a global SCM network

Re-engineering supply chain processes as part of the verticalisation strategy forces apparel and sports companies to focus on outsourcing all non-core activities and development of a global supply network. Outsourcing of non-core activities, like managing warehousing and distribution centres, frees up management time which can be utilised for managing the supply chain end-to-end. The development of a global supply network consists basically of four components:

- Enforcing end-to-end supply chain thinking within the focal firm, its suppliers and its logistics service providers.
- Setting up a physical infrastructure with selected lead logistics providers (LLPs) that manage the logistics hubs at sourcing origin and market destination (see Figure 4.13).
- Using central databases on the Internet (SCM portal and supplier portal) where all logistics partners, suppliers and buyers can view order status and product development in real time.
- Empowering LLPs to manage selected service level agreements on behalf of the focal firm in terms of cost and time.



**Figure 4.13** Example of physical infrastructure set-up with LLP origin in Asia

Source: (van Hoek, 1998)

Besides development of the above components of the supply chain, it is important to consider trade-offs. These are decisions that have to be made for each step in the supply chain. Figure 4.14 provides an overview of the steps and trade-offs in the supply chain from sourcing areas in Asia, Eastern Europe and South America towards a European market destination.

	ASIA	EUROPE	AMERICA
Consolidator	Hubs, consolidation	Hubs, consolidation	Hubs, consolidation
Carrier	Sea>land>air	Land>air>sea	Sea>air>land
Warehousing	Cross dock	Pick/pack, cross dock	Pick/pack, cross dock
Transport	Express, pallets	Express, pallets	Express, pallets

SCM tools to manage the time, dependability and cost of the network infrastructure

**Figure 4.14** SCM tools and trade-offs in the supply chain

### Cost versus time

Which trade-offs are to be made? For example when sourcing in China whilst selling in Germany, what process set-ups are possible? When focusing on *cost* the focal firm needs to make sure that shipments are in full container loads, shipped by sea, packed as cross-dock shipments which are then transported to retail stores via a cross-dock warehouse as consolidated shipments once a week. However, this slows down the process time substantially to approximately 20 days. When focusing on *time* the focal firm needs to ensure that shipments are packed by retailer store at the factory, shipped by air and transported directly to stores upon arrival without going through a cross-dock warehouse. Of course, this process is fast (2–5 days) but it is also very costly, and can only be justified with exclusive branded products with high gross margins. Therefore, companies like Esprit and Nike have a *range* of supply chain processes. Some of these set delivery windows which focus on time, while others organise supply chain processes on minimising cost.

(Source: Based on Leeman, 2007)

### Questions

- 1 What are the strategic drivers that are forcing focal firms in the apparel industry to change their supply strategy?
- 2 Why is time-to-market so important in the apparel industry? How does it impact supply chain processes?
- 3 Which trade-offs must be made when setting up a global SCM network for the apparel industry? Also discuss the trade-offs regarding sourcing countries versus quality.

## 4.5 Reverse logistics

### *Key issue: factoring in the return flow of goods when designing international networks*

Reverse logistics deals with the flow of goods that go back up the supply chain for a number of reasons, including: product returns, repairs, maintenance and end-of-life returns for recycling or dismantling. Reverse logistics has both a service (repair, recalls, etc.) and an environmental component. Corporate social responsibility considerations will be covered in more detail in section 4.7. Meanwhile, Table 4.7 – from the Reverse Logistics Executive Council – compares reverse logistics with forward logistics.

**Table 4.7 Comparing forward and reverse logistics**

Forward logistics	Reverse logistics
Forecasting relatively straightforward	Forecasting more difficult
One to many distribution points	Many to one distribution points
Product quality uniform	Product quality not uniform
Product packaging uniform	Product packaging often damaged
Destination/routing clear	Destination/routing unclear
Pricing relatively uniform	Pricing dependent on many factors
Importance of speed recognised	Speed often not considered a priority
Forward distribution costs easily visible	Reverse costs less directly visible
Inventory management consistent	Inventory management not consistent
Product life cycle manageable	Product lifecycle issues more complex
Negotiation between parties straightforward	Negotiations complicated by several factors
Marketing methods well known	Marketing complicated by several factors
Visibility of process more transparent	Visibility of process less transparent

(Source: Reverse Logistics Executive Council [www.rlec.org](http://www.rlec.org))

Reasons why reverse logistics is often only partially incorporated into international network design include:

- no infrastructure: companies often try to use the same outbound distribution system to handle returns without considering if it is fit for purpose;
- reverse logistics is often a ‘corner-of-the-desk concern’, and does not receive sufficient resources;
- much attention on the subject is driven by legislation, not yet by recognised business value;
- focal firms see reverse logistics as a cost of doing business;
- the subject is intuitively not popular: it means something has gone wrong, so people are tempted to ignore it or hide it;
- it is hard to forecast the reverse flow and composition – what is going to come back.

Opinions indicate that there are operational shortcomings such as using the same infrastructure for the return flow, and the difficulty of forecasting reverse flow. These might be explained by lack of management attention, and by lack of

appreciation of the full costs of reverse logistics. On the other hand, potential downsides of a reactive approach include image risks, service shortfalls and being a nuisance to customers. Suggested ways forward include considering the full impact of reverse logistics and approaching it as a business:

- consider reverse logistics for its full cost and negative potential market impact;
- seek green as a business ('green is green');
- design for disassembly and recycling;
- outsource reversed operations to a specialist third party logistics service provider (3PL);
- create dedicated (parts of) operations.

GE now thinks of 'green' as 'green' – meaning the colour of money. This will create the right platforms for developing capable infrastructure, or for investing in an outsourcing arrangement with a specialist company. Obviously, design for disassembly is one of the ways to ensure that – once parts are returned – costs are kept low, and likelihood of returns being profitable (through resale of parts) is increased.

## 4.6 Managing for risk readiness

*Key issue: developing appropriate responses to risk in both the short- and long-term.*

Supply chain disruptions such as transportation breakdowns and geopolitical risks can have many impacts: empty distribution channels, stores and goods stuck upstream leading to lost sales, revenue and customers. And they can be the result of plant shutdowns due to supplier discontinuity or collapse, bottlenecks in the transportation system or many other events in the supply chain. There are at least two levels at which companies are responding to risk in international logistics; preparing for immediate response to risks and structurally preparing for risk in international supply chains.

### 4.6.1 Immediate risk readiness

Recent events have shown that immediate responses to risks can include four things:

- raised inventory levels to assure a cushion for supply disruptions of key parts and supplies;
- redrawing transportation scenarios in the light of the possible logistics melt-down of global trade routes;
- supplier hedges are put into place; and
- global sourcing and supplier rationalisation efforts are being reconsidered actively.

### *Inventory policies to reflect volatility levels*

Shortly before the second Gulf War, GM and Toyota asked their just-in-time suppliers to raise inventory levels in order to avoid early and extensive plant shut-downs. It added short-term costs but as a hedge against supply disruptions it can be a real money saver down the line while assuring service to the customer that competitors might not be able to offer. LaCrosse Footwear raised its safety stock sixfold for certain products in order to ensure the ability to ship to customers on short notice.

### *Re-do transportation network redesign*

Based upon possible risks or a real situation, scenarios for transportation routes at risk can be developed together with contingency plans on a route-by-route and plant-to-plant basis. Airlines altered services to the Middle East before the Gulf War, for example. Here are three other examples:

- Hewlett-Packard maintains the ability to shift production between assembly facilities in Europe, North America, South America and Asia as part of a formal continuity plan to be implemented in a crisis.
- Chrysler quickly shifted component shipment from air to express truck service in response to transportation bottlenecks after 9/11.
- Continental Tyres' crisis team put together a list of all customers, parts, and suppliers outstanding, identified critical shipments by the afternoon of 9/11, and expedited those critical parts by land transport and through contingency relationships with transport firms.

### *Reconsider sole and global sourcing arrangements*

Despite the benefits of supplier rationalisation and focused factories, risk management does imply there is real rationale for lining up alternative suppliers in different locations and for manufacturers to develop a thorough understanding of their suppliers' capabilities and vulnerabilities. Companies are responding in two ways: consider alternative and back-up sources and proactively audit the supply base for financial and operational sustainability in these tough times. Hewlett-Packard, for example, has secondary suppliers for all critical components as part of its continuity plan.

## **4.6.2 Structural risk readiness**

Because risk needs to be an ongoing focus, companies are increasingly devoting dedicated teams to risk management in the supply chain. These teams can do several things:

- develop contingency plans and risk protocols;
- auditing preparedness;

- training plant management and staff;
- report to senior management on risk profiles and preparedness.

Most important, however, is not to leave risk management in the supply chain solely the responsibility of a team, but to use the team to create an ongoing organisation-wide focus and effort. Most often teams *help* plant management and various functions in the organisation, instead of telling them what to do. Henkel, the German consumer goods company for example, has appointed risk teams to work with various departments in assessing risk. It raises fundamental awareness across the organisation, and is the basis for developing contingency plans proactively.

## 4.7 Corporate social responsibility in the supply chain

**Key issue: Companies operating international or global supply chains need to incorporate social responsibility into their supply chain design**

Broadly defined, corporate social responsibility (CSR) in the supply chain deals with the social and environmental consequences of supply chain operations. Making a global supply chain environmentally sustainable and socially considerate is harder than just doing so for a focal firm. This is due to global reach and the fact that multiple companies are involved. As a result, it is harder to assess and improve operating policies across the entire supply chain. Yet this is a key opportunity to bring CSR to life.

Two examples illustrate the challenge:

- In 2006 the ship *Probo Koala* was redirected from Amsterdam to the Côte d'Ivoire where it dumped its waste, leading to the death of several people in the shore area. Consequently, questions were asked in Europe about the lack of responsibility taken and the approach of turning a blind eye locally.
- Nike came under heavy scrutiny from customers in the 1990s for its use of low-cost labour, predominantly in Asia. There were suspicions of use of child labour, and other unethical labour practices among Nike suppliers. Nike launched a comprehensive CSR effort – including the appointment of a Vice President for CSR – and now is considered to be a leader for improving supplier practices and for responsible behaviour along the supply chain.

CSR has caught both public and political attention, and companies are developing approaches that span the spectrum displayed in Figure 4.15 overleaf. Worst practice in CSR is for companies to publish a CSR report and to engage in PR efforts to make the company look responsible, yet hide behind the approach:

**I can't see everything in my supply chain that happens on the other side of the globe in another company, so I can't manage that.**

So not much changes in day-to-day operations – other than telling suppliers that they 'need to be responsible for their actions'.

Telling suppliers to shape up cannot be expected to have much of an impact. One example of a weak response to CSR is that of a focal firm which said, ‘we ask our suppliers to adhere to the rules, and if we have a continued suspicion of improper conduct we send them a letter’. Not only does that not help suppliers to develop, it also does not take active ownership of the challenge. Even worse – while this was happening – the firm continued to award business based on supplier price levels, with no consideration for the impact of these price levels on labour practices. But progress can be made in comparatively difficult circumstances, as Case study 4.5 illustrates.

#### CASE STUDY 4.5

### Eliminating child labour from the Sialkot soccer ball industry

Nearly 75 per cent of soccer balls were produced in Pakistan in 2002. Most of these were produced in the Sialkot district, Pakistan’s ‘export capital’ close to the border with India. However, an International Labour Organization (ILO) study in 2002 showed that more than 7,000 children aged between 7 and 14 were stitching footballs on a full-time basis, working between 10 and 11 hours/day and earning between PKR 20 and 22 per ball (1€ = PKR 81). Production ranged from 3 to 5 balls/day per person. An article in *Life* magazine appeared in June 1996, featuring Tariq, a 12-year-old, stitching balls in Sialkot. This resulted in pressure on international brands like Adidas, Reebok and Nike to ensure that their products were not produced with child labour. The ILO brokered the *Atlanta Agreement* (2001) to eliminate child labour from the soccer ball industry through improved monitoring.

However, monitoring was difficult to implement. Local ‘manufacturers’ outsourced work to middlemen, who in turn dealt with home-based stitchers. These could be whole families, including children. Payment was on a ‘fixed price’ basis, so there was no cost advantage whether the worker was adult or child. The anonymous nature of the network meant that manufacturers had no idea what age of worker was involved.

An independent monitoring committee was set up, and manufacturers were invited to register. Once registered, manufacturers had to declare details of their entire network – including the number of stitchers, daily production, location of stitching centres and names of the middlemen. This was to be done gradually over a period of 18 months. And once declared, stitching centres were to be subject to random visits. If child labour was discovered, the manufacturer was instructed to fix the situation. Repeated violations resulted in the manufacturer being withdrawn from the register and reported to international buyers and retailers. Within a few years, practically all of the manufacturers had registered.

Saga Sports, the largest manufacturer, decided to go a step further. It would stop the use of child labour completely by eliminating outsourcing and concentrating production in custom-built stitching facilities which Saga would manage. While Pakistani law allowed children to start work at the age of 14, Saga decreed that it would only employ workers aged 18 or over. Age would be verified against national identity cards and birth certificates. Once confirmed, employees benefited from a pay structure ‘equivalent to university teachers in Pakistan’. Employee benefits, such as free health checks and medical help, meals and transport, were introduced. Saga saw these benefits as compensation to families who had lost income as a result of the elimination of child labour.

While Saga’s actions have helped to purge child labour from the football stitching industry in an exemplary way, there are other sectors in which children can earn money.



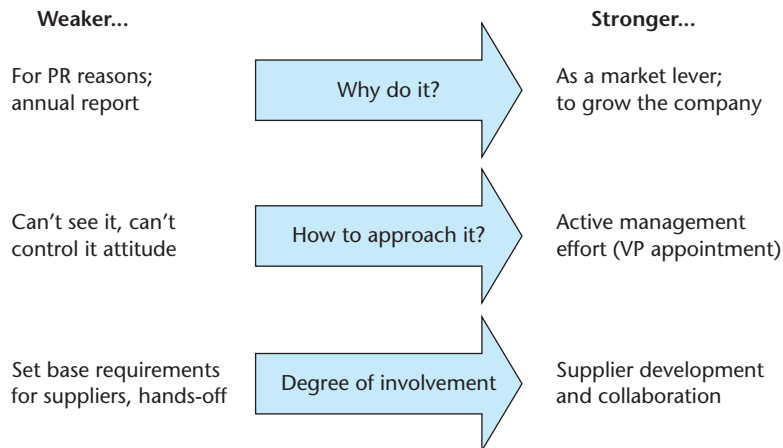
Sialkot is also famous for leather goods and surgical goods, where international pressures are more difficult to focus. Easy availability of work, lack of meaningful education opportunities and a 'poverty of thought' prevalent in the community could mean that the problem may only be transferred elsewhere.

(Source: Adapted from Hussain-Khaliq, 2004)

### Question

- 1 What further changes are needed for there to be a sustainable change in the incidence of child labour in developing countries like Pakistan?

More progressive firms are now beginning to use CSR as a market lever – not just to make them look good in the eyes of the consumer, but to expand the firm with new products at premium prices. An example is 'fair trade' products. Such firms are taking active ownership over the challenge – for example, NEC goes into considerable detail to specify CSR actions for suppliers in a lengthy handbook it has published. Nike has appointed a CSR Vice President, as noted above. Finally, companies such as NEC, Nike and HP invest time and resources in helping suppliers develop into more CSR-adept firms. They visit suppliers, conduct audits to identify improvement opportunities and proactively carve out opportunities to collaborate on achieving improvements.



**Figure 4.15** CSR practices in the supply chain

Examples of CSR efforts include:

- incorporating CSR standards and suggested efforts in purchasing policies (see the NEC example above and Table 4.8);
- conducting supplier audits to identify improvement opportunities, and following up on issues that are found (do not say you can't see it when you can go and look!);
- taking ownership of CSR initiatives by running supplier development sessions, and by collaborating on improvement projects;

- incorporating CSR into decision making by accepting a price premium for goods which conform to CSR standards.

**Table 4.8** NEC CSR supplier requests

Risk management priority	Action item
(CSR general requirement)	Promote positive CSR activities Contribute to the society and community
Product quality and safety	Ensure product safety Establish and apply a quality management system
The environment	Control hazardous chemicals in products Control hazardous chemicals in manufacturing Establish and apply an environmental management system Minimise environmental pollution (water, soil, air) Obtain environmental permits Promote resource and energy saving by reusing, reducing and recycling Promote greenhouse gas reduction Promote waste reduction Disclose environmental preservation activities
Information security	Secure computer networks against threats Prevent the leakage of personal information Prevent the leakage of confidential information of the customer and third party
Fair trading	Prohibit corruption and bribery Prohibit abuse of a superior position Prohibit the offering and receiving of inappropriate profit and advantage Prohibit impediment to free competition Provide correct information on products and services Respect intellectual property Use appropriate company information Detect injustice promptly
Occupational health and safety	Apply safety measures for equipment and instruments Promote safe activities in the workplace Promote hygiene in the workplace Apply appropriate measure for occupational injuries and illnesses Properly manage disasters and accidents Be careful about physically demanding work Promote safety and hygiene in all company facilities Promote health maintenance programmes for employees
Human rights	Prohibit forced labour Prohibit inhumane treatment and infringements of human rights Prohibit child labour Prohibit discrimination Pay appropriate wages Control working hours Respect the right to freedom of association

(Source: NEC Group CSR Guideline for Suppliers, [www.nec.co.jp/purchase/pdf/sc\\_csr\\_guideline\\_e.pdf](http://www.nec.co.jp/purchase/pdf/sc_csr_guideline_e.pdf))

**Activity 4.5**

List possible CSR concerns in the supply chain and the possible impact on the focal firm making and selling the end product if they go wrong and if they go right

## Summary

### *Why international logistics?*

- A major driver of the internationalisation of business has been labour shortages and costs in established markets, and the availability of low-cost production in newly industrialised regions. A further driver has been the need to follow customers into new local markets, and to create new learning opportunities.
- This has created phases in internationalisation of operations, and hence of the logistics pipelines that are associated with them. Logistics pipelines differ from market to market and from company to company over time.
- Global sourcing can create economies of scale for transportation through multiple consolidation as organisations orchestrate their global networks, and focus key areas such as manufacturing and R&D.

### *What are the logistics implications of internationalisation?*

- Despite the obvious benefits of global sourcing, focal firms should not ignore the logistical complexities and operational costs associated with sourcing globally (including longer shipment times and higher shipping costs) when deciding their internationalisation strategies. Increased complexities and costs are often ignored or only partially recognised in the rush to obtain lower piece part prices.

### *How do we organise for international logistics?*

- New solutions for layering and tiering the supply network are being tried out, such as co-location of suppliers with OEM plants in the auto industry. Meanwhile, the role of individual plants may be modified to allow more flexible response to local markets, for example by carrying out final assembly in local distribution centres.
- The key to success of internationalisation strategies is the rationalisation of sourcing, production and distribution. At the same time, the organisation needs to be sensitive to local markets and preferences. Crucial also is to ensure risk preparedness in international supply chains and to factor in corporate social responsibility policies proactively.

## Discussion questions

- 1 What are the benefits and limitations of international logistics? Illustrate your response by referring to the sourcing of standard shirts and fashion blouses (shown in Table 1.1 in Chapter 1) from manufacturers in the Far East.
- 2 Tiering of the supply network is referred to in section 4.4.1 above, and also in Chapter 1, section 1.1, and in the Global Lighting case study at the end of Chapter 2. Describe the advantages of tiering in terms of globalisation, touching on areas such as outsourcing and the focused factory.
- 3 Identify six potential sources and causes of risk in global supply chains. Use the reference to Peck (2003) below to propose counter measures.

## References

- Bartlett, C.A. and Ghoshal, S. (1989) *Managing Across Borders*. Boston: Harvard Business School Press.
- Ferdows, K. (1989) 'Mapping international factory networks', in Ferdows, K. (ed.), *Managing International Manufacturing*, pp. 3–22. Amsterdam: Elsevier Science.
- Helferich, O.K. and Cook, R.L. (2002) *Securing the Supply Chain*. Oak Brook: Council of Logistics Management
- Hussain-Khaliq, S. (2004) 'Eliminating child labour from the Sialkot soccer ball industry', *The Journal of Corporate Citizenship*, Spring, pp. 101–7.
- Leeman, J. (2007) *Supply Chain Management: integrale ketenaansturing*. The Hague: Pearson Benelux.
- Peck, H. (2003) *Creating Resilient Supply Chains: a practical guide*, and *Understanding Supply Chain Risk: a self-assessment work book*. Available for free download, courtesy of the UK Department for Transport, at [www.som.cranfield.ac.uk/som/scr](http://www.som.cranfield.ac.uk/som/scr).
- van Hoek, R.I. (1998) 'Reconfiguring the supply chain to implement postponed manufacturing', *International Journal of Logistics Management*, Vol. 9, No. 1, pp. 95–110.
- Yip, G.S. (1989) 'Global strategy ... in a world of nations?', *Sloan Management Review*, Fall, pp. 29–41.

## Suggested further reading

- Dicken, P. (2003) *Global Shift: Reshaping the global economic map in the 21st century*. London: Sage Publications.
- Dyckhoff, H., Reese, J. and Lackes, R. (2004) *Supply Chain Management and Reverse Logistics*. New York: Springer.
- Gourdin, K.N. (2006) *Global Logistics Management: A competitive advantage for the 21st century*, 2nd edn. Oxford: Blackwell Publishing.
- Grayson, D. and Hodges, A. (2004) *Corporate Social Opportunity!: Seven steps to make corporate social responsibility work for your business*. Sheffield: Greenleaf Publishing.



## CHAPTER 5

# Managing the lead-time frontier

### Objectives

*The intended objectives of this chapter are to:*

- introduce time-based competition definitions and concepts;
- show how the lead time needs to be managed to serve customer expectations;
- explain how organisations compete through responsiveness.

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

- how organisations compete through managing lead time;
- how time can be used as a performance measure;
- P-times and D-times and the consequence when they do not match;
- different solutions to reduce P-times;
- how to apply a methodology for implementing these solutions.

### Introduction

This chapter takes a strategic and a managerial view of time, and of the impact of time on logistics performance. It provides an introduction to the nature of time-based competition and how time can provide competitive advantage in logistics. As we saw in section 1.3, logistics supports the competitiveness of the supply chain as a whole by meeting end-customer demand through supplying what is needed, when it is needed and at low cost. Because logistics supports time and place commitments in the supply chain, it can be argued that the lead-time frontier accounts for at least half of logistics success.

Competing on time is the principle of taking timely completion of supply chain tasks to a higher level: that of compressing cycle times for supply chain operations for internal and external benefits. External benefits include:

- lowering overall cycle time and providing services faster;
- outrunning competition.

These benefits are especially important in the context of improving responsiveness to customers and volatile markets. Chapter 7 will return to these points.

Internal benefits include:

- shorter cash-to-cash cycles, thereby releasing working capital and reducing asset intensity of the supply chain;
- lowering inventories in the pipeline and storage by speeding up turnover times for work in progress and inventory.

These benefits are especially important within lean or waste elimination approaches, as will be developed in Chapter 6. This chapter focuses on how time-based solutions link with competitive strategy.

### Key issues

This chapter addresses five key issues as follows:

- 1 **The role of time in competitive advantage:** using time in logistics management and strategy.
- 2 **P:D ratios and differences:** the gap between the time it takes to get the product to the customer (P-time) and the time the customer is prepared to wait (D-time).
- 3 **Time-based process mapping:** how to create visibility of time across the network.
- 4 **Managing timeliness in the logistics pipeline:** strategies and practices for coping when P-time is greater than D-time.
- 5 **A method for implementing time-based practices:** implementing time-based practices across the network.
- 6 **When, where and how?** Tactical considerations in planning a time-based strategy.

## 5.1 The role of time in competitive advantage

*Key issue: What is time-based competition, how does it link to other initiatives, and what is the purpose of it?*

### 5.1.1 Time-based competition: definition and concepts

Many attempts at business improvement focus on cost reduction and quality improvement. While a great deal of benefit has been achieved by many organisations through these efforts, most of the obvious opportunities for improvement have now been taken. This has led to time emerging as a fresh battleground in the search for competitive advantage. A working definition of competing on time is:

**The timely response to customer needs**

The emphasis in this definition is on 'timely'. This means responding to customers' needs on time – neither early nor late. The implication of this definition is that the organisation must focus its capabilities on being responsive to the customer.

Traditionally, people often have the opinion that you cannot have low cost *and* high quality, or low cost *and* fast delivery, or fast delivery *and* high quality. The belief is that some kind of trade-off is necessary, meaning that more of one

advantage means less of another. For example, better quality means putting in more inspectors, which increases costs. Such thinking was shown to be flawed when the quality movement of the 1980s demonstrated that good quality actually *reduces* costs (Crosby, 1979). The trade-off between cost and quality can be altered by *preventing* defects from happening in the first place through such measures as:

- designing the process so that defects cannot occur (error proofing);
- designing products so that they are easy to make and distribute;
- training personnel so that they understand the process and its limitations.

This leads to savings in *detecting* defects, by removing the need for inspection, and in avoiding the *failures* that lead to scrap and the cost of resolving customer complaints. The result is that overall quality costs (prevention + detection + failure) can be reduced by spending more on prevention.

Understanding trade-off relationships lies at the heart of a focal firm's ability to achieve competitive advantage. Relationships that need to be understood and harnessed include recognising that:

- costs do not have to increase in order to improve quality, they can reduce;
- costs do not have to increase when lead times are reduced. It may be possible to reduce both in some processes (see Figure 3.9);
- costs do not have to go up as product variety increases and times reduce, they can also reduce.

Each of these trade-offs has important links with strategy. A focus on responsiveness to the customer means that a focal firm needs to change the way it goes about its business. This involves redesigning systems and processes to give priority to time. In these circumstances, cost plays a supporting role – since time and cost have distinctive strategy implications (section 1.4.3) and are not linearly related (section 3.3.2).

### 5.1.2 Time-based initiatives

When a company attacks time directly, the first benefits to show up are usually shorter cycle times and faster inventory turns. Lower overhead costs usually follow, as the costs of dealing with breakdowns and delays begin to disappear from the system. So by seeking time reduction, *both* time reduction and cost reduction are often the rewards.

Attacking the sources and causes of delays helps reduce quality defects in product and service. Thus by focusing on time, customers' needs are met more quickly and a quality benefit will often accompany the time benefit.

### 5.1.3 Time-based opportunities to add value

There are several ways in which a company can use time to help meet customer needs better and therefore add more value. The most common examples of this are:



- increased responsiveness to customer needs;
- managing increased variety;
- increased product innovation;
- improved return on new products;
- reducing risk by relying less on forecasts.

We deal with each of these opportunities in turn.

### *Increased responsiveness to customer needs*

Increased responsiveness to customer needs is the most common reason for organisations to invest in time-based approaches to performance enhancement. Many elements of customer service are dependent upon time. These include how long it takes to deliver a product or service, achieving on-time delivery and how long it takes to deal with customer queries, estimates and complaints.

High levels of responsiveness to customers tend to correlate to greater loyalty from them and therefore more business over time. Such responsiveness is also addictive to the customer, creating customer lock-in. Once they get used to short lead times they often reorganise their own products and services to customers to make use of responsiveness from their suppliers, such as by holding less inventory and promising their own customers shorter lead times. Once they start to do this they find it hard to accept longer times again.

Customers of time-based organisations do not have to carry as much raw material or component stock and therefore benefit from a cost saving. In order to profit from the service they provide, a time-based organisation needs to demonstrate to customers that the total cost of doing business is lower and to recover some of this value. This can be achieved by winning more business and/or by charging more.

### *Managing increased variety*

Shortened lead times in product development, the supply chain and manufacturing help factories deliver a variety of products without the traditional cost penalty. The same is also true of service organisations that can design and supply a range of new offerings in line with changes in market needs. By reducing overall lead time, product complexity and process set-up times, the production of a particular product can be scheduled more frequently with smaller production batches. This improves the variety of products available to a customer over a given time.

### *Increased product innovation*

Time-based organisations are more likely to meet customer needs accurately by using short product development times to produce new products that meet customer needs. The shortening of product development lead time means that innovations can be capitalised on to maximum effect. If a company innovates through product design faster than its competitors it will become increasingly

competitive. Conversely, if your competitors are innovative then reducing the time to develop imitations will underpin a 'fast follower' strategy to keep up.

### *Improved return on new products*

Reducing product development lead time means that a product can get to market earlier. This has a number of important advantages:

- the sales life of the product is extended;
- a higher price can be charged;
- new customers can be won;
- a high market share can be won through building upon the initial lead.

Each of these benefits can add to the other. Therefore, being first to the market allows a higher initial price to be charged, helping to recoup development costs quicker. This revenue will support investment into further developments necessary to retain these initial customers. Meanwhile, the initial product can continue to be sold, generating cash through its high market share. Being first in the market maximises the product life until the time when it becomes obsolete.

An impressive approach to the issue of obsolescence is attributed to Akio Morita, the co-founder of Sony and inventor of the Walkman. He believed that it was his job to make his own products obsolete before competitors did so. In effect, not only was his aim to make innovative products, he also sought to build on this success in the knowledge that if he did not then someone else soon would.

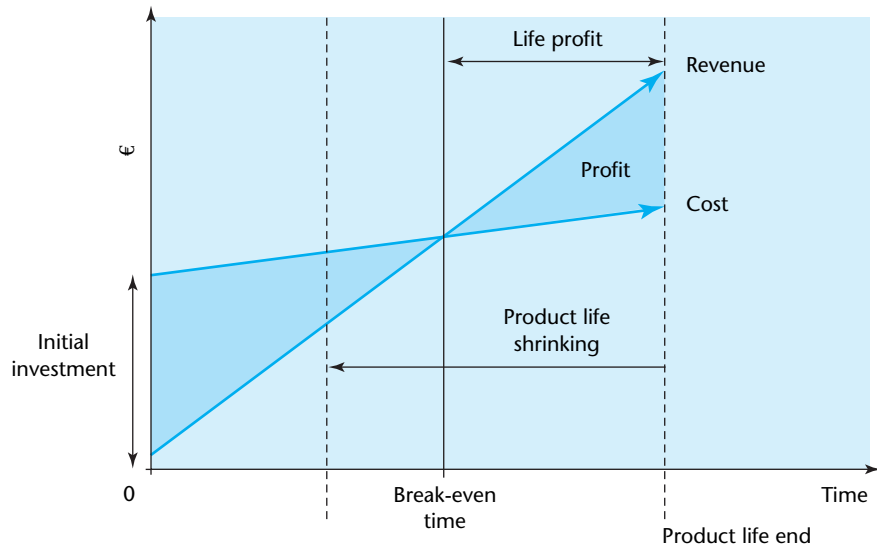
The related argument here is that of *break-even time* rather than the break-even volumes discussed in Chapter 3. Traditional break-even analysis focuses on the volume of product needed to be moved before the investment pays off. Given shortening times-to-market and compressed product life cycles (e.g. from 6 months to 45 days of shelf-life for Nike footwear) the analysis shifts towards the question 'how long before break-even is reached?' Figure 5.1 illustrates the point.

As product life cycles shrink, so the time window of opportunity for making profits also shrinks. This consideration means that a new product must achieve its break-even time more quickly.

### *Reducing risk by relying less on forecasts*

There is a saying in industry that there are only two types of forecast: wrong ones and lucky ones, and there are precious few of the latter! It is certainly true that the further ahead a company tries to forecast, the less likely the forecast is to be correct.

One of the aims of a time-based initiative is often to minimise how much forecasting is needed. By reducing the production lead time, the period when demand is uncertain becomes shorter. Forecasting over a shorter time period results in a more reliable forecast and therefore less risk of stockouts or obsolete stock. It also reduces the amount of finished goods stock needed, which frees up working capital.



**Figure 5.1** Break-even time

In product development, risk is also reduced by shortening lead times. This is achieved when the specification for the new product can be fixed with more certainty, thus improving the chances of market success.

The ultimate goal is to reduce production time so it lies within the lead time it has been given by the customer to deliver. In this situation, no forecasting is needed and all production is done in line with actual customer orders. The implications of reducing production time in relation to the demand time of customers are very significant and we have devoted the whole of section 5.2 to addressing them.

#### 5.1.4 Time-based opportunities to reduce cost

The second key element of time-based competition is to reduce cost and therefore improve productivity through the elimination of non-value-added time in processes. This means that wasted lead time and unnecessary tasks that are not actually adding any value in the customer's eyes should be identified and eliminated. Stopping unnecessary tasks and removing wasted time from those that remain lowers cost by:

- reducing the need for working capital;
- reducing the need for plant and equipment capital;
- reducing development costs;
- reducing quality costs.

We address each of these in turn.

### *Reducing working capital*

Increasing the speed of flow through processes by eliminating unnecessary steps and wasted time reduces the amount of money tied up in the system. In the short term the focus will be upon inventory. Here manufacturing lead time is inversely proportional to work-in-progress levels. By focusing on time we decrease raw material, work-in-progress and finished good stocks. Lowered inventory levels result in reduced working capital. As already mentioned, returns on working capital will be improved by reducing obsolescence caused by making to stock and not to order.

### *Reducing plant and equipment capital*

Over the longer term, processes become more visible, inventory levels reduce and opportunities to minimise capital expenses become more visible. These opportunities include the removal of equipment not employed in activities that add value. Initial items to remove will include the racking and pallets formerly used to store inventory. Next will be a purge of unnecessary equipment in offices, stores and production, including the jiggling for unnecessary operations of obsolete parts.

In terms of what to do with superfluous items, some may be sold and capital recovered. The remaining items should just be skipped. While it may seem stupid to simply throw away equipment given how much some items have cost, these are sunk costs. If the equipment can no longer be used to generate revenue, all it does is incur further costs, such as maintenance, and the floor space it occupies will have many better uses.

As a company embraces time-based competition then success in the marketplace will increase demand for products and services that the customer really values. To make way for these means that space will be at a premium in the company. This is just the driver needed to replace the old with the new.

### *Reducing development costs*

Shortened lead times in product development are achieved in part by more effective use of development resources through elimination of rework and reduction of distracting superfluous projects. This leads to cost reductions as the time spent on a given project is less.

### *Reducing quality costs*

One of the main elements in improving quality is to reduce the time between an error being made and the problem being detected. The sooner the error is detected the smaller the amount of the product affected by it. Reducing lead times has a positive effect on the speed of feedback and hence quality costs are reduced.

In keeping with the total quality movement, time-sensitive organisations will only become consistently responsive if they strive to maintain quality processes. This means that as defects and errors arise they are detected quickly, root causes identified and effective solutions installed to ensure they cannot recur.

**Activity 5.1**

List six applications of responsiveness in an organisation: for example, 'external phone calls answered within five rings'. How many organisations can you think of that compete overtly on time, such as the Vision Express example given in Chapter 1?

**5.1.5 Limitations to time-based approaches**

Despite the clear benefits of time-based approaches to logistics management described above, there are often barriers to its application, as well as limitations to its relevance.

Two basic limitations to the need for time-based logistics management are the need for speed and the degree of speed required. Not all operating environments require speed. Product demand that is very predictable such as high-volume, low-value commodity products can be planned well in advance and processed without a particular speed. Not all customers value speed as they may be able to order well in advance of delivery. Delivery before the parts are needed creates unnecessary inventories. In particular, when there are costs involved in creating speedy delivery, customers may trade that off against ordering in advance. Only selected parcels need to be shipped with express carriers, for example.

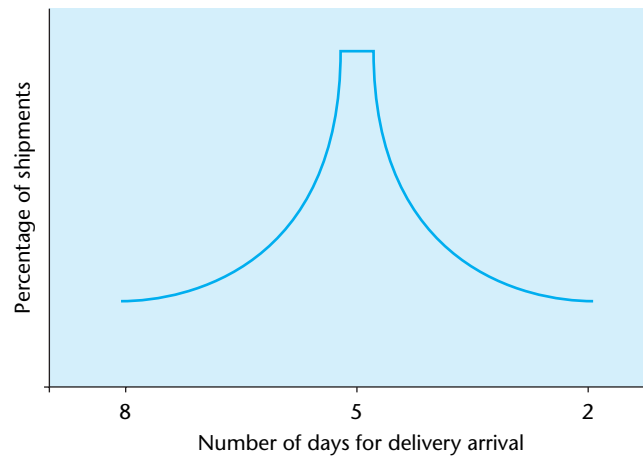
A particular issue with the costs involved in speeding up logistics processes in the supply chain is the distribution of those costs between companies in the supply chain. It is well known that JIT deliveries, for example, may generate significant costs for suppliers whereas the customer may experience most of its benefits (such as low process inventories and rapid delivery). Toyota is capable of manufacturing a car in five days but has decided not to do so because of the pressure it would place on its suppliers and its distribution processes, creating costs that are not expected to be outweighed by revenue opportunities in current market circumstances.

An additional issue is that time-based approaches might lead to superior performance only being achieved on a limited number of occasions. An illustration of this situation is shown in Figure 5.2. In this example a supplier demonstrates that it is able to deliver in only one day. However, it is clear that this was achieved for only a minor portion of shipments, which does not mean that customers can depend on shipments being consistently completed within a day. Rather customers will order seven days in advance, where the required 99 per cent service level for deliveries is achieved. Time-based approaches are not about managing exceptions but managing for speed reliably.

**5.2 P:D ratios and differences**

**Key issues:** What are P- and D-times, and why are they important to logistics strategy?

P-time and D-time are measures of performance of the supply pipeline. They are explained in section 5.2.2, but let us first look at the importance of time as a performance measure.



**Figure 5.2** Distribution of shipment cycle times in days

### 5.2.1 Using time as a performance measure

One of the major advantages of a time-based approach to managing processes over one based on cost or quality is the ease with which time is understood as a measure. While cost and quality are open to differences in interpretation, time is an absolute measure. Stalk and Hout (1990) refer to the ‘time elasticity of price’, where the price that customers are prepared to pay is often related to the delivery speed. For example, Talleres Auto in Case study 1.4 was able to charge premium prices for spare parts in breakdown situations because these were ‘distress purchases’.

Cost is a more subjective measure that is open to interpretation, three examples of which we saw in section 3.2. Many people have a poor grasp of how costs work in practice, and do not understand how the actions they take affect others. An all too frequent example is saving costs in one part of the supply network only to cause extra costs elsewhere. While quality is an important area for organisations to improve, there are a number of different ways to interpret ‘quality’. Garvin (1988) lists eight *dimensions of quality*, which depend on the perspective taken, such as product quality (design), conformance quality (manufacturing), and fitness for use (customer). In order for quality measures to be useful they often require a statistical approach that can easily be misunderstood by those who have not been explicitly trained. Deming’s famous Monte Carlo experiments with a funnel and glass marble (Deming, 1986: 327) illustrate the perils of interfering with a stable process:

**If anyone adjusts a stable process to try to compensate for a result that is undesirable, or for a result that is extra good, the output that follows will be worse than if he had left the process alone.**

Frequent interference in a stable process increases the variability of its output! Time, on the other hand, is a measure that everyone understands. Every person has access to the exact duration of a second, minute or hour, thanks to clocks using the same units of time. Time allows people across an organisation, with

very little training, to measure the performance of a process or activity. Using this measure anyone can answer the key question:

**Do we meet the target the customer has set for us?**

By comparing this measure with one taken for the performance of competitors, we can easily answer the next key question:

**How good are we compared with the competition?**

If we take a reason for measuring performance as being to understand the effect of making changes to a process, we can more easily answer the question:

**Is our performance getting better or worse?**

By using measures that are simple to understand, people can see the big issues more easily. They can measure and quantify the flow of activities directly, and ask themselves whether each of the steps in a process is adding real value or just adding cost. By following the flow through a process we can see where time is lost (see Chapter 3). This allows us to translate the data into time-reduction and cost-reduction opportunities. Looking at cost analyses alone does not tell anyone where to save time.

## 5.2.2 Using time to measure supply pipeline performance

In the same way that time can be used to measure the performance of a process within a company so it can be used to measure the supply pipeline. Two measures are presented below that are key to understanding supply pipeline performance: P-time and D-time.

### *P-time*

The first measure of performance for the total supply process is to determine how long it takes for a product or service to pass through it. This measure is used to identify the total logistics lead time, also known as the *P-time* or production time.

Just to be clear, the P-time is a measure of the total time it takes for a product to go through a pipeline. Thus it includes source, make and deliver lead times: it is not just the time it takes to supply from stock.

The measure starts the moment a new order is raised. It includes all the time needed to take a product through all the processes necessary to make and deliver that product. It is important to be clear about when these activities start and end in order for the measure to be consistent should you want to measure performance for a number of processes, including those of competitors. For a first attempt at this measure take the starting time as the point when an order is raised. Consider the total time needed to make and deliver a new product or batch of products. This includes the time needed to procure the longest lead parts and the total manufacturing time. The end of the process is the time when you fulfil an order and send the product to the customer.

When you are competent in measuring this time and creating useful data you should improve the measure you take. Instead of measuring from when you

receive the order, measure from when the person in the customer's company realises they have a need. The end point is not when you send the product but when it is received by that person. This measure incorporates the internal process of the customer's company for informing you of the order and the steps they take to receive your delivery and get it to where it is needed. Exploring this process will reveal useful opportunities where you can help the customer to help themselves, thus strengthening your competitive position.

### *D-time*

The time for which a customer is willing to wait to have their demand fulfilled is the *D-time* or demand time. D-time varies considerably. For example, the time a customer is willing to wait for 'fast food' is comparatively short. Assuming you are in a city with plenty of options, once you realise you are hungry you will probably want to be eating within 10 minutes. This D-time will include the time it takes to walk to the cafeteria/restaurant, wait in a queue, sit at a table and be served. By contrast, as a customer of an up-market restaurant, you may have travelled for an hour, spent 20 minutes in a reception area over an aperitif and study the menu for 15 minutes, before happily waiting for a further half an hour for the meal to be cooked and served.

In addition to the obvious differences in grade and choice of food, the implication from a supply chain point of view is that the two restaurants must be organised in totally different ways to deliver the food within their customers' D-time. Interestingly, the same customer may visit both restaurants on the same day and accept the two different delivery systems. You do not *expect* to wait at a fast-food counter, but you *do* expect to linger over a meal in a high-quality restaurant.

Similar examples can be found in other industries. Buyers of new premium cars expect to wait a month or two for delivery when they place an order. Some people are not prepared to wait so long, but are prepared to accept a second choice of colour instead of their first, especially if the dealer gives a discount! Manufacturers of vehicles for customers with short D-times face increased supply chain challenges compared with those who have long ones. If it is not possible to make a car to order within the expected D-time, then the manufacturer is forced to carry out some or all of the logistics processes speculatively. The most risky scenario is to make the whole car for stock, hoping that the forecast mix of diesel and petrol, of left- and right-hand drive and so on is correct. But taking such a risk is necessary to cope with the customer who wants to drive away a vehicle the same day he or she enters the dealer's showroom.

It is worth pointing out the parallels in new product development. Some new product development is a race to get new ideas and innovations to market. However, others involve hitting specific customer-defined windows of opportunity for getting products to market. This is particularly true for lower-tier suppliers in supply chains. These two concepts have different objectives, as shown in Table 5.1.

Suppose your customer announces their intention for the launch of their new product. They usually give a number of deadlines to would-be suppliers, including:



**Table 5.1** Getting ideas to market

	Idea to market	Meet window of opportunity
Objective	Reduce lead time for turning idea into cash	Delay commitment of cash Develop fresher, more fashionable product Operate within shorter, less unstable forecast period
Examples	Electronics – maximise advantage in a new market segment before competitors respond	Summer clothing – delay outlay on raw materials to improve cash flow and delay commitment to particular designs until last possible time
	Pharmaceuticals – get new drug to market to (1) save life and (2) begin to recover development spending	New car launch in four years' time – delay spend on tooling and delay design freeze so latest technologies can be incorporated

- date for tenders;
- date for first-off samples;
- date for volume launch.

These are the D-times for each stage of product development. As a potential supplier, you must be able to meet all of these windows. Indeed, each supplier must be capable of meeting all of these deadlines for the product to meet its launch date successfully.

### 5.2.3 Consequences when P-time is greater than D-time

P-time should be measured for each separate product group, because each will have different internal processes. D-time should be measured for each different market segment that is served, because customers may have different needs (e.g. prepared to wait/not prepared to wait).

Armed with this data, P-times and D-times should be contrasted for each product/customer group to see if P-time is more than D-time. A simple way to do this is by drawing them on a graph as time lines, as shown in Figure 5.3. The length of the arrows shown in Figure 5.3 represents *time*. The arrow for the P-time represents the time taken for buy, make and sell processes. The D-time arrow represents the time the customer is prepared to wait for an order to be fulfilled.

Comparing the length of the two arrows, it can be seen that the time it takes to respond to an order is longer than the customer is prepared to wait. Thus the P-time is greater than D-time. The consequence is that this focal firm is not able fully to make to order. On the other hand, it may be possible to complete the final 'make' processes such as assembly and test within the customer required D-time. Such a strategy is called *assemble to order* (ATO). This is basically how Dell manages to supply the computer you want so quickly.

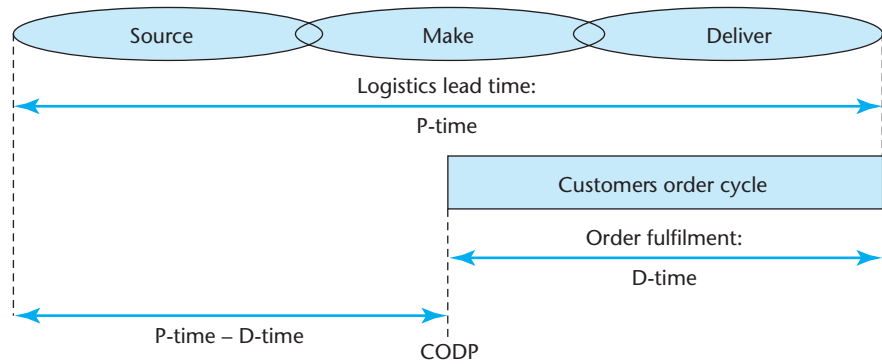


Figure 5.3 When P-time is > D-time

Activity 5.2

Assess the benefits and concerns that may arise as a result of the relative sizes of P-time and D-time. Compile your views in the table below:

	P-time greater than D-time	P-time = D-time	P-time less than D-time
Benefits	• • •	• • •	• • •
Concerns	• • •	• • •	• • •

The vertical dotted line which separates D-time from P-D time in Figure 5.3 is *the customer order decoupling point (CODP)*. This divides the point to which a focal firm carries out processes to known customer orders from the processes it has to carry out speculatively. We return to the importance of the CODP in terms of planning and controlling materials in the next chapter.

CASE STUDY 5.1

Wiltshire Distribution Transformers

Sid Beckett, the Managing Director of Wiltshire Distribution Transformers (WDT), had concentrated on a new generation of simplified, modular designs that used proven US technology. He had energetically exploited the market advantages this had given. WDT now has two major product ranges:

- TR 100: 3-phase, oil-cooled transformers with a power rating from 200 to 2000 kVA;
- PS 300: packaged substations that utilise TR 100 transformers with appropriate switchgear and LV control panels.

Judging by the number of enquiries, the market for both product ranges was now increasing.

### The new JIT system

Each product must be individually engineered to order (ETO). Formerly, this process had taken two weeks, because a design engineer had to develop an entirely new design from scratch based on the customer order. Designs have now been modularised as a result of the new system: that is, a new design is produced from a few hundred standard 'modules' that are held on file. This can be done by a sales engineer in a matter of hours. If a tender is accepted by a customer, it had formerly taken another two weeks to convert the tender information into specifications and drawings for manufacture. Today, it is possible simply to send the accepted tender information to the shop floor, and to use the set of standard engineering information already held on file to act as manufacturing instructions. The following is a list of the main features of the new JIT system.

### Enquiry processing

The engineer enters major design details (kVA rating, voltage ratio, product classification and quantity) into a computerised estimating program. From a list of 700 possible options, the selected ones to suit the tender requirements are added. From a library of material, labour and overhead costs, a tender price is calculated.

Should the customer accept this price, then a customer delivery date is agreed and the tender becomes the works order.

### Engineering instructions

WDT's efforts had resulted in the completion of a comprehensive library of standard drawings and instructions that covered all major options. The works order simply calls these up by reference number and description. The one exception is the fabricated cubicle that houses the packaged substations. This has to be individually designed. A simple CAD/CAM system enables the design and associated manufacturing instructions to be completed quickly. Presentations of the panels can be separately worked on and designed. The output is a set of computer numerical control (CNC) tapes for the relevant machines in the fabrication shop, and a set-up schedule indicating sheet size, clamp positions, list of tools, etc.

### Master production scheduling (MPS)

Standard networks are kept on file. Activity durations for each manufacturing process vary according to specific designs, and are picked up from the works order. Only bottleneck operations are scheduled, and can be loaded only up to 100 per cent of their capacity. Given the customer requirement date, the scheduling programme works backwards and loads activities to key resources so that the final assembly date will be met. The MPS acts by pulling demand through the manufacturing system (a process called pull scheduling).

Material requirements for each work centre for each order are calculated by means of a modular bill of material, which has been simplified as a result of the modular designs.

### Shop scheduling

The MPS generates operation release tickets (ORTs) for each scheduled process. The type and quantity of units required by the next process are withdrawn from the previous one as they are needed. When a work square becomes empty, an ORT is passed back to the preceding work centre to trigger a manufacturing operation. This serves as a signal (*kanban*) to the previous process to produce just enough units to replace those withdrawn.

Work is performed in sequence of ORTs, and is carried out only when an output square is available. Completed operations are marked up on the hard copy of the MPS, which is pinned to the wall of the works manager's office by the supervisors at the end of each shift. The MPS is updated for completed operations and new orders each week.

A combination of four weeks' reduction in the time taken to tender and the time taken to produce a manufacturing design, and a further two weeks' reduction in manufacturing times, has placed WDT in a pre-eminent position in the marketplace. Customers want to place orders for this type of equipment later and later in their own projects, so short lead times are a major benefit to WDT in the marketplace.

### Questions

- 1 Sketch out the main processes between a customer placing an enquiry and receiving delivery of a WDT transformer. Where has WDT really scored in terms of reducing this time?
- 2 What are the potential negatives of WDT's new JIT system in terms of limiting customer choice and short-circuiting the design process?

## 5.3 Time-based process mapping

### *Key issue: How do you go about measuring time in a supply network?*

The purpose of supply chain mapping is to generate visibility of the processes within the supply chain. Once this visibility has been achieved it is possible to benchmark similar processes. The processes we need to map are the actual processes that are taking place, not what is supposed to happen. Quality standards based on ISO 9000 require processes to be documented, but within the organisation the actual process undertaken may often differ considerably. When undertaking a supply chain mapping exercise it is the *actual* process that we need to focus on. The key is to track one order, one product, or one person through the process with respect to time. A map is a snapshot taken during a given time period. Workloads may vary during the course of a month, and so may the individual process times. Record the actual times that you observe. Most processes take place in batches, so if you are mapping a trailer being filled with tyres, record the time that the median (middle) tyre waits before being moved. The method of documentation of the process and the symbols to use are illustrated in Table 5.2.

Key operations and the subprocesses that can consume the most time and generate the greatest inefficiencies (e.g. waiting for transport) are revealed, enabling problem solving and improvement of the supply chain.

**Table 5.2** Example of process document

Step	Description	Symbol	Time	Notes
1	Machine complete	○	1:37	
2	Inspect	□	0:45	
3	Wait transport	D	5:53	
4	Transport to heat treat	→	0:08	
5	Wait heat treat	D	3:34	
6	Heat treat	○	4:15	

Symbol	Description
→	transport
▼	store
○	operation
□	inspect
D	delay

The following sections give an overview of the key stages involved in the time-based mapping process.

### 5.3.1 Stage 1: Create a task force

Before the mapping process can be undertaken it needs to be recognised that supply chain processes cross all functions of the organisation. It is therefore important to have all key functions represented. The task force must be assured of top management support. A project champion may also need to be appointed.

### 5.3.2 Stage 2: Select the process to map

It may not be feasible to map the total supply chain initially. Take an overview of the core processes within the organisation and the time they take before deciding on the priorities for detailed mapping. To get the organisation to 'buy in' to the project, a subprocess may be identified that has been a particular problem. This can act as a pilot for the task force, enabling them to prove that their methods really work. When selecting the process, ensure that there is a generic customer or group of customers that the process serves. A clear start (or trigger) and finish to the process should also be present.

### 5.3.3 Stage 3: Collect data

The most effective way to collect the data is to follow an item through the process. This is often referred to as *walking the process*. An actual component or order will be followed through all the stages of the process. Identify someone who is actively involved in each part of the process and knows what is really happening within the process; interview these key individuals. Get the interviewee to describe each movement of the item with respect to time. It can be useful to ask the interviewee to describe 'a day in the life of' that product or order. Remember the steps an item goes through are not just those where something is done: for example, items could be waiting or being moved, or may be sitting waiting for a decision to be made. Identify an appropriate level of detail at which to map the process. Initially it might be better to map at a high level to gain an overview of the process; one can always map in more detail if needed later.

### 5.3.4 Stage 4: Flow chart the process

Use the data collected by walking the process and the interviews with operators to sketch a flow chart so linkages and dependencies between steps can be clarified before constructing the time-based process map. This flow chart is used by the task force to ensure they have not missed any steps in the process.

### 5.3.5 Stage 5: Distinguish between value-adding and non-value-adding time

A rough definition of value-adding time is time when something takes place on the item that the end-customer is willing to pay for. The definition of value-adding time requires due consultation, and should be aligned with the overall business strategy. The business strategy should define the markets and segments, and the accompanying order qualifiers and order winners (see Chapters 1 and 2). Once the value-adding criteria at the strategic level have been defined, these can be translated into value-adding criteria at an operational level. The time data collected in stage 3 can then be analysed to identify the value-adding time. Value-adding time is characterised using three criteria:

- whether the process (or elements of the process) physically transforms the material that forms the input to that process;
- whether the change to the item is something that the customer values or cares about and is willing to pay for;
- whether the process is right the first time, and will not have to be repeated in order to produce the desired result that is valued by the customer.

Non-value-adding activity can be split into four categories: delay, transport, storage and inspection, using the categories from Table 5.2.

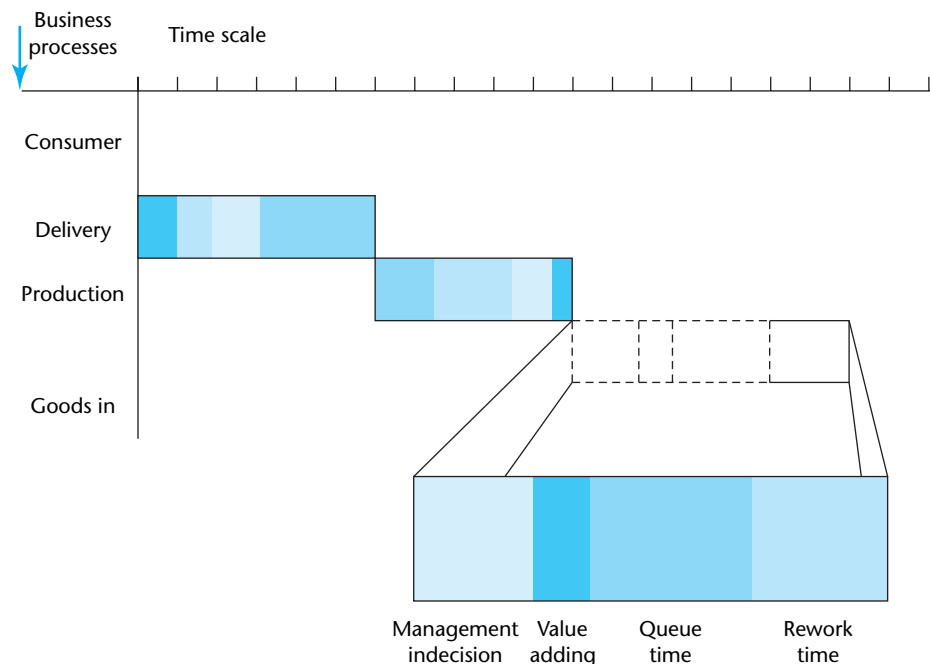
### 5.3.6 Stage 6: Construct the time-based process map

The purpose of the time-based process map is to represent the data collected clearly and concisely so that the critical aspects of the supply network can be communicated in an easily accessible way. The ultimate goal is to represent the process on a single piece of paper so that the task force and others involved in the project can easily see the issues. A simple Gantt chart technique can be used to show the process, and different categories of non-value-adding time can be represented on this. These categories will be dependent on the nature of each process. Figure 5.4 shows three operations processes (delivery, production and goods in), with the last one magnified to show four types of waste.

From the interviews and data from walking the process, extract the relevant data. It is sometimes useful to sketch a flow diagram so that linkages and dependences between steps can be clarified before constructing the map. This flow diagram can be used to approximate the total time that the business process consumes.

### 5.3.7 Stage 7: Solution generation

Once the time-based process map has been produced, the opportunities for improvement are generally all too obvious. The task force can collect ideas and categorise causes of non-value-adding activity using problem-solving approaches such as cause-and-effect diagrams. (A helpful condensed guide to problem-solving tools and techniques will be found in Bicheno, 2004.)



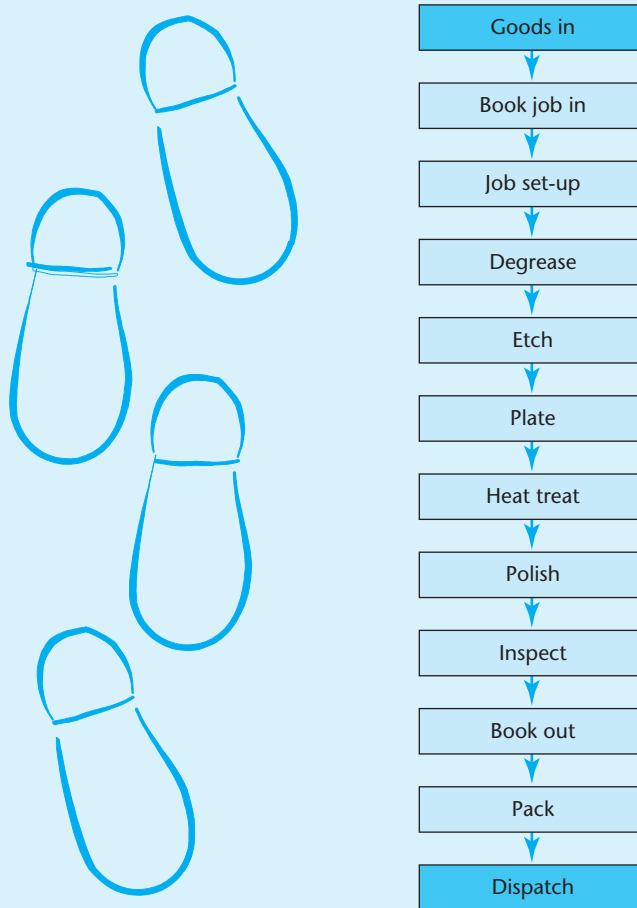
**Figure 5.4** Process activity mapping and sources of waste

The Electro-Coatings case study describes how the above principles were applied to a focal firm that produces electroplated parts for the automotive industry.

## CASE STUDY 5.2

### Electro-Coatings Ltd

Electro-Coatings Ltd electroplates parts for the automotive industry: for example, the marque badges fitted to the front of prestige cars. Customers were becoming increasingly demanding, resulting in Electro-Coatings' undertaking a review of its internal supply chain. The initial analysis by walking the process identified 12 key processes, shown in Figure 5.5.



**Figure 5.5** Walk the process (12 steps)

Once this initial map has been produced, each step was mapped in detail, and some 60 steps were identified. These steps have been summarised as a flow diagram in Figure 5.6, showing every process step.

An initial analysis of value-adding and non-value-adding time was undertaken. This is shown in Table 5.3, which summarises the total time, wasted time and value-adding



time for each of the 12 steps. These data were then used to produce a map with the value-adding (activity) time and non-value-adding (wasted) time shown as the series of 12 steps against total elapsed time in hours (Figure 5.7).

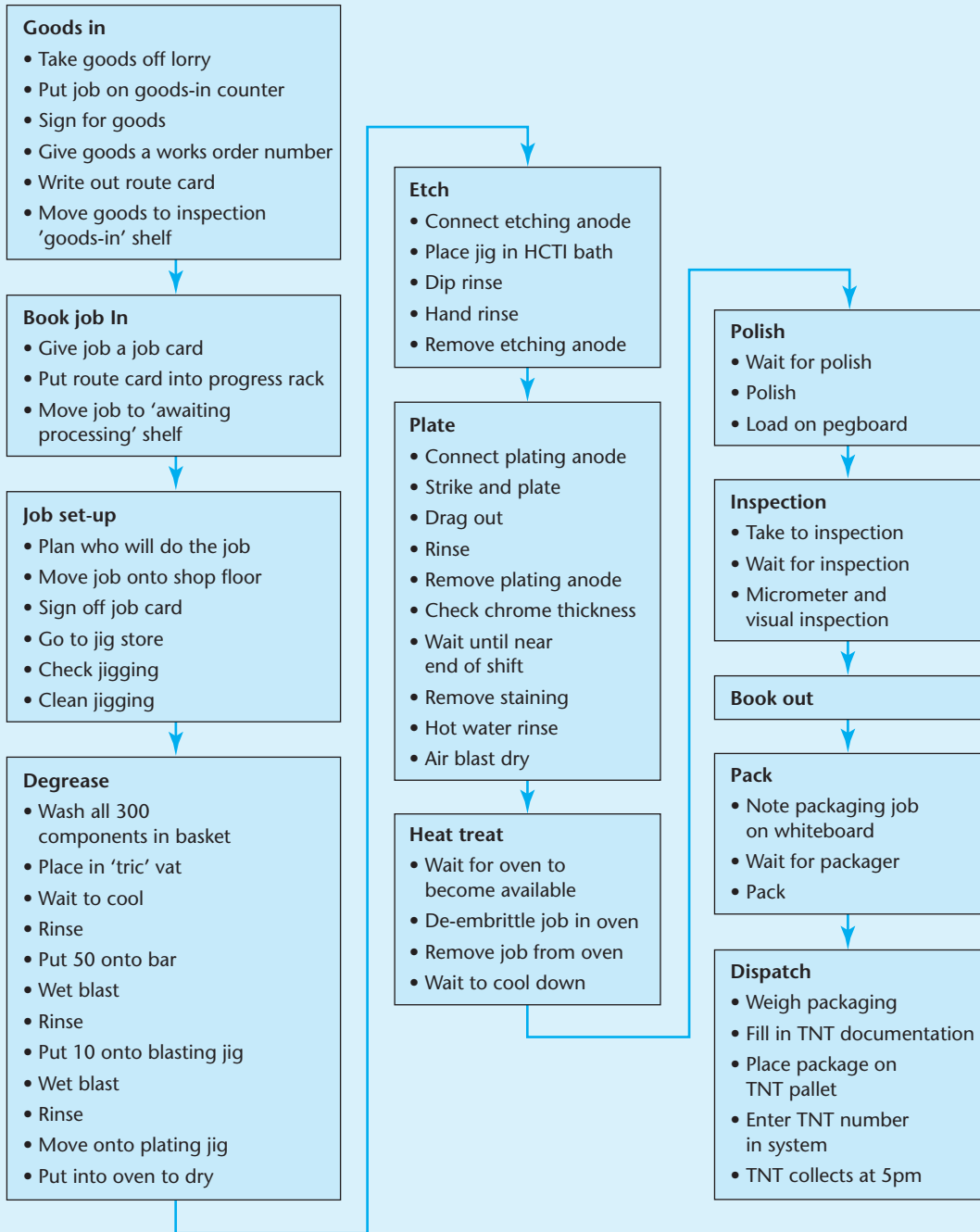
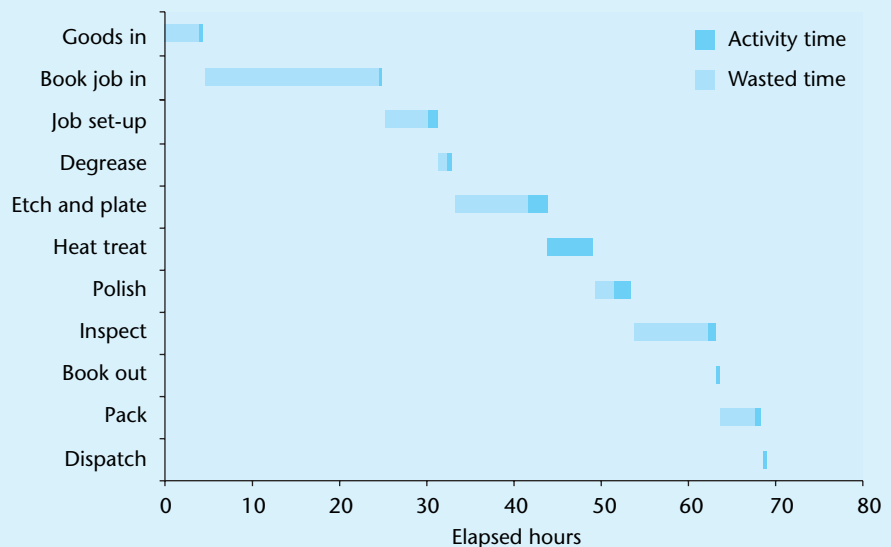


Figure 5.6 Identify every process step

The total process took approximately 70 hours. The project team held an afternoon meeting with those involved in the process, and the results of this brainstorming session produced the cause-and-effect diagram shown in Figure 5.8. This was then used to identify opportunities for improving the process. For example, the analysis revealed that jobs arriving goods inwards at 9.00am might not be input into the system until 5.00pm because the operator would undertake the computer inputting in one go at the end of the day. This resulted in manufacturing not having visibility of the updated order book until 9.00am the following morning. This was easily addressed by combining the booking-in process with the good inwards process, removing a further lead time. Figure 5.9 depicts the re-engineering process.

**Table 5.3** Time-based analysis data

	Total time/hours	Wasted time/hours	Activity time/hours
Goods in	0.00	3.91	0.41
Book job in	4.32	20.00	0.41
Job set-up	24.73	5.50	1.77
Degrease	32.00	1.00	0.60
Etch and plate	33.60	8.75	2.20
Heat treat	44.55	0.00	4.50
Polish	49.05	1.95	1.95
Inspect	52.95	9.50	1.00
Book out	63.45	0.00	0.40
Pack	63.85	4.00	0.85
Dispatch	68.70	0.00	0.40



**Figure 5.7** Time-based process map: current

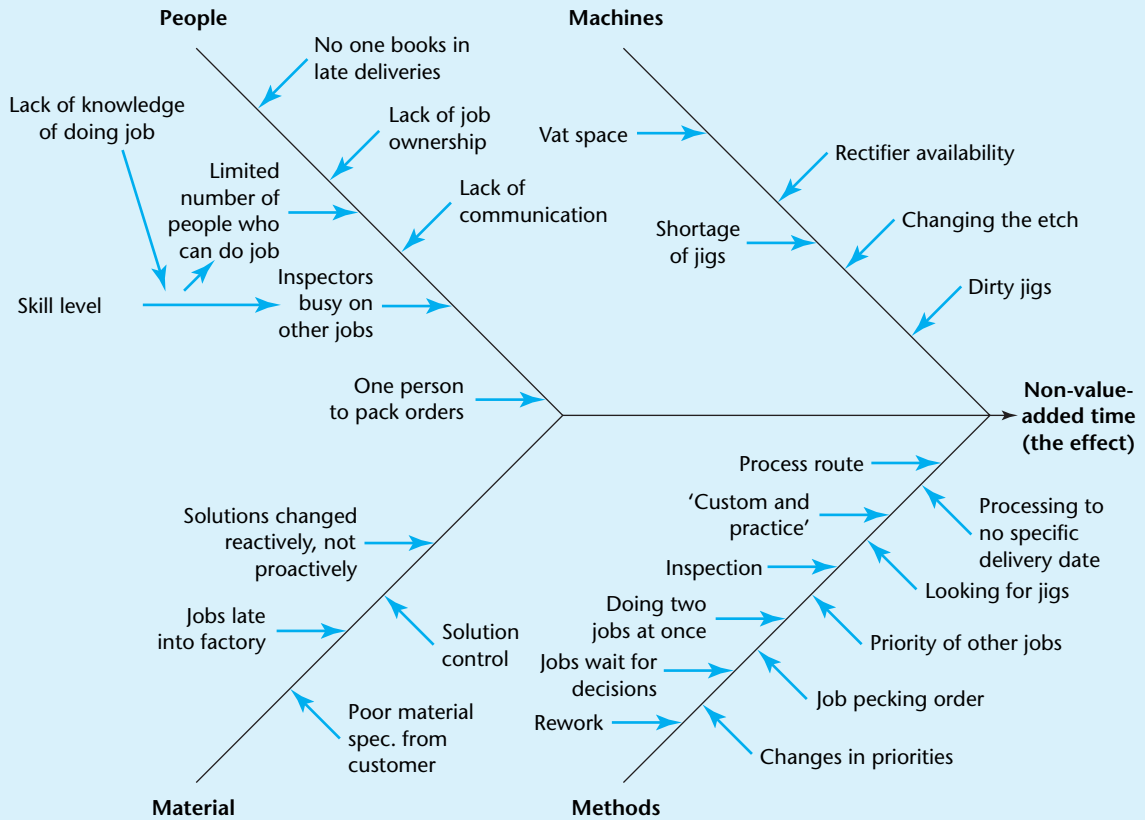


Figure 5.8 Cause-and-effect diagram

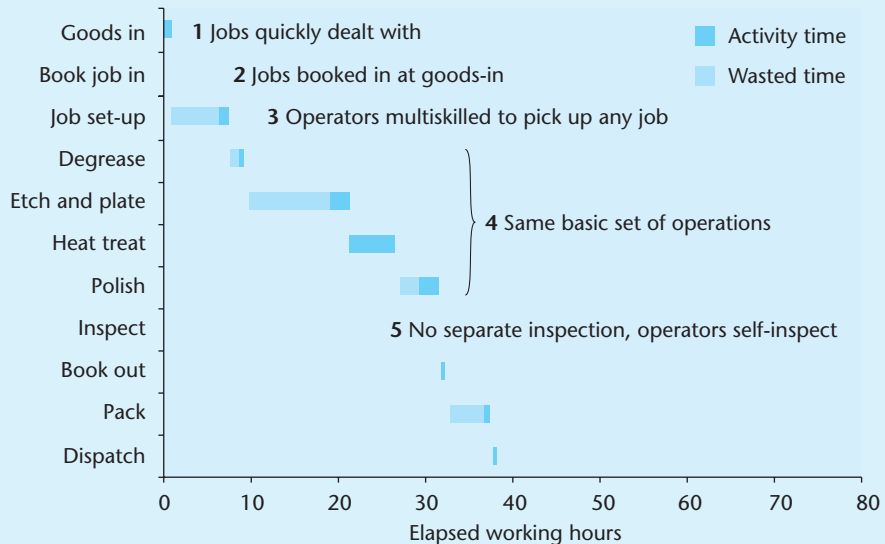


Figure 5.9 Time-based process map: re-engineered

The simple actions undertaken by the company resulted in the total process taking 37 hours. This led to a more responsive service being offered to its customers, and increased business.

(Source: Based on a study by Dr Paul Chapman and Professor Richard Wilding, Cranfield Centre for Logistics and Supply Chain Management)

## 5.4 Managing timeliness in the logistics pipeline

**Key issue: When P-time is greater than D-time, what time-based strategies and practices can help to improve competitiveness?**

Two basic strategies for managing timeliness in the logistics pipeline are make to stock (MTS) and make to order (MTO). In between, we have assemble to order (ATO). We begin with a brief description of each:

- *Make to stock (MTS)*. Here, the key task is to offer products for customers to buy from available inventory. Customer service is determined by this availability, so a key performance measure in supermarkets is *on-shelf availability* (OSA). Achieving 100 per cent OSA would mean holding infinite inventories, so in practice a compromise of say 98.5 per cent OSA across most products at most times is targeted. MTS firms have to plan the availability of their inventory by means of a distribution network which may involve several levels (regional, national and local). In turn, this requires that models are determined for *stock replenishment* – how much, when and where.
- *Assemble to order (ATO)*. By shifting the decoupling point (CODP) upstream, it is possible to greatly reduce risk – of holding inventories of finished products that do not sell, and of missing out on sales opportunities because the desired product was unavailable at the time. Thus Dell computers and BMW cars use ATO as their basic strategies. A BMW 3-series is available in around a million finished vehicle specifications, and it would be risky and impractical to have all of these available in the distribution pipeline. This means that the vehicle must be designed flexibly in terms of *components, options and modules*.
- *Make to order (MTO)*. Here, the CODP is moved to product design, thus reducing the need for speculative processes even further. In the Wiltshire Distribution Transformers case (Case study 5.1 above), we saw how a focal firm had moved from an engineered to order (ETO) to a MTO strategy. It had achieved this by developing standard modular designs which meant that customer orders could be configured by the sales engineer, rather than having to be designed from scratch.

Let us now consider the strategies and practices that can be used to cope when P-time is greater than D-time.

### 5.4.1 Strategies to cope when P-time is greater than D-time

When faced with a D-time shorter than the corresponding P-time, a company has a number of options. In the short term it can attempt to make to order, or it can forecast demand and supply from stock (MTS). Making to order in these circumstances is likely to dissatisfy customers. If competitors exist that can deliver within the customer's D-time, or there are substitute products available that will, then the customer is likely to select them. If there are no alternatives then it may be possible to continue supplying to order for the short term. In the longer term it is likely that the customer will seek to develop alternative suppliers, or re-engineer its products to remove the need for yours.

The more common solution is to forecast customer demand, make products to stock, and supply from there. This stock may be held as finished goods if the D-time is very short, or it could be work-in-progress held in the manufacturing process that can be finished in time. This option incurs a number of penalties. The stocks of goods will need to be financed, as will the space needed to store them. There is also the risk that the customer may not order those goods already made within their shelf-life, causing them to become obsolete.

Both make to order and make to stock have associated costs and risks, so a company should look at ways to reduce these costs and risks in the longer term. Reducing risks can be grouped into three inter-linked areas. These are marketing, product development and process improvement. Each of these areas is analysed below.

#### *Marketing*

There are various ways in which you could reduce risk, with customer help. For example, ask the customer to cooperate by supplying more detailed demand information at an earlier stage. Speed up the access to demand data, perhaps by locating one of your people in the customer's scheduling process. Perhaps the customer is prepared to wait longer than stated, if you can guarantee delivery on time.

#### *Product development*

There are only so many improvements to the reduction of production time that can be made when a process is based around existing products. With time-based thinking in mind, next-generation products can be designed for 'time to market'. Such thinking aims for products that can be made and distributed quickly, and which offer product variety without unnecessary complexity.

#### *Process improvement*

Time-based organisations come into their own by changing the way they go about their business. They engineer their processes to eliminate unnecessary steps, and take wasted time out of those that remain. Engineering your key processes means focusing on those things the customer cares about and getting rid

of all the rest. Having done this once, the best organisations go on to do it again and again as they learn more about their customers and grow in confidence in what they can change.

## 5.4.2 Practices to cope when P-time is greater than D-time

There are a number of ways to reduce P-time. These can be summarised as follows:

- *Control* by optimising throughput and improving process capability.
- *Simplify* by untangling process flows and reducing product complexity.
- *Compress* by straightening process flows and reducing batch sizes.
- *Integrate* by improving communications and implementing teams.
- *Coordinate* by adding customer-specific parts as late as possible.
- *Automate* with robots and IT systems.

### Control

In any process, lead time depends on the balance between load and capacity. If demand rises above available capacity, lead times will increase unless resource is also increased, for example through overtime or subcontracting work. Therefore, in order to maintain or reduce lead time it is necessary to balance this equation effectively by optimising throughput. Similarly, if a process is out of control, and we are never sure whether a conforming product will be produced, the focus will be on improving the capability of that process.

### Simplify

Simplification is concerned with cutting out sources of process complexity and of product complexity. Process complexity is often caused by many different products *sharing the same process*. This process becomes a bottleneck, and process flows become tangled because they all have to go through this single, central process. In manufacturing, the solutions are based on cellular manufacturing: in distribution, the solutions are based on different distribution channels. Product complexity is often related to the *number of parts*. The more parts there are in a product the more difficult it is to plan, to make and to sell. One way to reduce product complexity is to reduce the number of parts, by integrating several components into one. The other is to reduce the number of parts by standardising them between products.

### Compress

Compressing P-time is concerned with squeezing out waste in each process step. There are two main ways to achieve this. First, straighten the process flow by making a linear flow for each product. Second, reduce the batch size so that flow is improved and queuing time is minimised.

### *Integrate*

Integrating different value-adding activities so that they work more closely together helps to reduce P-time. Integration is in turn helped by improving the speed and accuracy of information to the process owner. Important issues are demand information (what to do next?), product information (what is it?) and process information (how is it done?). Ways of speeding up information range from simple, paperless systems such as *kanban*, through simple IT systems such as e-mail, to more complex systems such as making EPOS data available in real time through the Internet. Integration is also helped by forging relationships between departments or organisations that need to communicate. Teams and partnerships help to integrate activities that are otherwise disconnected.

### *Coordinate*

Other approaches to reducing P-time aim to reorganise value-adding activities so that they are done in parallel and/or in the best order. Thus running activities at the same time (in parallel) instead of one after another (in series) will reduce lead times. Sometimes it is possible to reduce lead times by doing the same activities in a different order. This may make it possible to combine activities or allow them to be done in parallel. It may also make better use of resources by fitting an extra job into a shift, or by running long tasks that need no supervision overnight.

### *Automate*

This approach should be used last, once all the others have delivered their improvements (do not automate waste!). Chiefly it is concerned with reducing lead time through the use of robots and IT systems to speed up processes. Such approaches are best focused on bottleneck steps in the overall process. The aim is to improve process capability and reliability as well as speed.

## 5.5 A method for implementing time-based practices

### *Key issue: How can time-based practices be implemented?*

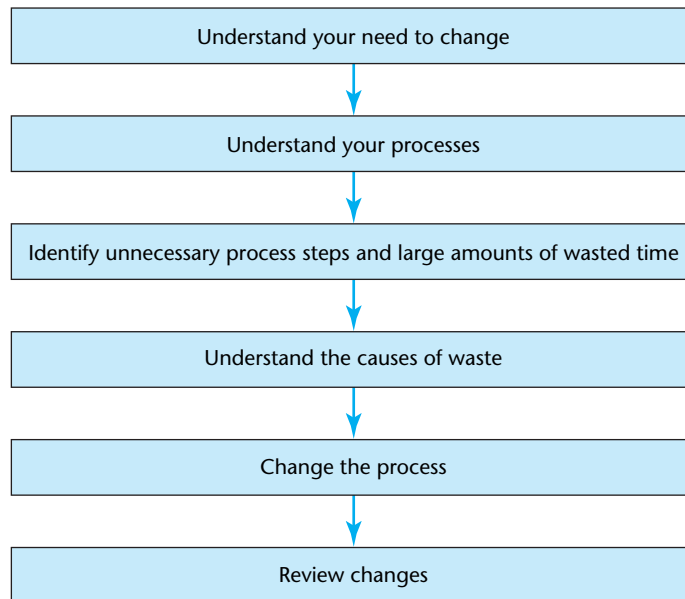
Becoming a time-based company means that a systematic approach is essential to improve all three measures of cost, quality and time. This approach means identifying and removing the sources and causes of waste in the supply network, rather than merely treating the symptoms. The method shown here will give you a starting point for implementing a time-based strategy.

First, you need to understand the ways in which customers value responsiveness. Then the method (shown in Figure 5.10) takes you through a series of steps that help you to change your processes to be able to deliver what the customer wants.

### 5.5.1 Step 1: Understand your need to change

The first step in implementing a time-based strategy is to understand whether you *need* to change. This need to change depends on how important responsiveness is to your customers. Here are five key questions that will help to identify the strategic importance of time:

- Is supply responsiveness important to your customers?
- How important is it to them?
- What is the supply D-time target that customers have officially or unofficially set?
- What happens if you do not meet this target?
- What is the total P-time, i.e. the lead time taken from an order arriving in the company until it is fulfilled and finally leaves the company?



**Figure 5.10** A methodology for time-based process improvement

### 5.5.2 Step 2: Understand your processes

While you may think you already know your current processes, the only way to make sure is to walk the process in the way described in section 5.3 above. Mapping a process involves creating a very simple flow chart. This is best done with a pad of paper, a pencil – and a smile. Start at the point where a customer order comes into the company. This could be with a salesman in the field, over a phone, through the fax or via a computer. Write down the name of this step and draw a box around it. Ask whoever picks this order up what happens next. Very probably it gets reviewed, logged in or put on someone's desk. Any of these options is a step. Write this down on your pad of paper below the first step. Draw



a box around it too, then join the boxes with an arrow. Keep going, throughout the company, following that order until a product is finally delivered to the customer. Write down every step you encounter.

During your expedition following the process through the company ask the people who undertake each step how long it takes to work on a single, typical order. You need to find out the *activity time* – the time they spend physically working on it, not the time it spends on their desk or next to their machine.

When you have mapped the whole process, compare the total lead time (the P-time) with the time in which your customers are demanding you respond to them (their D-time). How well do you do? If the P-time is greater than the D-time you have a challenge.

Now add up the activity times for all of the steps in the process. How does this compare with the overall lead time (the P-time)? It is likely to be considerably smaller. How does it compare with the D-time? Possibly it is also smaller. If so, you have a real opportunity to improve your responsiveness and get your lead time within that demanded by the customer through applying the ideas listed above, and without the need for extensive investment in technological solutions.

### 5.5.3 Step 3: Identify unnecessary process steps and large amounts of wasted time

Using your process flow chart you should work with the other members of the company involved in the process to identify those steps that do not add value to the customers. Also, identify where large amounts of wasted time are added to the overall lead time.

### 5.5.4 Step 4: Understand the causes of waste

Once again, work with your colleagues and identify the causes of the unnecessary process steps and wasted time. Why do they exist?

### 5.5.5 Step 5: Change the process

Having understood the process, and the causes of waste in it, choose from the generic solutions described above those approaches that will make the process more responsive. Apply these solutions with vigour, going for easy ones that deliver early results first to give everyone confidence that you are doing the right thing.

### 5.5.6 Step 6: Review changes

Having altered the way you go about your operations, measure the performance of the process again and find out whether there have been any changes to your

performance. Have you become more responsive? If not, why not? Find out and try again. If you have, tell as many people as you can, and have another go at building on your success.

### 5.5.7 Results

The likely result of the above change programme is a situation such as that graphically displayed in the basic four-step supply chain shown in Figure 5.11. Through the implementation of time-based practices or initiatives, cycle times are compressed throughout the supply chain. As a result, delivery can take place in a timely manner more reliably and faster, while more operations can be performed to order within the service window. As a result, lower asset intensity is coupled with enhanced delivery service as possible input to both lean thinking and agility efforts (see Chapters 6 and 7 respectively).

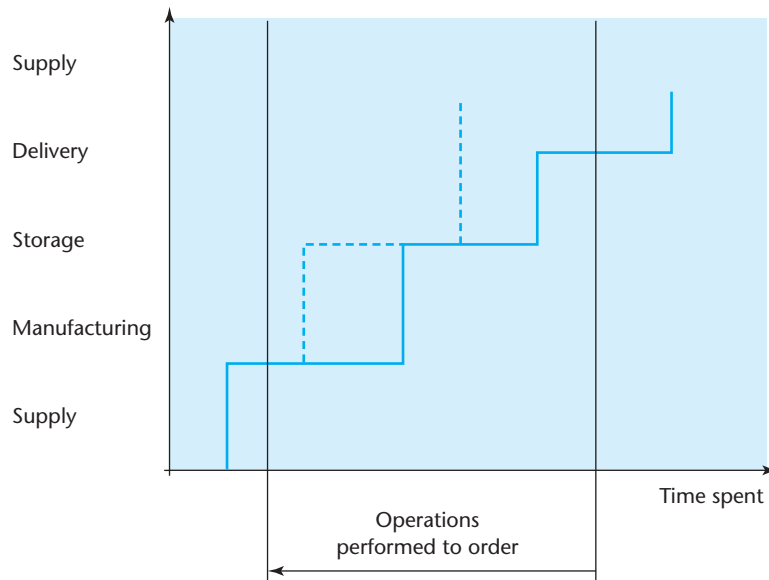
Note that this approach assumes a supply chain point of view, not just a focus on manufacturing or any other segment of the supply chain. A well-known illustration of the importance of this point is that lean approaches have resulted in automotive manufacturing cycle times being compressed to a matter of hours. After manufacture, however, cars are stored in the distribution pipeline or in dealer outlets for weeks, if not months. Lack of supply network thinking results in all of the cycle time investments in manufacturing being wasted.

This does not mean to say that all operations in the supply chain need to be subject to time compression. In the example shown in Figure 5.11, the new delivery cycle times (shown with a dotted line) actually increase in the new structure. But this suboptimisation is allowable, as traditional distribution from local warehouses here is replaced with direct delivery from the factory, where products are made to order. The transition to make to order replaces the need for inventory-holding points, where goods typically are stored for extensive periods of time. Of course this basic example also indicates how time-based initiatives can require structural supply chain redesign, such as the reconfiguration of distribution channels and the adjustment of manufacturing systems and policies.

## 5.6 When, where and how?

There are several tactical considerations to be made when planning a time-based strategy. We have grouped these in the form of three questions to be asked:

- *When?* Time-based competition is only as relevant as the customer perceives it to be. Speed for the sake of speed can create unnecessary costs, and can cut corners, leading to poor quality.
- *Where?* D-times are a measure of the importance of speed as a competitive factor, while P-times measure the ability to deliver. The integration of the two measures the point at which the customer order penetrates the supply chain. In Chapter 5 and Chapter 6, p. 176, we develop this issue in terms of the customer order decoupling point.



**Figure 5.11** Results of time-based change initiatives

- *How?* The more predictable and lower-priority products and components can be delivered from inventory with less priority given to speed. Shipments of customised products can be assembled from stocks of standard components and modules within the D-time demanded.

## Summary

### *What is the lead-time frontier?*

- Competing on time demands a fast response to customer needs. Time-based approaches to strategy focus on the competitive advantage of speed, which helps a network to cope with variety and product innovation, while also improving returns on new products. Speed also means less reliance on long-term forecasts.
- Speed of response helps to lower costs by reducing the need for working capital, and plant and equipment. It also helps to reduce development costs and the cost of quality.
- The lead-time frontier is concerned with reducing P-time (time needed to produce a product or service) to less than D-time (time for which the customer is prepared to wait).
- Differences between P-times and D-times are referred to as the lead-time gap. The gap has strategic implications for marketing, product development and process development. P-time can be reduced by a six-stage process: control, simplify, compress, integrate, coordinate, automate.

### How do we measure and implement time-based strategies?

- Time-based mapping aims to generate visibility of time in the supply network. A six-step approach to mapping involves creating a task force, selecting the process, collecting data, distinguishing between value-adding and non-value-adding activities, constructing the time-based process map and generating a solution.
- Implementing time-based practices can be accomplished using another six-step process involving understanding the need to change, understanding the processes, identifying non-value-adding processes, understanding the causes of waste, and reviewing what has been done.

## Discussion questions

- 1 Why is time important to competitive advantage? Identify and explain six key contributions that speed can make to logistics strategy.
- 2 Explain the significance of P:D ratios. How can the production lead time be reduced?
- 3 Sections 5.3, 5.4 and 5.5 all contain step-by-step models for reducing waste and implementing improved logistics processes. Explain why such models are useful in implementing logistics strategy.

## References

- Bicheno, J. (2004) *The 'New' Lean Toolbox*. Buckingham: Picsie Books.
- Crosby, P.B. (1979) *Quality is Free: The art of making quality certain*. New York: McGraw-Hill.
- Deming, W.E. (1986) *Out of the Crisis*. Cambridge, MA: MIT.
- Garvin, D.A. (1988) 'The multiple dimensions of quality', in *Managing Quality*, Ch. 4. New York: Free Press.
- Stalk, G. and Hout, T. (1990) *Competing Against Time*. New York: Free Press.

### Suggested further reading

- Galloway, D. (1994) *Mapping Work Processes*. Milwaukee, WI: ASQC Quality Press.
- Hammer, M. (2007) 'The process audit', *Harvard Business Review*, April, pp. 111–23.
- Rother, M. and Shook, J. (1999) *Learning to See*, Version 1.3. Brookline, MA: The Lean Enterprise Institute Inc.



## CHAPTER 6

# Supply chain planning and control

### Objectives

*The planned objectives of this chapter are to:*

- explain the methods by which material flow is planned and executed within a focal firm and between partners in a supply chain;
- explain how lean thinking can be used to avoid the build-up of waste within and between supply chain processes.

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

- appreciate the sophistication that lies behind an integrated model of material flow in a supply chain, and why this model is so easily corrupted;
- understand how lean thinking can be used to improve performance of the supply chain in meeting end-customer demand by cutting out waste;
- develop a sensitivity for the enemies of flow in the supply chain.

### Introduction

In Chapter 3, we introduced the simple framework for coordinated processes across the supply chain that has become known as the ‘SCOR model’ (Figure 3.13). This model creates a vision of integration of supply chain processes both upstream and downstream. An overall planning process – that coordinates movements seamlessly from one process to the next – orchestrates material flow and information flow. The reality of supply chain management today – summarised in our paper on theory, practice and future challenges (Storey *et al.*, 2006) – shows a very different picture. We conducted a three-year detailed study of six supply chains, which encompassed 72 companies in Europe. The focal firms in each instance were sophisticated, blue-chip corporations operating on an international scale. Managers across at least four echelons of the supply chain were interviewed and the supply chains were traced and observed. We showed that ‘supply management is, at best, still emergent in terms of both theory and practice. Few practitioners were able – or even seriously aspired – to extend their reach across the supply chain in the manner prescribed in much modern theory’ (Storey *et al.*, 2006: 754).

The factors behind the gap between vision and reality are many, reflecting the sophisticated web of processes and coordination that lie behind the vision and the almost endless ways of corrupting it. UK retailer Marks & Spencer introduced

vendor-managed inventory (VMI – described in Chapter 8) to its clothing range, and achieved high levels of coordination with its tier 1 suppliers, low costs and high on-shelf availability. However, events unravelled after a few years due to a number of factors (Storey and Emberson, 2005). Two of the major factors were:

- A change in management structure at Marks & Spencer created a new category team, many of whom did not like the idea of sharing sales data with suppliers. The method used to generate sales data was changed, and resulted in loss of access to the flow of sales data on which the VMI system depended.
- Suppliers began to outsource their production to new factories in South East Asia and Morocco to reduce costs, but this resulted in six-week replenishment cycles and loss of responsiveness. Complementary sets of clothes were sourced to different countries, and it proved hard to coordinate deliveries.

Decisions based on advantages internal to a focal firm, and on the search for cheaper prices, are but two common factors in corrupting the flow of materials and information and the focus on the end-customer. Corruption is displayed by poor customer service, stock write-offs or markdowns, and a lot of resource devoted to ‘fire fighting’.

This chapter aims to summarise the detail of an integrated planning and control system. The most comprehensive models originate from manufacturing, and link key activities like resource planning, demand management and capacity planning into a holistic framework. Individual firms have been quite successful not only in developing effective manufacturing planning and control (MPC) systems, but also in integrating them with other business functions like finance and human resources through enterprise resource planning (ERP). However, linkages *between* the MPC systems of supply chain partners are relatively weak (Vollman *et al.*, 2005: 578). And linkages between MPC systems at manufacturers and ‘service’ processes like distribution and back of store are even weaker. Skim the detail at your peril! Far too many logistics ‘decisions’ are made on the basis of lack of understanding of the sheer scale and scope of the intricacies of balancing load and capacity, of coordinating marketing wants and supply chain realities.

We propose how the linkages between manufacturing firms should develop, and the implications for integrating material flow across the supply chain. We continue by reviewing the huge impact that just-in-time and lean thinking have had on supply chain planning and control.

### Key issues:

**This chapter addresses two key issues:**

- 1 The supply chain ‘game plan’:** addresses the challenges of planning and controlling material flow and information flow within the focal firm, between supply partners and across the supply chain as a whole.
- 2 Just-in-time:** examines the implications of just-in-time thinking for logistics, especially for material control methods like reorder point and material requirements planning.
- 3 Lean thinking:** a cyclical route to seeking perfection by eliminating waste and thereby enriching value from the end-customer perspective.

## 6.1 The supply chain 'game plan'

**Key issues:** What are the key steps in planning and executing material flow and information flow within the focal firm? What are the key steps in planning and executing material flow and information flow between partners in a supply network? What are the implications for planning and controlling the supply chain as a whole?

In this section, we consider planning and control within the focal firm (intra-company) and then between firms in the supply chain (inter-company). The model used is based on that developed within manufacturing firms, since it is the best developed. An excellent text, which goes into detail on most of the issues discussed in this section, is Vollman *et al* (2005) – included in the 'reference' section at the end of this chapter. We conclude with the implications for planning and controlling the supply chain as a whole.

### 6.1.1 Planning and control within the focal firm

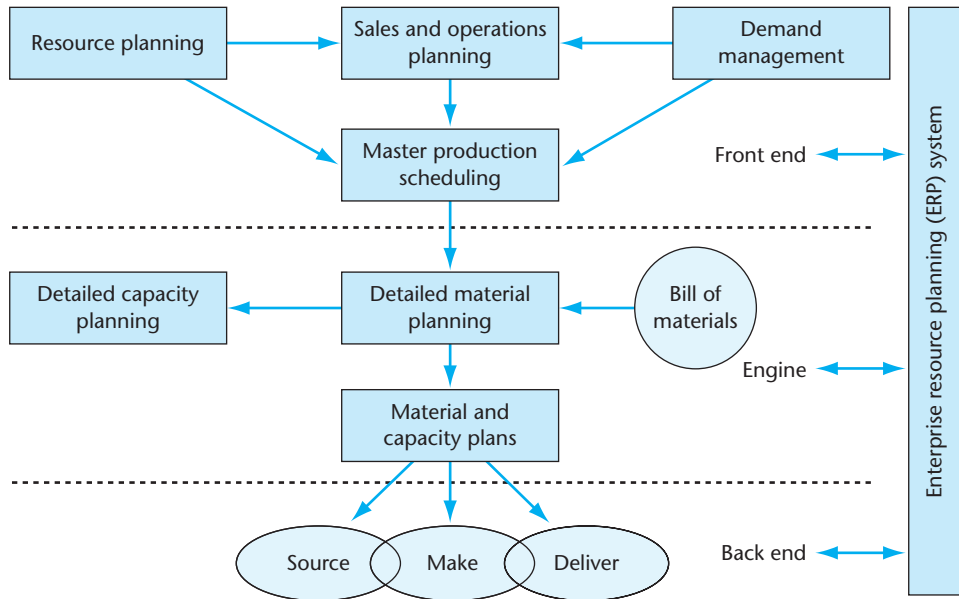
The purpose of a manufacturing planning and control (MPC) system is to meet customer requirements by enabling managers to make the right decisions. The system coordinates information on key 'source–make–deliver' processes to enable material to flow efficiently and effectively. Three time horizons are involved for all of these processes:

- *Long term:* to support decisions about capacity provision. These decisions are essentially strategic, and answer the questions how much capacity is needed, when and of what type? Thus Mercedes Benz may plan new model ranges for 20 years ahead – including outline volumes, internal and supplier capacities and distribution strategies.
- *Medium term:* to match supply and demand. Here, Mercedes may plan in more detail over the next 12 months to ensure that forecast demand can be met by correct material provision, together with capacity and resource (such as manpower) availability. The plan would be refreshed monthly.
- *Short term:* to meet day-to-day demand as it unfolds. Here, Mercedes makes weekly production plans to meet specific customer orders. There may be numerous changes that affect achievement of the medium-term plan. These include changes in customer demand, facility problems and supplier shortages. The short-term plan helps managers to decide what corrective actions are needed to resolve such problems, and would be refreshed daily or weekly.

Figure 6.1 shows the main modules in an MPC system. The top section is called the 'front end', and provides an overall match of demand and resource. We here summarise the main front end modules, followed by a summary of engine and back end:

- *Demand management:* collates demand from all sources – external (forecasts and orders), internal (other firms within the organisation), and spares. Such





**Figure 6.1** The focal firm 'game plan'

(Source: After Vollman *et al.*, 2005)

demand is called *independent* – that is, it is independent of the actions of the focal firm. Referring to Figure 5.3, demand is independent up to the customer order decoupling point (CODP). At this point, demand changes from independent to *dependent*. Upstream from the CODP, in the area referred to as 'P-time – D-time', the focal firm assumes responsibility for sourcing and making speculatively – on the assumption that orders will eventually transpire. Thus *make to order* (MTO, section 5.4) incurs less speculation than assemble to order (ATO) and much less than *make to stock* (MTS). Speculation implies that it is necessary to *forecast* demand for the relevant module. Thus, forecasting for sales and operations planning is carried out monthly or quarterly and is at the level of the overall product line. Forecasts for master production scheduling purposes are refreshed frequently for the next few days or weeks, and are made at the level of the individual sku (stock keeping unit). Short-term forecasting is carried out using techniques like *moving averages* and *exponential smoothing*, which are described in Vollman *et al.* (2005: 32). Forecast accuracy (comparing forecast and actual values) is measured by such techniques as *mean average deviation* (MAD). It is only necessary to forecast for independent demand items: demand for dependent items can be calculated.

- **Resource planning:** pooling demand and passing it on to manufacturing *must* be moderated by capacity to deliver. Otherwise, a focal firm is at risk from being unable to fulfil marketing plans that do not take into account the realities of what can be done. Again, this would mean that marketing plans are not actionable (section 2.2). Resource planning is concerned with manufacturing capacity in the longer term (output measure), and with machine and man-power loading (input measure) in the shorter term.

- *Sales and operations planning (SOP)*: is the module concerned with matching of demand management and resource planning. Therefore, it is crucial that compatible measures of demand and capacity are used – for example, tonnes/week or '000 units produced/week. Sales and marketing must check with manufacturing that new enquiries can be made and delivered within requested lead times. This may well require coordination across several manufacturing units in different countries. The aim of SOP is to maintain *balance* between demand and supply. Too much demand in terms of capacity, and manufacturing will be under pressure to work overtime and to rush work through. Too little demand, and margins will be under pressure from under-utilised resources, layoffs and price cuts.
- *Master production scheduling (MPS)*: is the disaggregated form of the SOP. This means that the SOP is broken down from high-level measures like product families into the detail of skus by major production facility. The MPS is the link between front end and engine of the MPC system. On the one hand, it receives SOP data about sales and forecasts. On the other hand, it feeds data back to SOP on orders and stock replenishment status so that customers and distribution can be kept up to date. The MPS handles the detail of what is planned and what is happening. For MTS environments, the priority is inventory management: for MTO environments, the priority is timely execution of all of the processes from design through to delivery.
- *Material and capacity planning (engine room)*: from overall demand by sku it is next necessary to develop detailed plans by part number. For each part and subassembly, detailed plans show how many and when each must be made. Like the 'big picture' front end logic, not only must a detailed material plan be devised, but it must also be moderated by capacity availability (resources) in each production centre. The logic behind this is called material requirements planning (MRP). This takes MPS data, and explodes it into detailed plans by component and subassembly. Each of these plans must be checked and optimised against available capacity by means of the detailed capacity planning module. An impression of what is involved is given in Victoria SA, Case study 6.1. Engine room logic is described in the form of a novel by Goldratt and Cox (1984); further details are in Vollman *et al.* (2005).

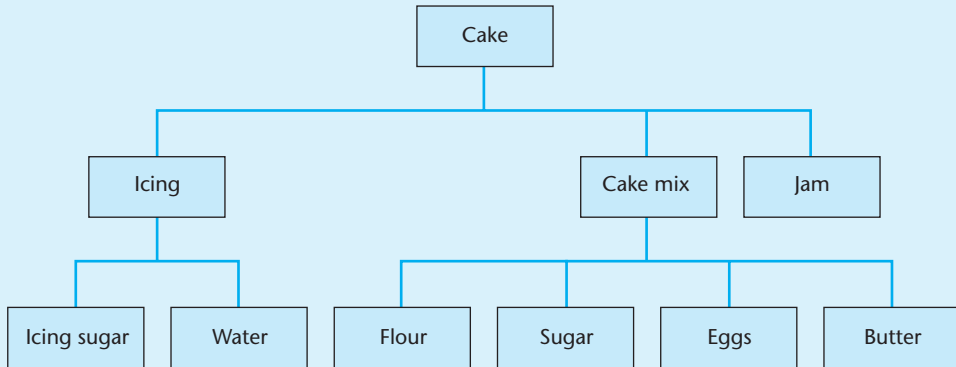
## CASE STUDY 6.1

### Victoria SA

Victoria SA makes 'fantastically good cakes' from basic ingredients like flour, water and cherries. Demand for Victoria sponge cakes comes from two sources. Some big retailers place their order with the firm two days in advance, while other customers arrive at Victoria's own shops without prior warning and select from cakes that are on display. This means that some cakes are made in line with orders, whilst a forecast is also required to predict day-by-day demand.

Whilst there are many varieties of cake, the bill of material for the Victoria's famous sponge cake is shown in Figure 6.2.

When overall demand across the range has been collated, Victoria SA is able to determine how much of each ingredient will be needed to make the right number of cakes.



**Figure 6.2** Structured bill of materials (BOM) for sponge cake

Too many and cakes will have to be thrown away, because the shelf life is 5 to 8 days (Victoria does not use stabilisers like potassium sorbate). Too few and sales will be lost. Accurate planning is thus crucial to the efficiency of the whole operation. The ideal situation is that cakes are made and delivered *just-in-time* to meet customer demand because inventories will be low and freshness at its best.

In an effort to increase sales, Victoria SA decides to increase the product range. Strawberry jam is the traditional filling, but marketing considers that customers would also like other types of filling and decides to try blackberry jam, apricot jam, lemon curd and chocolate. Over the course of the next few months, the experiment appears to be working. Overall sales are up by 10 per cent, with each of the new varieties contributing well. The problem however is that no stable pattern exists in the mix of sales. For example, some days the chocolate-filled cakes sell out while on other days hardly a single chocolate-filled cake is sold. The issue appears to be that offering increased variety has led to less stability in the demand pattern – as well as increased complexity in the production operation. Major retail customers are complaining about wastage and lost sales opportunities.

To fix the unexpected problems, Victoria SA decides on a new way of working. It is recognised that demand is not going to stabilise given the increased product range. The firm decides to adopt a *postponement* strategy. The basic cake is a *standard component*, whilst the filling is non-standard and represents the source of complexity and variable customer interest. Cakes are therefore kept in the standard form and only turned into the final form by adding the filling once customer orders have been received. Victoria SA has applied postponement to the supply chain and introduced a decoupling point at the end of the cake-making process. Upstream of the decoupling point overall demand is forecast to inform sourcing decisions. Standard components are baked each morning. Downstream of the decoupling point, cakes are finished in the shop in line with customer requirements. The time this activity takes has been minimised by setting up a workstation with cakes, filling and spreading tools arranged in a mini flow-line. This brings the production time (P-time: see section 5.2) within the time the customer is prepared to wait (D-time). Carrying out the operation in view of the customer also helps engage them and extends their D-time to a minute or so, long enough to complete the final assembly task.

The flexibility of the new operation means that customers no longer need to place an

order two days in advance. Victoria SA can now supply from the new process if orders are received by major customers the day before. An unexpected benefit of the new approach is the ease with which innovations can be test-marketed and adopted.

(Source: From an original by Dr Paul Chapman)

### Question

1 Explain what Victoria SA has achieved in terms of P-time and D-time (see section 5.4).

- *MPC execution systems (back end)*: the outputs from material and capacity plans in the engine are sets of instructions to suppliers, manufacturing and distribution. These schedules are in the form of purchase orders, works orders (or schedules for MTS) and shipping orders – hence the familiar ‘source–make–deliver’ processes at the bottom of Figure 6.1. The basic format is ‘how many’ and ‘when’ for each part number for each planning process for the relevant planning period (for example the next two weeks, or the next four weeks). Achievement against schedule has to be monitored by minute, by hour or by day. Failures to meet schedule – as a result of for example breakdowns or quality problems – require that remedial action is taken, such as overtime working or outsourcing. An example here is the Nokia supply problem described in Case study 1.4.

Front end, engine and back end MPC modules are all connected to the *enterprise requirements planning* (ERP) database. This enables MPC modules to be seamlessly connected to human resource management, finance and sales and marketing modules. SAP includes MPC systems as part of its supply chain software – supply chain planning, execution, collaboration and coordination.

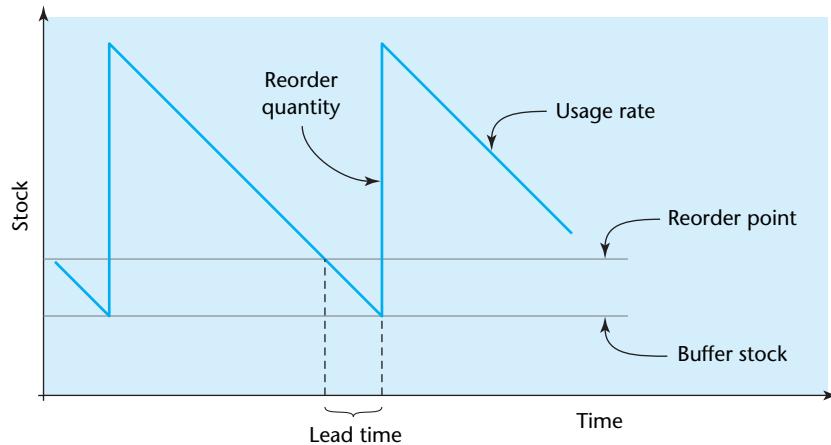
## 6.1.2 Managing inventory in the supply chain

Planning and controlling factory output is but part of the challenge of managing material flow in the supply chain. A focal firm positioned in a network such as that shown in Figure 1.2 is at the centre of many possible connections with other supplier and customer companies. Upstream processes such as distribution and retail for both finished products and spare parts are subject to independent, random demand. Such demand is independent in that it is not affected by the actions of the focal firm. Dependent demand, on the other hand, is fixed by the actions of the firm – such as order acceptance and determining forecasts. This section is concerned with the management of inventories of independent demand items using *order point* methods. These are aimed at balancing inventory needs (how much to order and when to order) with customer service needs.

### ‘Economic’ batch sizes and order sizes

The question of how many parts to make at a time has traditionally been answered by reference to a long-standing concept called the ‘economic’ batch

quantity (EBQ) formula. Similar principles are used to determine how many parts at a time to order from suppliers in 'economic' order quantities (EOQs). Both EBQ and EOQ assume that parts are used up at a uniform rate, and that another batch of parts should be ordered when stock falls below the *re-order point*. The principle behind the reorder point, which sets out to answer the question when to order, is shown in Figure 6.3.



Notes:

1. Reorder point = demand during lead time + safety stock
2. Reorder quantity = economic order quantity
3. Buffer stock =  $f(\text{service level, lead time variability, demand variability})$

**Figure 6.3** When: the reorder point

A buffer (or safety) stock line is shown below the reorder level. Buffer stock acts as a 'safety net' in order to cushion the effects of variability in demand and in lead times. Buffer stock is a function of the service level (risk of stock outs), lead time variability and demand variability. The re-order point is therefore the sum of the forecast demand during the lead time plus the buffer stock requirement. There are various ways of calculating buffer stock (for a detailed coverage, and for details of EBQ and EOQ calculations, see Vollman *et al.* 2005, and Waters, 2003).

In the case of manufacturing, the EBQ is determined by optimising the trade-off between changeover cost and inventory carrying cost:

- *Changeover cost per unit.* The cost associated with changing over a given machine from the last good part from a batch to the first good part from the succeeding batch.
- *Inventory carrying cost.* The cost of holding stock, calculated from the total inventory cost and the annual rate charged for holding inventory.

All too often overlooked when calculating the EBQ is that the higher the changeover cost, the higher the EBQ. The key point here is that the EBQ can therefore be reduced when the changeover cost is reduced. In the ideal case, the changeover activity should be simplified so that it can be carried out in seconds rather than in hours. Where this is achieved, the changeover cost becomes negligible and the EBQ becomes one.

Given zero changeover costs, the EBQ formula obeys the JIT ideal of pull scheduling – only make in response to *actual* demand. Actual demand, of course, is likely to vary from one day to the next, unlike the assumption for demand rate shown in Figure 6.3 above. Pull scheduling is more sensitive to demand changes, because only what is needed is made.

Similar considerations have resulted in the concept of the economic order quantity (EOQ). Here, the calculation addresses the question 'how many parts will we order?' The trade-off this time is between the cost of placing an order and inventory carrying cost, where:

- *Cost of placing an order:* All order-related costs, including purchase department costs, transportation costs from the supplier, and goods-in inspection and receiving.

EOQ again increases in line with the cost of placing an order, and reduces in line with the inventory carrying cost. Again the trade-off can be changed. If the cost of placing an order can be simplified to a routine basis whereby parts are ordered by paperless systems such as cards, and collected on regular pickup routes called 'milk rounds', the EOQ can again be reduced towards the JIT ideal. EOQ principles are still widely used for ordering 'independent demand' items that are not directly used to manufacture products, such as automotive spare parts, class 'C' parts in retail and office supplies.

### Periodic order quantity and target stock levels

EOQ models generally relate to a given order size being placed whenever the inventory level falls below the reorder amount. The effect upon suppliers is that although a regular amount is ordered, the time the order is placed can vary enormously. An EOQ system finds it very difficult to cope if demand goes up or down rapidly. If demand goes up rapidly, then an EOQ system would tend to make replenishments that lag behind the demand trend.

To illustrate, let us assume a sequence of 10 weeks where demand fluctuates between 100 and 1,000 units. The EOQ has been established as 1,000 units, and the safety stock at 100 units. Inventories at the start and end of each week can then be calculated as shown in Table 6.1.

An alternative way to deal with variable demand is to use the periodic order quantity. Here, the reorder quantities are revised more frequently. The method uses mean time between orders (TBO), which is calculated by dividing the EOQ by the average demand rate. In the above example, the EOQ is 1,000 and the average demand 410. The economic time interval is therefore approximately 2. An example shown in Table 6.2 illustrates the same situation as in Table 6.1 in terms of demand changes and safety stock level. However, the reorder quantity is based on total demand for the immediate two weeks of history. This reorder method is called *periodic order quantity* (POQ).

POQ normally gives a lower mean inventory level than EOQ in variable demand situations. In this example, the average inventory holding has fallen from 5,150 to 4,150. The same number of orders (Chase *et al.*, 2005) have been used, but the order quantity varies from 200 to 1,800.

**Table 6.1** Economic order quantity example

Week no.	Demand	Order quantity	Inventory end	Inventory start	Inventory holding
1	100	1,000	900	1,000	950
2	100	0	800	900	850
3	200	0	600	800	700
4	400	0	200	600	400
5	800	1,000	400	200	300
6	1,000	1,000	400	400	400
7	800	1,000	600	400	500
8	400	0	200	600	400
9	100	0	100	200	150
10	200	1,000	900	100	500
Sum	4,100	5,000	5,100	5,200	5,150
Average	410	500	510	520	515

**Table 6.2** Periodic order quantity example

Week no.	Demand	Order quantity	Inventory end	Inventory start	Inventory holding
1	100	200	100	200	150
2	100	0	0	100	50
3	200	600	400	600	500
4	400	0	0	400	200
5	800	1,800	1,000	1,800	1,400
6	1,000	0	0	1,000	500
7	800	1,200	400	1,200	800
8	400	0	0	400	200
9	100	300	200	300	250
10	200	0	0	200	100
Sum	4,100	4,100	2,100	6,200	4,150
Average	410	410	210	620	415

### Periodic review

A widely used model for inventory control in retailing is *periodic review*. This works by placing orders of variable size at regular intervals – the *review period*. The quantity ordered is enough to raise stock on hand plus stock on order to a target level called the target stock level (TSL):

$$\text{Order quantity} = \text{Target stock level} - \text{Stock on hand} - \text{Stock on order}$$

The TSL is the sum of cycle stock (average daily demand over the review period and replenishment lead time) and the safety stock. An example of the way the TSL is calculated is:

$$\begin{aligned} \text{TSL} &= \text{cycle stock} + \text{safety stock} \\ &= D \cdot (T + LT) + Z \cdot \sigma \cdot \sqrt{(T + LT)} \end{aligned}$$

where  $D$  = average daily demand per sku,  $T$  = review period in weeks and  $LT$  = lead time in weeks.  $Z$  = number of standard deviations from the mean corresponding to the selected service level, and  $\sigma$  standard deviation of demand over  $T + LT$ .  $D$  may be raised to weekly intervals for slow moving items.

## 6.1.3 Inter-firm planning and control

Both section 6.1.1 on intra-firm MPC systems and 6.1.2 on managing independent demand show that relatively sophisticated modelling data are needed to enable accurate and timely planning and control of logistics in a focal firm. Attention to detail – both in planning and in execution – is key. The greater the product variety, the more component parts and the greater the number of levels in the BOM, the more challenging the task. When it comes to coordinating logistics between supply partners, the challenges multiply because the number of processes at stake is so much greater. There are many other factors that make life even more challenging, resulting from differences between the partners:

- *Differences in process technology*: a supplier of aluminium cans to a soft drinks manufacturer is positioned between producers of aluminium rolled sheet, and high speed canning lines. At the can supplier, the sheet has to be deep drawn and printed with increasingly sophisticated designs. High speed filling machines (1,500 cans/minute) at the soft drinks manufacturer means that the lengthy changeovers are carried out as infrequently as possible. During the peak summer sales period – when sales can double during a hot spell of weather – the whole logistics pipeline is under pressure. The can supplier – situated next to the factory of the drinks manufacturer – supplies cans through a 'hole in the wall' conveyor which enables just-in-time delivery. Coordinating these three quite different manufacturing processes is a major challenge. The default solution is to hold huge stocks at the can supplier – but even then, you have to hope that the forecasts were correct! If we move to the NDC for the drinks manufacturer, the even tougher challenge is to interface manufacturing with service processes – distribution and retail. Retail demand is not based on manufacturing batch sizes, but on end-customer demand through the till – influenced by weather forecasts and promotions.



- *Differences in working routines*: shift patterns, conditions of employment, holidays and shutdowns are but a few of the possible differences in working routines between partners in a supply chain. Retailers complain that they work 24/7, while manufacturers may only work 5 days/week. In turn, this means that replenishments for weekend sales (the highest of the week) have to be made up by extra quantities delivered on Monday and Tuesday.
- *Priority planning*: while an order for a major customer may be priority number 1 for the focal firm in Figure 1.3, the existence of the order may not be visible to upstream partners. Each has different priorities to manage – and each has a different perspective about what order should be processed next.
- *Inadequacies in MPC systems design*: we document the case of a manufacturer of electrical cables ('ElectriCo') to specific customer orders against very short lead times (Skipworth and Harrison, 2004). Orders from the customer – a distributor of power leads – were placed daily against generic stocks held at ElectriCo (MTS). Attempts to cut out these stocks at ElectriCo by changing to MTO were frustrated by weekly MRP planning intervals, and by the fact that each planning run took 36 hours to complete. We have surveyed a number of firms to identify best practice in demand planning and forecasting (Harrison *et al.*, 2004). This survey provides dozens of examples of good practice and bad practice in these areas. Partners in a supply network who have weak MPC systems potentially create problems for everyone else.

### Implications of poor coordination

One consequence of poor coordination within a supply network is amplification of changes in demand upstream. Amplification of demand changes has been called the *bullwhip effect*. For example, a retailer may order only in full truckloads from its suppliers. Instead of understanding the actual end-customer demand, the suppliers see huge swings in orders that are essentially due to the retailer's desire to minimise transport costs. This has the unfortunate impact of increasing manufacturing costs at the suppliers, because they are asked to make large quantities at irregular time intervals. What may originally have been stable demand through the till becomes heavily distorted.

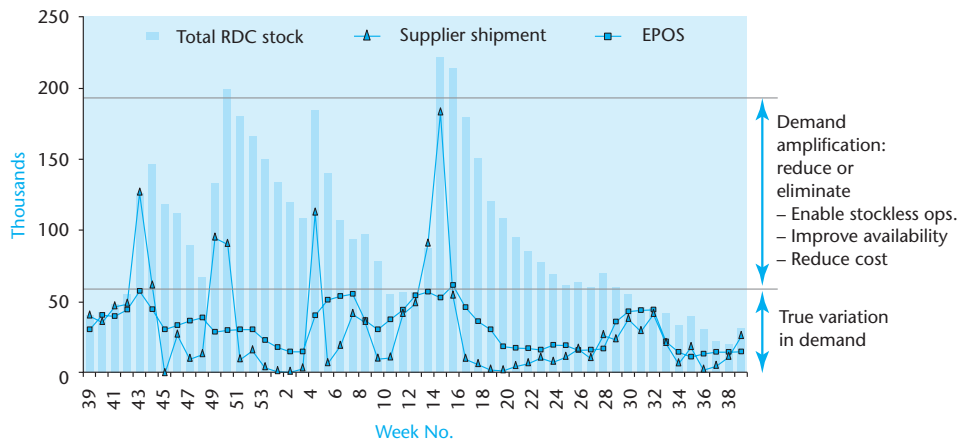


Figure 6.4 The bullwhip effect at work

Figure 6.4 shows an example of the bullwhip effect. Demand through the till is relatively stable, but orders on the supplier are anything but stable! The original range of variation has been amplified into something much worse. The only way in which the manufacturer can respond is to hold stocks – and even those vary enormously from one week to the next. Uncertainty about customer demand leads to large up-and-down swings in the need for capacity and in inventory levels. This effect ripples through the supply chain. Batching rules at the manufacturer make things even worse for its own suppliers upstream. Lee *et al.* (1997) identify four major causes of the bullwhip effect:

- *updating of demand forecasts*: resulting in changes to safety stock and stock in the pipeline;
- *order batching*: while retail customers may buy mostly on Saturdays, MPC systems may batch orders according to different timing rules;
- *price fluctuations*: promotions most often result in lumping of demand into peaks and troughs, when the ongoing pattern is stable;
- *rationing and shortage gaming*: when the latest games console is in short supply, retailers are rationed by manufacturers. Customers place multiple orders on different retailers, causing apparent demand amplification.

To make matters even worse, it is quite possible for material movements in supply chains to descend into *chaos* (Wilding, 1998). Chaos is characterised by:

- the same state is never repeated ('aperiodic');
- on successive iterations, the state stays within a finite range and does not approach infinity ('bounded');
- there is a definite rule with no random terms governing the dynamics ('deterministic');
- two points that are initially close will drift apart over time.

Wilding lists several implications for management, three of which are:

- *Supply chains do not reach stable equilibrium*: small perturbations will always prevent equilibrium being achieved.
- *Treat the supply chain as a complete system*: small changes made to optimise one echelon of the supply chain can result in massive changes in other parts of the chain. Driving down inventory and lead times may not always improve performance, it could result in the system slipping into chaos.
- *Remove chaos by focusing on the end-customer*: communicate demand information as far upstream as possible.

### **Implications for planning and controlling the supply chain**

Based on evidence from MPC systems in manufacturing, the intricacies of managing independent demand and the conclusions of the bullwhip effect and chaos theory, we can conclude that coordinating material flow across the supply network requires attention to detail in both planning and execution on a grand

scale. So often, firms have ‘orchestrated’ (or did we mean ‘optimised’?) the supply chain around their own interests – own up auto manufacturers, ‘big pharma’ and retailers! And simplistic solutions to collaboration and partnership remain at the partial level – especially if limited to dyadic (supplier–customer) relationships. Making MPC systems work across supply chains requires hard work, not just a commitment to ‘partnership’.

## 6.2 Just-in-time (JIT)

**Key issues: What are the implications of just-in-time for logistics? How can just-in-time principles be applied to other forms of material control such as reorder point and material requirements planning?**

Just-in-time is actually a broad philosophy of management that seeks to eliminate waste and improve quality in all business processes. JIT is put into practice by means of a set of tools and techniques that provide the cutting edge in the ‘war on waste’. In this chapter, we focus on the application of JIT to logistics. This partial view of JIT has been called *little JIT* (Chase *et al.*, 2005): there is far more to this wide-ranging approach to management than we present here (see for example Harrison, 1992). Nevertheless, little JIT has enormous implications for logistics, and has spawned several logistics versions of JIT concepts.

The partial view of JIT is an approach to material control based on the view that a process should operate only when a customer signals a need for more parts from that process. When a process is operated in the JIT way, goods are produced and delivered just-in-time to be sold. This principle cascades upstream through the supply network, with subassemblies produced and delivered just-in-time to be assembled, parts fabricated and delivered just-in-time to be built into subassemblies, and materials bought and delivered just-in-time to be made into fabricated parts. Throughout the supply network, the trigger to start work is governed by demand from the customer – the next process (Schonberger, 1991). A supply network can be conceived of as a *chain of customers*, with each link coordinated with its neighbours by JIT signals. The whole network is triggered by demand from the end-customer. Only the end-customer is free to place demand whenever he or she wants; after that the system takes over.

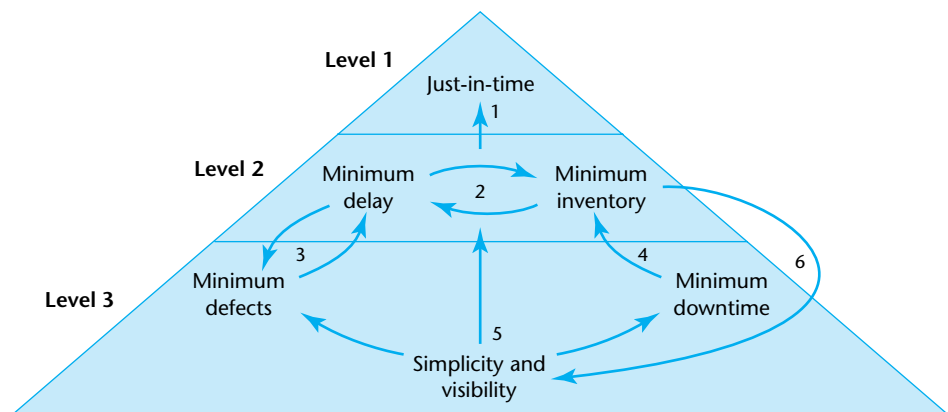
The above description of the flow of goods in a supply chain is characteristic of a *pull* system. Parts are pulled through the chain in response to demand from the end-customer. This contrasts with a *push* system, in which products are made whenever resources (people, material and machines) become available in response to a central plan or schedule. The two systems of controlling materials can be distinguished as follows:

- *pull scheduling*: a system of controlling materials whereby the user signals to the maker or provider that more material is needed. Material is sent only in response to such a signal.
- *push scheduling*: a system of controlling materials whereby makers and providers make or send material in response to a pre-set schedule, regardless of whether the next process needs them at the time.

The push approach is a common way for processes to be managed, and often seems a sensible option. If some of the people in a factory or an office are idle, it seems a good idea to give them work to do. The assumption is that those products can be sold at some point in the future. A similar assumption is that building up a stock of finished goods will quickly help to satisfy the customer. This argument seems particularly attractive where manufacturing lead times are long, if quality is a problem, or if machines often break down. It is better and safer to make products, just in case there is a problem in the future. Unfortunately, this argument has severe limitations. Push scheduling and its associated inventories do *not* always help companies to be more responsive. All too often, the very products the organisation wants to sell are unavailable, while there is too much stock of products that are not selling. And building up stock certainly does not help to make more productive use of spare capacity. Instead it can easily lead to excess costs, and hide opportunities to improve processes.

### 6.2.1 The just-in-time system

Companies achieve the ability to produce and deliver just-in-time to satisfy actual demand because they develop a production system that is capable of working in this way. Such a system can be envisaged as a number of ‘factors’ that interact with each other, as shown in Figure 6.5. This shows JIT capability as founded on layers of factors that interact together to form a system that is designed for flow. Excellence in each of the six factors determines the effectiveness with which JIT capability can be achieved: that is, how easy it is to get to the top of the pyramid.



**Figure 6.5** The pyramid of key factors that underpin JIT

#### *Factor 1*

The top of the pyramid is full capability for just-in-time supply. This is the level at which a focal firm can produce and deliver according to the demand that is placed on it. The relationships operating within and between levels 2 and 3 form the system that ultimately underpins the achievement of JIT. They are complex,

and in some cases there is a long time delay between taking actions and seeing the effects.

### Factor 2

The two factors *delay* and *inventory* interact with each other in a system of positive amplification: that is, they go up together and they go down together. This interrelationship results in either a virtuous cycle, where things keep getting better, or a vicious cycle, where they keep getting worse. For example, extra delay in a process will result in extra inventory being held to compensate for the delay. Adding more inventory causes further delays as products take longer to flow through the process, which leads to the need for more inventory. Conversely, if delays are reduced then less inventory is needed, which results in fewer delays, meaning that inventory can be further reduced. Making sure this relationship operates as a virtuous cycle of reducing delay and inventory instead of a vicious one where they increase depends on the underpinning factors in level 3.

### Factor 3

Defects lead to delays, either through requiring rework or necessitating increased production to compensate for scrap. The likelihood of defects leads to safety stocks being held as a buffer against potential problems. This thinking amplifies quality problems by increasing the time between a defect occurring and its discovery. Not only is the cause harder to identify, but more production will be affected. The attitude that holding inventory can mitigate the effect of quality problems is fundamentally flawed. It stands in opposition to the only successful approach to defect minimisation, where problems are quickly identified, their causes are traced, and permanent solutions are devised and applied.

### Factor 4

Machine downtime relates to a number of issues:

- unplanned downtime – that is, breakdowns;
- planned maintenance;
- changeover times.

Downtime, and particularly the risk of unplanned downtime, is a key cause of the need for safety stocks in a process. Other JIT tools and techniques can help to minimise the problems here. For example, *total productive maintenance* (TPM; Nakajima, 1989) seeks to answer the question ‘What can everyone do to help prevent breakdowns?’ Regular planned preventive maintenance, closer cooperation between production and maintenance personnel, and equipment sourcing for ease of maintenance are some of the actions that can be taken in response. In other words, increasing planned maintenance costs often results in reduced overall costs of machine downtime. Minimising changeover time is a JIT tool that can be used not only to reduce lost production time but also to improve production flexibility. Inflexible facilities delay the rapid production of customer orders.

### Factor 5

Where the flow through a process is easily seen, people in the process will have a better understanding of their colleagues' work and how they themselves affect others. A simple process results from having first *focused* operations around a family of compatible products. Layout is then organised to bring together all the people and equipment needed to undertake the process. These are arranged so that there is a logical flow between the process steps. Arranging the process so that the stations for undertaking the steps are close together not only helps to reduce inventory but also will itself be made easier when inventory is low. A simple process will be more *visible*, allowing it to be better maintained. Not only should there be fewer things to go wrong, they will be more obvious when they do, and will be easier to fix. This attribute helps to minimise both machine downtime and product defects.

Maintenance of the process is underpinned by housekeeping and cleanliness. This starts with designing processes and facilities to create order. There is a place for everything, and everything has its place. Orderliness depends on a thinking workforce that has accepted ownership and responsibility for organising the work place. Attention to detail in terms of 'respect for human' issues is an essential part of JIT philosophy (Harrison and Storey, 2000).

### Factor 6

The levels of work in progress and other types of inventory have a significant impact upon the visibility of a process. It becomes increasingly difficult to see the flow of a process as inventory increases. This may be literally true on a shop floor or in a warehouse, where piles and stacks of goods can isolate workers. The same is true in offices when the process flow becomes lost in assorted piles of work on people's desks.

In order to highlight the limitations of push production we next consider the case of how a focal firm took a rather traditional approach to responding to new demands being placed on the production process.

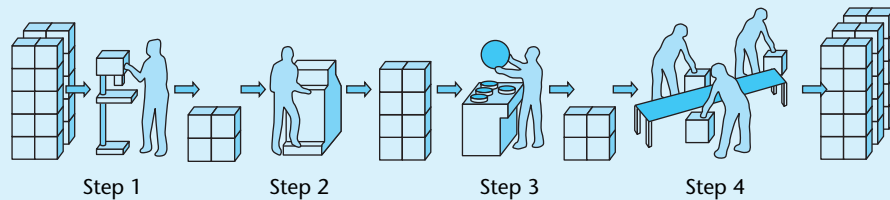
## CASE STUDY 6.2

### Smog Co.

#### The Smog Co. production system

This is the case of Smog Co., a small supplier of well-engineered components. Smog produces a range of products grouped into families. Production of one of the higher-volume product families has been organised into a flow process made up of four steps, which follow one after the other in sequence. Changeover from one product to another is relatively simple, but takes around 10 minutes per machine. To minimise delays caused by changeovers, products tend to be made in batches. These batches move from one step to the next, where they queue on a first in, first out basis to be worked on, after which they move to the next step. This process is shown in Figure 6.6.

Key measures of the performance of this process are the utilisation of people and of machines. The objective is to keep utilisation of both as high as possible. In this situ-



**Figure 6.6** The Smog Co. Production process

ation, if people or machines are idle – and material is available – they are used to make something. Naturally it would not make sense to make just anything. Instead, the production manager has a feel for what is needed, and uses a forecast from the sales department to make an early start on products that it is considered will be required in the near future.

Fred Hollis, the Smog production manager, felt pleased with performance as he looked out across the factory. He was pleased because his machines and people were busy, there were plenty of finished goods on hand, which the sales team could use to supply customers, and there was stock to call upon if product demand increased. Everything seemed to be under control.

### Changes to customer requirements

The motivation to change from the current system has been low in the past, as the process at Smog Co. is a reliable one, which has worked well for the company. The ‘big three’ customers, who take three-quarters of sales, tend to order the same things in similar quantities one week in advance of delivery. With a production lead time of three weeks, Smog Co. uses a forecast to schedule production and make sure that finished goods stocks will be available to meet predicted demand. Consistent demand means that forecasts are often close to real demand, so stockouts are rare. In fact the only time this occurred was an incident a couple of years ago, when a key machine went down and a spare part took a long time to source. Current inventory levels now include safety stock to provide cover against a similar problem in the future.

When the company found that certain finished goods were selling slowly, the sales team was particularly good at finding a way to move them. Sometimes prices were cut; at other times sales used special promotions. If production was too high, or the forecast was a bit optimistic, then there were ways of selling surplus stock, and the sales team seemed to enjoy the challenge.

Recently, however, this well-understood position began to change. The main customers started to use a number of new strategies to compete with each other. First one and then a second of them announced that it will be reducing the call-off time for its products from one week to two working days. At the same time they are all looking for a 5 per cent cost reduction, and are demanding quality improvements.

### A ‘traditional’ reaction to customer demands for better service

The combination of demands for better services caused Smog management some concern. The obvious response to the changes in ordering patterns was to increase stock levels to cater for unexpected variations in demand. This approach had worked before,

when it was used to justify the safety stocks that covered production problems. It seemed worth trying again, so stocks were increased.

Things went well over the first few months, during which time delivery performance remained good, while the customers went ahead with their plan to reduce the order lead time. Keeping up with these orders provided the production manager with a few headaches. Preventing stockouts led to an increase in the number of batches being expedited through the factory. This disrupted the production plan, increased the number of machine changeovers, and lowered productivity. As a result, overtime increased in order to maintain output.

The higher level of inventory meant that quality problems were harder to detect. In one case a new operator missed a drilling operation. By the time the first customer discovered the error, nearly two weeks' worth of production had to be recalled and reworked.

The higher inventory levels were also taking up more space. Fred Hollis had submitted a requisition to the finance director to pay for more storage racking. The extra racks were necessary because existing ones were full, and parts stored on the floor were suffering occasional damage in an increasingly cramped factory. Some parts were recently returned by a customer, who felt that damaged packaging indicated damaged products. Naturally, Fred was concerned when his request for more storage space was turned down owing to spending reductions imposed in response to price cuts demanded by customers.

Reflecting on what had happened at Smog, the increase in stock levels had badly affected competitiveness. Smog Co. was experiencing the consequences of trying to forecast demand and using the forecast to determine what to make. Their 'make to stock' approach was responsible for:

- removing the company's ability to be responsive to changes in either quantities or product mix;
- increasing costs and making quality problems worse;
- burying underlying production problems under inventory, and thereby preventing efforts to uncover and resolve them.

In conclusion, while the company had been motivated by its customers to change, the direction it took seemed to have caused many problems.

(Source: after an original by Paul Chapman)

### Questions

- 1 List the actions that Smog Co. took to respond to the new demands being placed on it by customers. Group your responses under the headings of stock levels, level of expediting, and storage space. Briefly describe the effects that these actions had on production performance.
- 2 Use the 'Pyramid of key factors that underpin JIT' to describe the factors that caused these actions to affect the company's ability to respond to the demands being placed on it by customers.



## 6.2.2 JIT and material requirements planning (MRP)

As we saw in section 6.1, material requirements planning (MRP) was conceived in order to answer the questions *how many?* and *when?* in ordering parts that are directly used to manufacture end products. MRP is a logical and systematic way of planning materials. It links downstream demand with manufacture and with upstream supply. It can handle detailed parts requirements, even for products that are made infrequently and in low volumes.

On the other hand, MRP is based on a centrally controlled, bureaucratic approach to material planning. Although it is based on a pull scheduling logic, it instructs processes to make more parts whether or not the customer (the next process) is capable of accepting them. Typically, MRP adopts push scheduling characteristics. It remains insensitive to day-to-day issues at shop floor level, and continues to assume that its plans are being carried out to the letter. In other words, MRP is good at planning, but weak at control.

Meanwhile, JIT pull scheduling is good at handling relatively stable demand for parts that are made regularly. It is sensitive to problems at shop floor level, and is designed not to flood the next process with parts that it cannot work on. On the other hand, JIT pull scheduling is not good at predicting requirements for the future, especially for parts and products that are in irregular or sporadic demand. JIT is good at control, but weak at planning. There are clear opportunities for putting together the strengths of both systems, so that the weaknesses of one are covered by the strengths of the other. For example, even in systems with great variety, many of the parts are common. So JIT can be used to control those parts, while a much downsized MRP plans what is left.

JIT has become associated with the Japanese way of cutting out waste, doing the simple things well and getting better every day. The pillars of Toyota Production System (TPS) are JIT and *jidoka*. *Jidoka* means humanising the man-machine interface so that it is the man who runs the machine, not vice versa. MRP has become associated with the Western way of automating our way out of trouble, and by investing in bigger and better systems that competitors cannot afford to match. Let us next review how these two different approaches apply in motor manufacture by comparing Ford (which has developed its own version of TPS called Ford Production System, FPS) and Toyota.

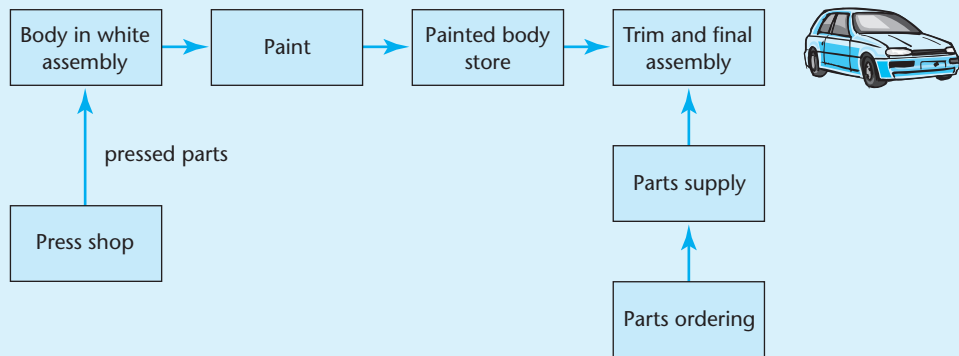
### CASE STUDY 6.3

#### Ford and Toyota

A car assembly plant is built around a simple sequence of tasks that starts in the press shop and ends as a car rolls off the final assembly line. Figure 6.7 shows these basic tasks in summary form.

While these basic tasks are the same for both Ford and Toyota, the way they are managed by the two firms is quite different. We compare policies and practices in relation to small cars like the Ford Fiesta and the Toyota Yaris:

- Ford has been driven by a long-term strategy in Europe. It has invested heavily in fixed assets, and does not seek an early return on them. It has been struggling with



**Figure 6.7** Basic tasks in a car assembly plant

a capacity that was designed for a 15 per cent market share when current loading is only 9 per cent. It seeks to make a step change in the production process through high capital investment. Its investment policy has therefore been technically oriented, seeking the 'best' technical solution for each task. For example, Ford's body shop is almost fully automated with robots that are flexible across different parts. When production is changed between one part and another, the robots must be reprogrammed. This places high emphasis on technical support for the software, and makes Ford dependent on given equipment suppliers. The layout is designed around the robots, and for fixed volumes.

- Toyota has expanded cautiously in Europe. Its investment policy has been step by step, and it has sought to make early returns. Key to Toyota Production System (TPS) are process and quality disciplines through JIT and *jidoka*. Toyota's philosophy is more people-oriented: shop floor people are heavily involved in improvement activities as well as in production work. Toyota's body shop has maybe one-third the number of press shop robots as Ford, and tends to use simple multi-welders at low initial cost. It is relatively easy to swap suppliers. Tooling must be changed when production is changed between one batch and another, but people are trained to go for fast setups and to improve the process. The layout is designed around people and volume flexibility.

Having learned much from its stake in Mazda, Ford launched its own version of just-in-time called Ford Production System (FPS) a few years ago. Ford has done much to reduce product complexity. This is basically measured by the number of different body styles that are possible. Both Ford and Toyota have three basic body styles, But Ford limits variation to left-hand/right-hand drive and sunroof/no sun roof versions. Since these are multiplicative, 12 body shells are possible. Toyota in addition has variations to allow for different engine types and air conditioner types, together with spoiler/no spoiler versions. In total, this means that Toyota has over 70 body shell variations. When multiplied again by the number of painted body colours (say 10 for both firms), Toyota ends up with hundreds more painted body options than Ford. This contributes to a surprising difference when it comes to building the car:

- Ford treats the painted body as a commodity. Once they have been painted, bodies are kept in the painted body store, which is a buffer between the body shop and final assembly. The Ford system calculates the number of each painted body type that should be in the store to meet forecast final assembly requirements. The trouble

is that the store can be full of the wrong bodies, which means that it is impossible to build the current orders. Up to this point in the sequence, the emphasis is on numbers, not on the end-customer. Bodies are not given a vehicle identification number (VIN) – which allocates the body to a particular customer order – until the painted body is removed from the store and dropped onto the trim and final assembly line.

- Toyota treats the body shell as a customer's car from the start. The VIN is added as the first process at body in white assembly, when panels are welded together to make the shell. In turn, this drives discipline and focus in the paint shop, and helps to improve first time through (FTT) in the paint process. The sequence of bodies through trim and final processes is thereby more predictable, allowing more precise material control downstream.

The parts ordering process for auto assembly is particularly challenging, because some 2,000 individual parts are needed for each vehicle. Most of these parts are added at the trim and final assembly stage. TPS already has a number of advantages when it comes to this task. First, the more predictable sequence of painted bodies into trim and final means that there are few last minute schedule changes. Second, TPS sets stable lead times that are fixed at certain times for each part. Third, supplier lead times are allowed for. Ford, on the other hand, leaves schedules uncommitted until parts are collected. The Ford call-off quantities are set on the day of collection, and do not allow for supplier lead times. Figures 1.8 and 1.9 compare what happens from a supplier point of view – there are huge differences between scheduled and actual demand.

### Question

- 1 what changes would you propose to both TPS and to FPS in order to cope with customer demands for increasing product variety and more rapid model changes?

## 6.3 Lean thinking

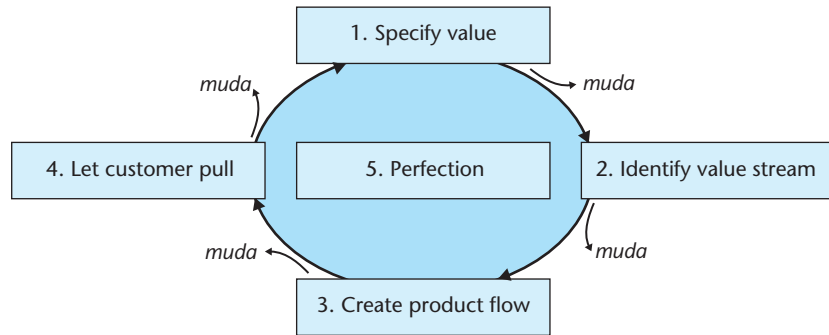
**Key issues: What are the principles of lean thinking, and how can they be applied to cutting waste out of supply chains?**

As stated in the introduction to this chapter, *lean thinking* (Krafcik and MacDuffie, 1989) developed as a term used to contrast the just-in-time production methods used by Japanese automotive manufacturers with the mass production methods used by most Western manufacturers. Suffering shortages and lack of resources, Japanese car manufacturers responded by developing production processes that operated with minimum waste. Gradually the principle of minimising waste spread from the shopfloor to all manufacturing areas, and from manufacturing to new product development and supply chain management. The term *lean thinking* refers to the elimination of waste in all aspects of a business.

Lean thinking is a cyclical route to seeking perfection by eliminating waste (the Japanese word is *muda*) and thereby enriching value from the customer perspective. The end-customer should not pay for the cost, time and quality penalties of

wasteful processes in the supply network. Four principles are involved in achieving the fifth, seeking perfection (see Figure 6.8):

- specifying value;
- identifying the value stream;
- making value flow;
- pull scheduling.



**Figure 6.8** Principles of lean thinking

(Source: After Womack and Jones, 2003)

### Specify value

Value is specified from the customer perspective. In Chapter 3 we discussed value from the shareholder perspective. From the end-customer perspective, value is added along the supply network as raw materials from primary manufacture are progressively converted into the finished product bought by the end-customer, such as the aluminium ore being converted into one of the constituents of a can of coke (see Chapter 1, section 1.1). From a marketing and sales perspective the can of coke should be ‘always within reach of your thirst’. That is an attempt to define value from the end-customer perspective. Another is Porter’s concept of the *value chain* (Porter, 1985), which sees two types of activity that are of value to the customer. The first is the primary value activities of transforming raw materials into finished products, then distributing, marketing and servicing them. The second is support activities, such as designing the products and the manufacturing and distribution processes needed to underpin primary activities.

### Identify the value stream

Following on from the concept of value, the next principle is to identify the whole sequence of processes along the supply network. The principles of time-based mapping are discussed in sections 5.4 and 5.5 of Chapter 5.

### *Make value flow*

In essence, this means applying the pyramid of key factors that we outlined in section 6.2. Minimising delays, inventories, defects and downtime supports the flow of value in the supply network. Simplicity and visibility are the foundations to achieving these key factors.

### *Pull scheduling*

Enforce the rules in section 6.2: make only in response to a signal from the customer (the next process) that more is needed. This implies that demand information is made available across the supply chain. Where possible, supply from manufacturing, not from stock. Where possible, use customer orders not forecasts.

While some of these concepts may be distant from current practice, lean thinking shares the philosophy of ‘big JIT’: seek perfection. This is the fifth principle, and is achieved by gradually getting better at everything we do, squeezing waste out at every step. We continue this section by considering the sources of waste, and the way in which lean thinking can be applied to enriching value in business processes.

## 6.3.1 The seven wastes

In Chapter 5 we saw how any activity that does not add value is a form of waste. By mapping processes through the supply chain, it is possible to sort value-adding and non-value-adding activities (transport, store, inspect and delay). Lean thinking goes further by adding three more types of ‘waste’ to make seven in all. They are as follows:

- *The waste of overproduction*: making or delivering too much, too early or ‘just in case’. Instead, the aim should be to make ‘just-in-time’ – neither too early nor too late. Overproduction creates unevenness or lumpiness of material flow, which is bad for quality and productivity. It is often the biggest source of waste.
- *The waste of waiting*: takes place whenever time is not being used effectively. It shows up as waiting by operators, by parts or by customers.
- *The waste of transporting*: moving parts around from one process to the next adds no value. Double handling, conveyors and movements by forklift truck are all examples of this waste. Placing processes as close as possible to each other not only minimises the waste of transport but also improves communications between them.
- *The waste of inappropriate processing*: using a large, central process that is shared between several lines (e.g. a heat treatment plant) is an example of this type of waste. Another example is a process that is incapable of meeting quality standards demanded by the customer – so it cannot help making defects.
- *The waste of unnecessary inventory*: inventory is a sign that flow has been disrupted, and that there are inherent problems in the process. Inventory not

only hides problems, it also increases lead times and increases space requirements.

- *The waste of unnecessary motions*: if operators have to bend, stretch or extend themselves unduly, then these are unnecessary motions. Other examples are walking between processes, taking a stores requisition for signature, and decanting parts from one container into another.
- *The waste of defects*: producing defects costs time and money. The longer a defect remains undetected (e.g. if it gets into the hands of the end-customer), the more cost is added. Defects are counteracted by the concepts of 'quality at source' and 'prevention, not detection'.

Lean thinking invites us to analyse business processes systematically to establish the baseline of value-adding processes and to identify the incidence of these seven wastes. The aim is to get parts and data to flow through business processes evenly and in harmony. The more detailed analysis prompted by the concept of seven wastes encourages a greater analysis and understanding of processes and their relationships than is made by supply chain mapping. This analysis should first start with key business processes such as the supply pipeline. Working back from the customer, a business should consider the following processes in the first instance:

- order to replenishment;
- order to production;
- product development.

In each of these processes, the application of lean thinking involves examining the process, quantifying waste within it, identifying root causes of the waste, and developing and implementing solutions. Examining the process involves mapping it using a variety of techniques such as flow charting, depending on the nature of the process. Performance is quantified by taking measures of the different kinds of waste. For a first attempt, using the time-based measures of lead time and value-adding time often reveal the main incidences of waste. Having identified waste, lean thinking applies the problem-solving tools associated with total quality control (TQC) to identify root causes and develop solutions.

The application of lean thinking is the means by which many companies bring their processes under control. Following a systematic approach to tackling waste, they seek to minimise defects, to minimise downtime and to maximise simplicity and visibility.

## 6.3.2 Application of lean thinking to business processes

### *Order to replenishment*

The order replenishment cycle concerns the time taken to replenish what has been sold. Lean thinking seeks to manage the order replenishment cycle by replacing only what has been sold within rapid replenishment lead times. These points are taken up in the next two sections of this chapter, on vendor-managed inventory and on quick response.

### *Order to production*

The order to production cycle is the series of steps that are followed to respond to an order, organise and undertake production, and deliver the product to the customer. This 'make to order' process may be contained within a company or can extend down the supply chain.

### *Product development*

Product development delivers new products or services that can be sold. This process is essential if an organisation is to have future success. Lean thinking can be applied to this process to make it more effective by supporting the development of products with desirable attributes and features and achieving this on time. It can also make the process more efficient and ensure that products are developed to cost.

## 6.3.3 Role of lean practices

Lean thinking is associated with a number of operational practices that help to deliver the aim of waste minimisation. Two of the most significant are:

- small-batch production;
- rapid changeover.

These two practices are closely associated with each other, but are considered separately here to aid clarity.

The target in small-batch production is a batch size of 1. The traditional logic behind large batches is to take advantage of reduced costs through economies of scale (see EBQ in section 6.1 above). This approach is often flawed, as batch size decisions generally consider only production costs, and overlook the costs of inventory and lack of flexibility that is caused by large batches. Lack of flexibility is a major contributor to poor quality of service to the end-customer. The rationale behind small batches is that they can reduce total cost across a supply chain, such as removing the waste of overproduction. They help to deliver products that the end-customer wants within the expected lead time (D-time – Chapter 5, section 5.2).

The contribution of rapid changeover was graphically shown by the changeover of press tools used to make car body panels. These cumbersome pieces of equipment can weigh up to 10 tonnes, and historically took up to eight hours to change within the large presses. The consequence of these long changeover times was that component production runs were long, often going on for days before the press tools were changed so that another component could be made. Extensive work, again led by Toyota, was undertaken on press design, tooling design and component design over a number of years to help to reduce changeover times. The effect has been to reduce changeover times for tools for large pressed parts to around five minutes. Consequently, practices that reduce changeover times are often known as *single minute exchange of dies* (SMED,

Shingo, 1988). The ability to undertake rapid changeovers allows a batch of each different body panel to be produced each day in line with current demand instead of having to produce to forecast.

The lesson from the automotive industry is that even very large pieces of equipment can be developed to allow rapid changeovers. This effort may take a number of years, and is reliant upon developments in machinery and product design, but it can be done. The effect is to provide the flexibility to make possible small-batch production that responds to customer needs.

Small-batch production associated with rapid changeover allows productivity to be maintained by taking advantages of economies of scope. Instead of economies of scale, where quantities of the same thing are made, economies of scope lower costs when quantities of similar things that use the same production resources are made.

### 6.3.4 Design strategies

Underpinning the application of lean thinking is the need to influence design. Many of the wastes uncovered in the replenishment, make to order and product development cycles cannot be removed because they are inherent in the design of products, systems, processes and facilities. The design strategy employed in lean thinking is to incorporate the ability to undertake lean practices across the total life of a product or facility and also include flexibility to deal with unpredicted events. These issues are described more fully below.

### 6.3.5 Lean product design

Products can be designed with a number of lean attributes. These include:

- a reduction in the number of parts they contain and the materials from which they are made;
- features that aid assembly, such as asymmetrical parts that can be assembled in only one way;
- redundant features on common, core parts that allow variety to be achieved without complexity with the addition of peripheral parts;
- modular designs that allow parts to be upgraded over the product life.

### 6.3.6 Lean facility design

The facilities within which new products are developed and existing ones are made and delivered should be designed with lean attributes. Amongst these are:

- modular design of equipment to allow prompt repair and maintenance;
- modular design of layout to allow teams to be brought together with all the facilities they need, with the minimum of disruption, and then subsequently to be dispersed and reassembled elsewhere;



- small machines, ideally portable, which can be moved to match the demand for them;
- open systems architectures (both IT and physical ones) that allow equipment to fit together and work when it is moved and connected to other items.

### 6.3.7 Lean thinking summary

Lean thinking is based around the simple philosophy of eliminating waste. This concept can be applied to almost all business processes in almost any company. A simple method to help companies achieve this is for them to pursue the goal of single-piece flow, where the batch size passing through the processes of a company is a single item. Problems encountered during progress towards this goal reveal the areas that need to be resolved in order to become leaner.

To aid waste elimination, a number of practices have been developed. Key ones such as rapid changeover, presented here, provide standard solutions that are widely applicable, and help most companies to reduce costs and improve quality.

## Summary

### *How is material flow planned and controlled in the supply chain?*

- The most detailed planning and control systems have been developed in manufacturing – hence our focus on manufacturing planning and control (MPC systems). They are based on three time periods – long term, medium term and short term.
- The focal firm ‘game plan’ comprises a set of inter-linked modules ranging from ‘front end’ (demand management, resource planning, sales and operations planning and master production scheduling) to ‘engine’ (materials and capacity planning) to ‘back end’ (detailed planning and control of source–make–deliver processes). All are linked to the enterprise resource planning (ERP) database.
- After manufacture, independent demand items in the supply chain must be managed by order point methods like EOQ and POQ. Periodic review places orders of variable size at fixed intervals.
- Linking MPC systems between firms greatly increases the need for management of detail. There are many more ways to inhibit the accurate exchange of data than within a focal firm. This results in undesirable symptoms like the bullwhip effect and even chaotic behaviour of material movements.

### *What is JIT, and how does it apply to logistics?*

- JIT is a broad-based philosophy of doing the simple things right and gradually doing them better. As applied to logistics, JIT can be conceived as a pyramid of key factors that centre on minimum delay and minimum inventory.
- ‘How many?’ and ‘when?’ to order are key questions that impact on delay and inventory. JIT contributes to the answers to these questions by cutting down the sources and causes of waste in logistics. Specific contributions include the reduction of changeover times and simple, paperless systems of material control.
- Longstanding approaches to material control, such as reorder point stock control (ROP), economic order quantities (EOQ) and material requirements planning (MRP), can be made far more responsive by the application of JIT principles. Examples are reducing batch sizes and reorder quantities, and reducing lead times. Synergies can be delivered, too: JIT pull scheduling works best for control, MRP for planning.

### *What is lean thinking, and how can it be applied to logistics?*

- Lean thinking seeks perfection by gradually reducing waste from each of four areas: specifying value from the customer perspective; identifying the value stream (through time-based mapping); making the product flow through the supply network (by applying JIT principles); and letting the customer pull (through pull scheduling).
- Lean thinking focuses on how the seven wastes can be used to support lean principles. Lean thinking follows JIT principles via the concept of ‘one piece flow’. Lean thinking extends these principles into product and facility design.

## Discussion questions

- 1 Apply the MPC framework in Figure 6.1 to a restaurant. Pay special attention to identifying the front end, engine and back end components.
- 2 Evaluate the impact of international supply chains on the challenges to MPC systems in practice. Does increasing the physical distance between processes mean that they are more difficult to plan and control?
- 3 Demand changes from independent to dependent at the customer order decoupling point (CODP, Figure 5.3). What actually happened to demand, and why is this change so important in managing material flow?
- 4 What actions are needed to address the problems of inter-firm planning and control listed in section 6.1.3? How would you go about orchestrating material movements (for example cheeses, shown on Figure 1.1) across a grocery supply chain?
- 5 Dealers have criticised the way auto assemblers use JIT as an excuse for buying parts from the inbound supply network ‘so that their costs are kept down’. They then dump finished vehicles onto the dealer by matching *their* perceptions of a marketplace

demand with *their* constraints as a manufacturer, i.e. what they've produced' (adapted from Delbridge and Oliver, 1991). Referring to the Ford/Toyota case in Case study 6.3, comment on the trade-offs implied in these comments from disgruntled dealers.

- 6 What matters more: value to the customer or value to the shareholder? Refer to section 3.4 of Chapter 3 in formulating your response. How does this question impact on the philosophy of lean thinking?
- 7 What is meant by the term *overproduction*? Why do you think this has been described as the biggest waste of all?
- 8 Explain the difference between pull scheduling and push scheduling. Under what circumstances might push scheduling be appropriate?

## References

- Chase, R.B., Jacobs, R. and Aquilano, N.J. (2005) *Operations Management for Competitive Advantage*, 10th edn. New York: McGraw-Hill.
- Delbridge, R. and Oliver, N. (1991) 'Just-in-time or just the same? Developments in the auto industry: the retailers' views', *International Journal of Retail and Distribution Management*, Vol. 19, No. 2, pp. 20–6.
- Goldratt, E.M. and Cox, J. (1984) *The Goal*. New York: North River Press Inc.
- Harrison, A.S. (1992) *Just in Time Manufacturing in Perspective*. Hemel Hempstead: Prentice Hall.
- Harrison, A., Chapman, P., Rutherford, C. and Stimson, J. (2004) Demand planning and forecasting: survey of best practice, Cranfield University.
- Harrison, A. and Storey, J. (2000) 'Coping with world class manufacturing'. *New Technology, Work and Employment*, Vol. 13, No. 3, pp. 643–64.
- Krafcik, J.F. and MacDuffie, J.P. (1989) Explaining High Performance Manufacturing: The International Automotive Assembly Plant Study, International Motor Vehicle Program. Cambridge MA: MIT Press.
- Lee, H.L., Padmanabhan, V. and Whang, S. (1997) 'The bullwhip effect in supply chains', *Sloan Management Review*, Vol. 38, No. 3, pp. 93–102.
- Nakajima, S. (ed.) (1989) *TPM Development Program: Implementing total productive maintenance*. Cambridge, MA: Productivity Press.
- Porter, M.E. (1985) *Competitive Advantage: Creating and sustaining superior performance*. New York: Free Press.
- Schonberger, R.J. (1991) *Building a Chain of Customers: Linking business functions to build the world class company*. New York: Free Press.
- Shingo, S. (1988) *Non-Stock Production*. Cambridge: Productivity Press.
- Skipworth, H. and Harrison, A. (2004) 'Implications of form postponement to manufacturing: a case study', *International Journal of Production Research*, Vol. 42, No. 1, pp. 2063–81.
- Storey, J. and Emberson, C. (2005) 'The barriers to customer responsive supply chain management', *International Journal of Operations and Production Management*, Vol. 25, No. 3/4, pp. 242–61.
- Storey, J., Emberson, C., Godsell, J. and Harrison, A. (2006) 'Supply chain management: theory, practice and future challenges', *International Journal of Operations and Production Management*, Vol. 26, No. 7, pp. 754–74.

- Vollman, T.E., Berry, W.L., Whybark, D.C. and Jacobs, F.R. (2005) *Manufacturing Planning and Control for Supply Chain Management*, 5th edn. New York: McGraw Hill/Irwin.
- Waters, D. (2003) *Inventory Planning and Control*. John Wiley and Sons Ltd.
- Wilding, R. (1998) 'The supply chain complexity triangle: uncertainty generation in the supply chain', *International Journal of Physical Distribution and Logistics Management*, Vol. 28, No. 8, pp. 599–616.
- Womack, J. and Jones, D. (2003) *Lean Thinking*, 2nd edn. New York: Free Press.

### *Suggested further reading*

- Crum, C. and Palmatier, G. (2003) *Demand Management Best Practices: Process, principles and collaboration*, Fort Lauderdale, FA: J. Ross Publishing.
- Wild, A. (2002) *Best Practice in Inventory Management*, 2nd edn. Oxford: Butterworth Heinemann.
- Womack, J., Jones, D. and Roos, D. (1990) *The Machine that Changed the World*. New York: Rawson Associates.



## CHAPTER 7

# The agile supply chain

### Objectives

*The planned objectives of this chapter are to:*

- introduce the concept of the agile supply chain as a broad-based approach to developing responsiveness advantages;
- explore the challenges and difficulties of coping with uncertain demand situations;
- explain how capabilities can be developed and specifically targeted at thriving in conditions of market turbulence.

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

- that different strategies are needed for different volume/variety conditions in the supply chain;
- the distinctions between lean and agile mindsets, and how the two can work together;
- the type of market conditions under which agile strategies are appropriate and how they can be operationalised;
- practices that can help develop agile capabilities.

*In Chapter 9 we consider another key aspect of the agile supply chain – the virtual supply chain.*

### Introduction

In the previous two chapters, we reviewed process mapping, just-in-time and other time-based approaches to developing the capabilities needed to support the speed advantage. While such logistics capabilities are important enablers to lean and responsive supply chains, the ‘agile supply chain’ takes the argument a significant step further. Marketplaces of the twenty-first century are often characterised by proliferation of products and services, shorter product life cycles and increased rates of product innovation. Simply responding quickly and at the right time are not enough to meet the needs of such marketplaces.

The mission of logistics today is to ensure that it is the right product – to meet exact end-customer needs – that gets delivered in the right place at the right time. Such a mission means that the *end-customer comes first*. This chapter proposes the agile supply chain as an approach that elevates speed capabilities in a given

supply chain to much higher levels than would be possible using the tools and techniques discussed so far.

In Chapter 6, we looked at the concepts of ‘lean production’, and the wider concept of the ‘lean enterprise’. The focus of the lean approach has essentially been on the elimination of waste or *muda*. A common view is that lean thinking works best where demand is relatively stable – and hence predictable – and where variety is low. But in situations where demand is volatile and customer requirement for variety is high, the elimination of waste becomes a lower priority than the need to respond rapidly to a turbulent marketplace. In fact, it may be important to have, for example, five production lines rather than the three that are justified by overall forecast volumes. The ‘surge’ capacity may be needed to ensure that customer service levels do not suffer during periods of peak loading. While this is hardly ‘lean’ capacity management, and the investment cost alone is 67 per cent higher, the benefits are in maintaining consistent lead times.

It is also important to recognise that no single approach offers a solution to every supply chain situation, a point we made in section 1.4.3.

### Key Issues:

This chapter addresses two key issues:

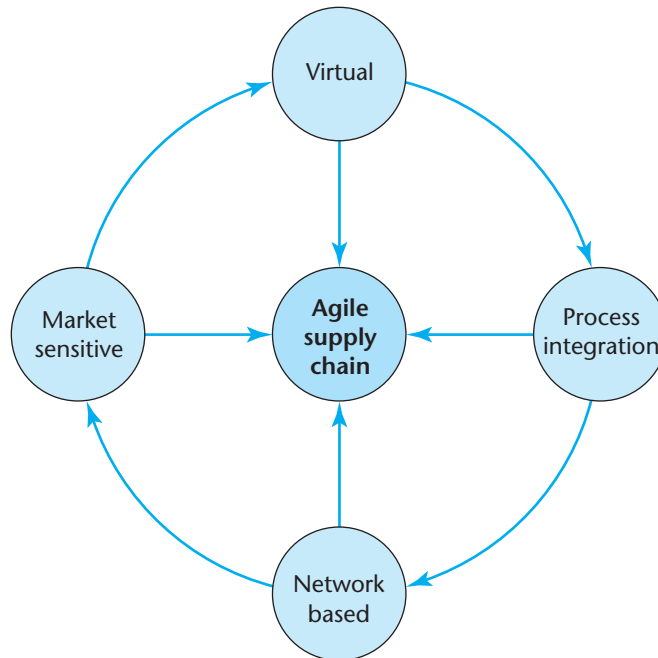
- 1 **The concept of agility:** the dimensions of the agile supply chain, and the environments that favour agility. We consider when and where agile capabilities should be applied to supply chains.
- 2 **Agile drivers and practices:** addressing the drivers of agile supply chains, and the use of agile practices to support them.

## 7.1 The concept of agility

*Key Issue: what are the dimensions of the agile supply chain?*

Figure 7.1 sets out our vision of the agile supply chain (Harrison *et al.*, 1999). Firstly, the agile supply chain is *customer responsive*. By customer responsive we mean that the supply chain is capable of reading and responding to end-customer demand. Most organisations are forecast-driven rather than demand-driven. In other words, because they have inadequate real-time data and cannot react fast enough anyway, they are forced to make forecasts based upon past sales or shipments and convert these forecasts into inventory. The breakthroughs of the last decade in the form of such advances as efficient consumer response (ECR – see section 8.2) and the use of information technology to capture data on demand direct from the point-of-sale or point-of-use are transforming an organisation’s ability to hear the voice of the market. This throws down the challenge of how to develop the capabilities needed to respond.

Second, the supply chain should be viewed as a *network* of partners who have a common goal to collaborate together in order to respond to end-customer needs. In Chapter 1, we introduced the term ‘network’ to refer to the cross-linking of partners that forms the basic model used in this book. Individual partners are viewed in terms of their contribution to the value being generated for the



**Figure 7.1** An integrated model for enabling the agile supply chain

end-customer. Competitive strength comes from focusing the capabilities of a network of partners onto responding to customer needs.

The third component of agility is viewing the network as a system of *business processes*. Nesting the capabilities of these processes creates power and synergy for the network. ‘Stand alone’ processes that do not support material flow create penalties in terms of time, cost and quality for the whole network. As we said on page 12, ‘all processes within the network need to be understood in terms of how they interact with other processes’.

Fourth, use of information technology to share data between buyers and suppliers creates, in effect, a *virtual* supply chain (see sections 8.1.3 and 9.5.2). Virtual supply chains are information-based rather than inventory-based. Conventional logistics systems seek to identify optimal quantities of inventory and their spatial location. Complex formulae and algorithms exist to support this inventory-based business model. Paradoxically, what we are now learning is that once we have visibility of demand through shared information, the premise upon which these formulae is based no longer holds. Electronic data interchange (EDI) and the Internet have enabled partners in the supply chain to act upon the same data – real demand – rather than to be dependent upon the distorted and noisy picture that emerges when orders are transmitted from one step to another in an extended chain.

As proposed in Figure 7.1, enabling the agile supply chain requires many significant changes. As an example of such changes, consider the position of Li and Fung, the largest export trader in Hong Kong. The organisation coordinates manufacturers in the Far East to supply major customers like *the Limited*, mostly in the USA. Chairman Victor Fung says that one of the key features of his



approach is to organise for the customer, not on country units that end up competing against each other.

**So customer-focused divisions are the building blocks of our organisation, and we keep them small and entrepreneurial. They do anywhere from \$20 million to \$50 million of business. Each is run by a lead entrepreneur. (Magretta, 1998)**

Capabilities of the supply networks are ‘all about flexibility, response time, small production runs, small minimum order quantities, and the ability to shift direction as the trends move’.

### 7.1.1 Demand characteristics and supply capabilities

The ‘agile supply chain’ is an essentially practical approach to organising logistics capabilities around individual end-customer demand. It is about moving from supply chains that are structured around a focal company and its operating guidelines (for example, ‘Ford Production System’) towards supply chains that are focused on end-customers. The key here is to organise logistics from the customer order back – or ‘outside in’ – as opposed to pushing product-service offerings into the market – or ‘inside out’. Key requirements for that change in mindset include:

- a relentless focus on drivers of customer value in all logistics processes;
- developing capabilities for responsiveness and flexibility in advance ;
- using those capabilities to align supply chains operations in a dynamic manner.

Mason-Jones *et al.* (1999) developed a helpful comparison between agile and lean supply, shown in Table 7.1. We have extended such ideas into our comparison of characteristics of lean and agile supply, shown in Table 7.2.

There is no reason why there should be an ‘either-or’ approach to logistics strategy. Thus, many supply chains can adopt a ‘lean’ capability up to a given downstream process, and then adopt an ‘agile’ capability thereafter. This enables high-productivity, low-cost processes to start with, followed by responsive processes to allow high levels of customisation thereafter. Such a strategic choice has been referred to as ‘leagility’ (Naylor *et al.*, 1999) because it combines the benefits of both supply capabilities. The concept of leagility is close to that of postponement, which we discuss later in this chapter. Case study 7.1 shows how a focal firm decided to differentiate its supply chain strategy according to lean and agile attributes.

The comparisons in Tables 7.1, 7.2 and 7.3 help us to place ‘agile’ in relation to ‘lean’, and thus to complement our earlier concept of logistics performance objectives. In Table 1.1 (page 25 in Chapter 1), we considered the issue of competing through logistics. The relative importance of the various ways of competing through logistics (quality, time, cost, dependability and agility) can be assessed with the help of order winners and order qualifiers (see section 1.3.4). *Order qualifiers* comprise the factors that are needed to gain entry into a given market. Winning orders demands that performance of the focal firm on one or

**Table 7.1** Comparison of lean supply with agile supply: the distinguishing attributes

Distinguishing attributes	Lean supply	Agile supply
Typical products	Commodities	Fashion goods
Marketplace demand	Predictable	Volatile
Product variety	Low	High
Product life cycle	Long	Short
Customer drivers	Cost	Availability
Profit margin	Low	High
Dominant costs	Physical costs	Marketability costs
Stockout penalties	Long-term contractual	Immediate and volatile
Purchasing policy	Buy materials	Assign capacity
Information enrichment	Highly desirable	Obligatory
Forecasting mechanism	Algorithmic	Consultative

**Table 7.2** Comparison of characteristics of lean and agile supply

Characteristic	Lean	Agile
Logistics focus	Eliminate waste	Customers and markets
Partnerships	Long-term, stable	Fluid clusters
Key measures	Output measures like productivity and cost	Measure capabilities, and focus on customer satisfaction
Process focus	Work standardisation, conformance to standards	Focus on operator self-management to maximise autonomy
Logistics planning	Stable, fixed periods	Instantaneous response

## CASE STUDY 7.1

### Supply chain restructuring at Aristocrat Leisure Ltd

Aristocrat Leisure ranks as the world's second largest manufacturer of slot machines after International Game Technology, supplying clubs, hotels, casinos, and bars in nearly 60 countries with casino games and gaming systems. The firm also provides technical services, training, and project management services for operating and proposed casinos. Aristocrat is based in Sydney, New South Wales, and has annual sales in excess of AUS \$1bn (1 AUS \$ = €0.6). Entry by new competitors is made difficult because of the need to obtain licences to operate in each major territory. Most markets are moving towards computerised gaming machines with lower denominations, since this allows the operators greater flexibility. The trend places Aristocrat at an advantage, since its home base in Australia is already well developed along these lines. Aristocrat machines have been winning business across the globe on superior technology, and the

firm has been increasing its market share in the US, the traditional home of International Game Technology. Seventy per cent of Aristocrat revenues are now generated outside Australia. The trend towards global customers and away from supplying conventional slot machines to customised, computerised models has prompted a fundamental review of the structure of the supply chain at Aristocrat.

The key change has been from a vertically integrated manufacturer based in Sydney to a systems integrator operating a global supply network. The first step was to modularise design of the cabinets (see Case study 5.1) to maximise common parts, and to rationalise manufacturing stages from components to subassemblies to generic product assembly to final customisation. Most common parts and standard subassemblies could now be outsourced to global suppliers – selected for their commitment to Aristocrat’s business, comparable demand profile and low costs. Knowledge transfer from Aristocrat and the development of supplier capabilities were key aspects of this process. The next step was to create a new logistics and supplier network, whereby global suppliers delivered to a 3PL that then delivered subassemblies to hubs that supplied regional integration centres in Las Vegas and Sydney. Here, the final customisation process could take place. Order fulfilment centres in London and Macao supplied and serviced the important European and Macao markets.

In developing the new logistics and supplier network, Aristocrat had to make important decisions about which parts should be outsourced to global suppliers in low-cost regions, and which should be outsourced to suppliers local to the regional integration centres. It was decided that the split should take place on part characteristics – shown in Table 7.3.

**Table 7.3** Sorting lean and agile parts and components

Characteristic	Lean	Agile
Volumes	Predictable volumes and usage patterns	Unpredictable volumes and usage patterns
Key drivers	Economies of scale – high volumes, low cost Consolidation of global volumes	Ability to deliver – short and reliable lead times Ability to respond at short notice
Customisation	Low – generic items	High – customised items
Supplier positioning	Anywhere – search for low costs	Close to the integration centre – search for responsiveness

Source: (Aristocrat Leisure Ltd)

Parts with lean characteristics were allocated to a ‘lean supply chain’, with global suppliers delivering to the integration centres as explained above. These included subassemblies like power supply, door, trim, LCD and wiring looms. Parts with agile characteristics were allocated to local suppliers that could deliver the behaviours and processes needed to support flexibility (section 1.3.2) and fast response. These parts included artwork, currency validators, printers and software. In between were parts that required ‘further analysis’, but which would then be allocated into one or other category. The distinction between the two categories was about managing the trade-off

between the financial reward of low cost (lean) and the customer service reward of fast response (agile).

### Question

- 1 Sketch out what the basic structure of the new logistics and supplier network might look like. From a lean and an agile supplier's perspective, what would be the order winners and qualifiers in dealing with Aristocrat?

more factors must be superior, so that products win orders in the marketplace because performance of competitors on these factors is not as good. These are called *order winners*. The specification of order qualifiers and order winners helps in the development of logistics strategy. Order winners and qualifiers can *change over time*, for example as a result of changes in the product life cycle. Thus it is essential to revisit the specification of order winners and qualifiers regularly to ensure that they reflect current market characteristics (Aitken *et al.*, 2005).

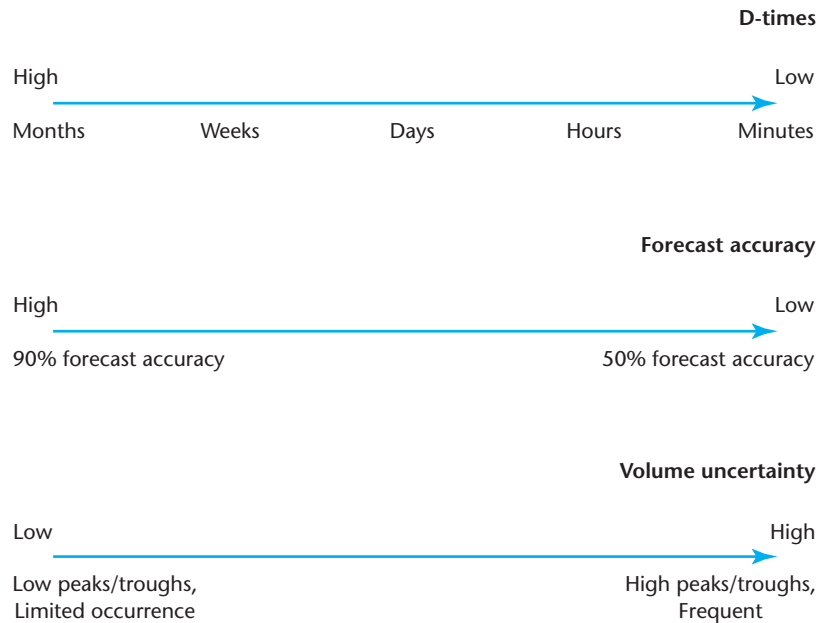
The agile mindset aims to align supply capabilities with end-customer demand, so we can view demand characteristics as placing the challenges that supply capabilities must meet. Let us now examine demand characteristics and supply capability in more detail. Both of these strategic considerations need to be applied to major market segments, a topic that we explored in Chapter 2.

### Demand characteristics

In 5.2.2, we defined *D-time* as the time that the customer is prepared to wait to have their order fulfilled. D-time may be measured in time-related units from months to minutes to seconds. Essentially, this sets time objectives for the supply chain. Response in minutes means that there is no time to procure materials or to process them. Therefore, inventories of finished products are inevitable. However, as D-times reduce in turbulent markets, holding inventories becomes an increasingly risky option, and in turn places increasing pressure onto supply capabilities. A focal firm may decide to respond to such pressure by reducing the range on offer, and by increasing the commonality of parts between different skus. At the other end of the scale, if the customer is prepared to wait for a long enough period to enable design and procurement processes to be completed, a relatively high level of customisation may be possible.

*Forecast error* (measured for example by the *mean absolute deviation* between actual and forecast demand for a given time series) provides clear objectives for developing supply capabilities. Forecast error ties in with the logistics need to align mid- to longer-term capacity decisions with demand. In Chapter 5, we argued that reducing P-times reduces the need to rely on forecasts. But clearly there is a limit to how far this ideal can be pushed. Being able to respond immediately to actual demand means that logistics capabilities have been put in place to do so. In particular, it is still necessary to make mid- to longer-term forecasts – for example to allow for advanced orders to suppliers, long cycle time production processes and to expand facilities.

It is also tough in logistics terms to support high levels of *volume variation* of demand across a given time period in a given supply chain. Constraints such as capacity limitations and fixed order quantities and lead times inhibit what may be done. Building *buffer capacity* into the supply chain (in the form of inventories or spare production capacity) may be too costly. Instead, it helps to analyse the causes of volume variation. Two main factors are the differences between peaks and troughs of demand, and the frequency with which peaks and troughs occur. A standard seasonal pattern may have just one peak (summer for garden furniture for example), whereas fashion industries may have six seasons or more. Retail promotions may create peaks every other week, which lead to volume variations of 60 to 70 per cent of 'normal' demand. We analyse these points further in section 7.2. Figure 7.2 shows how demand characteristics can be analysed.



**Figure 7.2** Analysing the influence of demand characteristics on a supply chain

### Supply capabilities

Now let us look at the supply capabilities that are needed to meet the above demand characteristics. Allocation of finished goods to given customer orders is a familiar way of responding quickly to demand – for example, selling cars from a dealer forecourt. But this approach to supply means that inventories of finished goods must first be built up. The problem is that they must be built up in anticipation of *unknown* demand. If stocks pushed by a manufacturer onto its dealer network are too high, they will have to be discounted. If they are too low, sales are lost to competitors. Delaying the exact specification of the car until the customer order is known, and then delivering it within an acceptable D time, is called *form postponement*. The concept of 'postponement' is now increasingly widely employed by organisations in a range of industries (van Hoek, 2001).

Postponement is widely used to increase responsiveness, and is defined (Skipworth and Harrison, 2004) as:

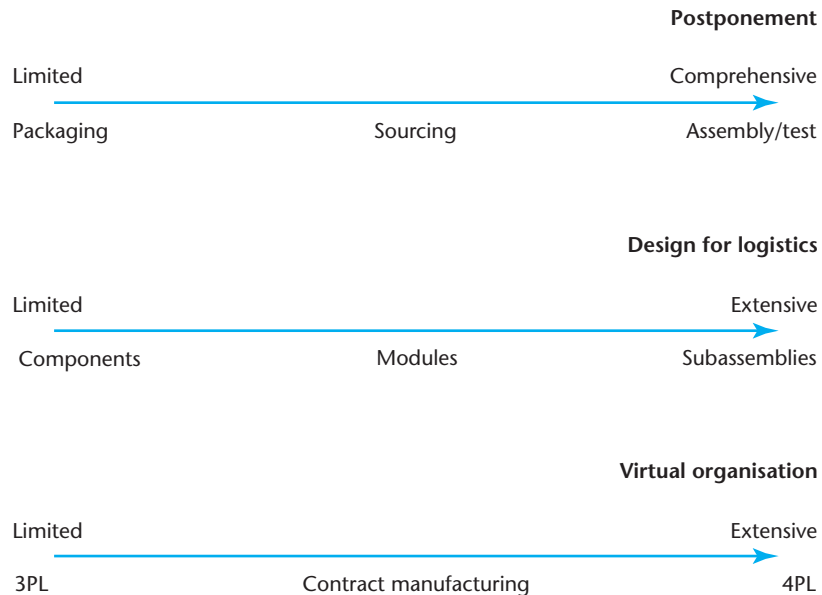
**The delay, until customer orders are received, of the final part of the transformation processes, through which the number of stock keeping units proliferates, and for which only a short time period is available. The postponed transformation processes may be manufacturing processes, assembly processes, configuration processes, packaging, or labelling processes.**

For example, the aim of the ‘three-day car’ project is to complete paint, trim, final assembly and delivery of a car to dealer within three days (Holweg and Miemczyk, 2002). Many less ambitious postponement applications delay packaging, labelling, adding documentation or product peripherals until an order is received. If the decision is limited to peripherals such as type of power supply to a printer, or to whether the number of cans in a pack is 6 or 12, we call this *logistical postponement*.

The appearance of wide customer choice can be created while keeping source, make and deliver processes as simple as possible. This is the thinking behind the principle of *design for logistics* (Sharifi *et al.*, 2006). Creating an agile supply chain requires more than revising logistics and distribution management: it goes all the way to product design. A favourite trick of computer manufacturers like Dell is to make common PCB assemblies, and to package them in many ways to create different options. While parts of a board are redundant on many of the finished products, this is more than offset by savings in inbound and manufacturing logistics.

Individual companies in an agile supply chain need to align their operations by redesigning the flow of goods, information and management practices. The aim is the *virtual organisation*, where groups of supply chain partners agree common terms for working together. There are several possible stages in the evolution of a virtual organisation. Traditional sourcing and contract logistics imply an interface between trading partners that is limited to buy–sell transactions. JIT sourcing is an example of a broader interface with sharing of demand data and alignment of logistics processes. Integrated contract manufacturing – in which a third party controls most of the make processes – attempts the integration of demand with supply in the way suggested by Figure 1.6. ‘Fourth-party logistics’ is close to this model in that a third party takes over organisation and coordination of the entire flow of goods, information and management of the entire logistics. These supply capabilities supporting the agile supply chain are summarised in Figure 7.3 overleaf.

We explore these approaches further in section 7.2. Meanwhile, Case study 7.2 shows how Xerox developed a ‘next generation’ logistics strategy by injecting fresh thinking into the position outlined in Case study 1.2.



**Figure 7.3** Supply capabilities supporting the agile supply chain

## CASE STUDY 7.2

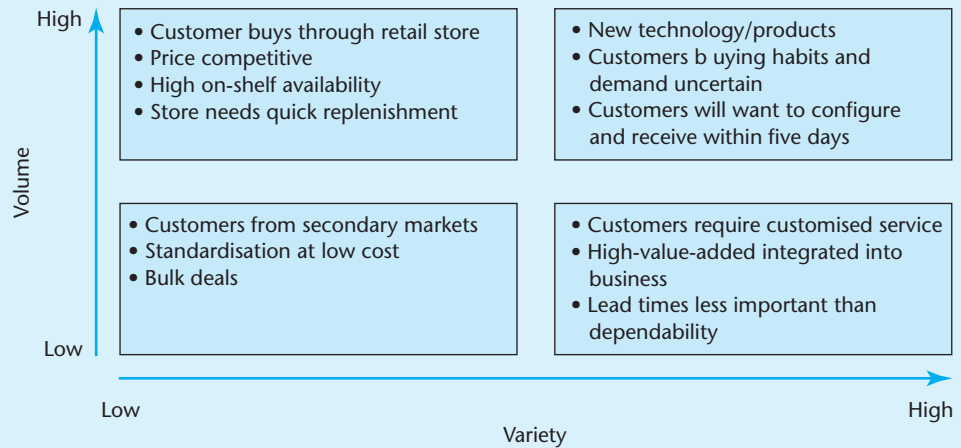
### Segmenting the supply chain at Xerox

By the middle of the 1990s Xerox had integrated its European manufacturing and logistics processes and organisations developing an end-to-end approach to its supply chain. This had delivered massive financial benefits to the company both in terms of inventory reduction and operating cost. At the time, it was to launch a new range of products and to extend its market coverage and it was recognised that the predominantly 'one size fits all' approach to customer fulfilment was not competitive. The company embarked on a programme of asking customers about their requirements for overall fulfilment and understanding supply chain competitive performance.

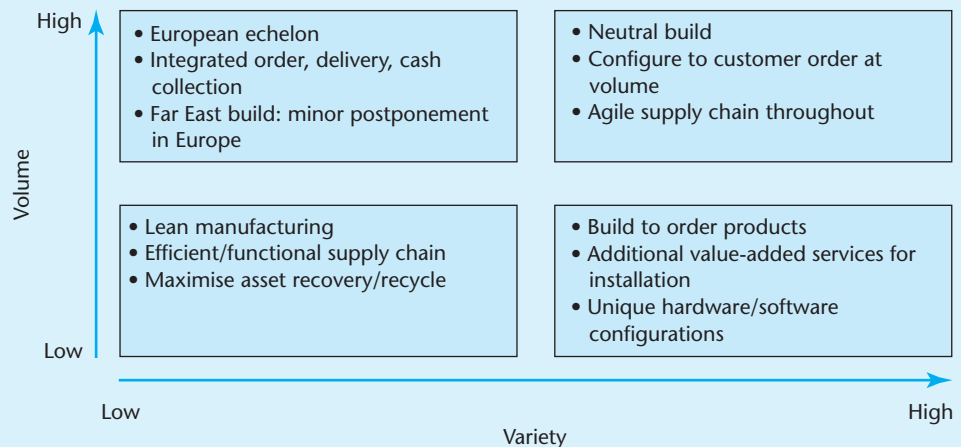
Based on market/customer expectations the company segmented its supply chain into four different streams across the total source–plan–make–deliver process. The segmentation of the market/customer expectations are shown in Figure 7.4 and the supply chain response in Figure 7.5. *Volume* represents the number of orders/shipments; *variety* reflects the combination of product variation and day-to-day demand variability.

The organisation and the processes of the supply chain needed to operate differently since the priorities of the market and customers were different. Different performance measures and targets were established for each segment and cultures and incentives put in place to drive the change. In all cases the company operated with outsourced partners as part of the supply chain operations but the balance between outsourced and in-house varied depending on the skills and flexibility required. As 'adding customer uniqueness as late as possible' was a key element in the process design, collaboration with the product design teams and suppliers became essential to engineer supply-chain-friendly products.

In particular in the high-volume/high-variety segment the customer order is directed to the integration centre at the end of the line, which has less than five days to finalise the product and deliver to the end-consumer. This could only be achieved by engin-



**Figure 7.4** Segmenting the market



**Figure 7.5** Supply chain response

earing the product to a modular design with final configuration from stock of 'neutral' modules and adding customer-unique options. This capability required flexibility and agility in all areas of the supply chain. In turn, this required investment in the skills needed for planning demand and supply so that capacity and inventories could meet the variable demand.

At the time, the segmentation approach allowed the company to fulfil the majority of its European customer orders from a European supply, with the exception of the high-volume/low-variety segment which supplied customers through distributors and retailers.

This approach not only improved measures of customer responsiveness but also improved inventory turns, reducing the need for stocks below the European level and reducing overall supply chain costs. Inherent in the design was not only the flexibility in operation but the ability to create and restructure the segments depending on changes to market and customer needs. This configuration of the Xerox supply chain segmentation had a life of approximately four years.

(Source: Graham Sweet)

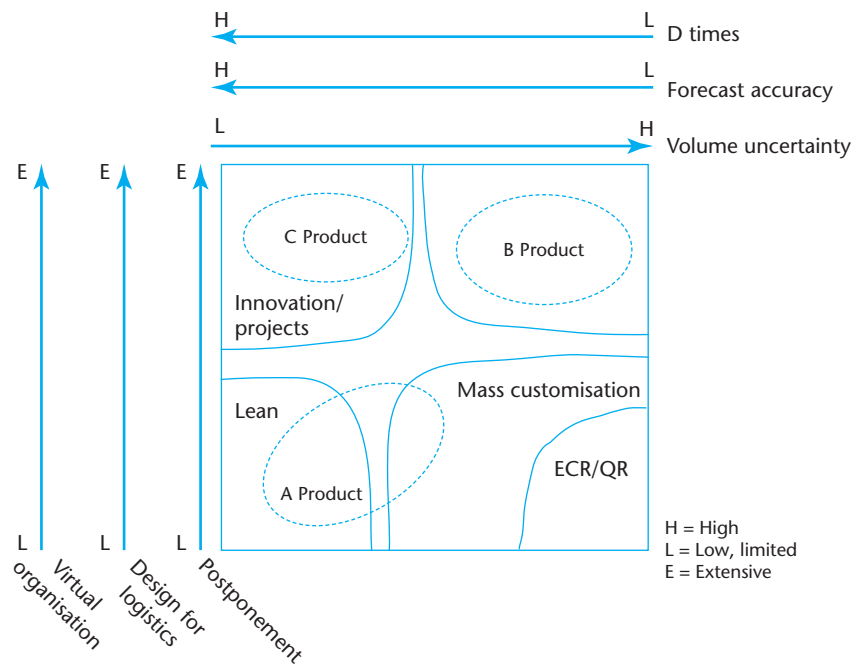


**Question**

- 1 Map the Xerox segments and market response (Figures 7.4 and 7.5) onto demand influences and supply capabilities in Figures 7.2 and 7.3 as far as you can, making assumptions where necessary. How closely does the 'actual' match the 'theoretical'?

### 7.1.2 Classifying operating environments

Figure 7.6 offers a classification of operating environments based on the above demand and supply characteristics. This classification places agility in the context of alternative logistics strategies. First, classes A, B and C products are positioned. This is based on a Pareto analysis of an organisation's product range (for an example, see Figure 2.1). Typically, class 'A' products comprise 80 per cent of sales value taken on just 20 per cent of orders. They tend to be more standardised, have lower forecast errors and lower volume variation. Lean logistics methods are therefore often appropriate. Class 'B' products, on the other hand, are often subject to higher forecast errors, and have higher volume variations. They tend to be better served by agile approaches.



**Figure 7.6** Classifying operating environments

### 7.1.3 Preconditions for successful agile practice

In addition to the above supply capabilities within the supply chain, there is another set of factors that needs to be in place for the agile principles and practices described in the next section (section 7.2) to pay off or work at all. These are

cross-functional alignment and enterprise-level focus on the contribution of logistics management and strategy. If revenue-generating functions in particular do not adopt at least a base-level understanding of agile principles, all efforts within logistics may be wasted. And if there is not an enterprise-wide focus on the value potential of logistics, agile efforts are not going to be recognised for what they are worth – and might not provide a compelling enough case for possible investment in them. We propose an *enterprise-level reality check* and a *cost of complexity sanity check* before investing in agile capabilities. We also argue that complexity should be controlled, and that agility will not take away the need for forecasting accuracy.

### *Enterprise-level reality check*

Starting with the enterprise-wide context, most senior managers know that turning to logistics and the supply chain is a ‘good call’ when times get tough. Logistics is probably most mentioned in earnings reports when cost cutting is offered as a response to poor performance. In spite of its potential to contribute to cost saving programmes, the value of logistics should not be seen as a first port of call when the bottom line needs to be improved. Agility is centred around the notion of winning in the marketplace based upon service and responsiveness. While such a strategy can be aimed at doing more for less, it may actually – and more importantly – be doing less to earn more. Top-line improvement can flow from outperforming competitors through responsiveness to customer needs. Delivery speed and reliability can be such important sources of productivity to customers that we can earn more of their business. Practices described in section 7.2 will show how this can be achieved in an efficient way; doing less to earn more. An enterprise-level recognition of the contribution of logistics is a precondition for any business case on agile practices.

### *Cost of complexity sanity check*

The value potential of logistics can only be capitalised on if other functions comply with another key precondition: lowering the cost of complexity where differentiation has no competitive value. As much as agility principles are based on the notion that differentiation is good and ‘doable’, it does not mean that revenue groups should be given a ‘carte blanche’ to create proliferating service, product assortments and promotions. There are limits to how much value that variety creates, and the extent to which these demands can be met without cost of complexity spiralling out of control, even for the most agile supply chain. The key point is not to exceed the capability of the supply chain to deliver the marketing promise.

While differentiation of logistics service can generate short-term gain, the question that revenue-enhancing proposals need to answer is ‘will it do so profitably?’ Adding a product feature, offering special delivery service and timetables, and engaging in a special promotion might help close a deal in the market in the short term. But such deals can also create added logistics and supply chain costs that are not compensated for by the added revenue. One executive from a manufacturing company put it well:

When we showed the financial impact of certain deals our sales teams had closed, it made them realise there were certain deals we should have walked away from.

Even though it may be hard to assess economic gain or pain from product/service differentiation, reality can be checked by asking questions like:

- Do customers *really* want fast delivery, or is reliable delivery more important even when slower?
- Do customers *really* want delivery whenever they ask for it, or could a shared forecasting effort resolve fire-drill situations?
- Do we need product proliferation for short-term gain, or because we add sustainable revenue to the business?
- Is there a limit to the number of product variations that the market can recognise and absorb?
- Did we offset added warehousing and distribution costs – even when just directionally right – against added revenue potential?

Heineken, the brewer, offers a powerful example of the last point. During a recent Christmas season it introduced a special product for promotion in the market – the magnum bottle. This seasonal promotion and product won several marketing prizes, and created a lot of buzz (or fizz, even!) in the marketplace. It was also a product that suffered from substantial added shipment, packaging and production costs because different production line setups, bottles, labels and boxes were needed for a very limited demand window. Was it worth the effort and focus of the responsive capabilities that were needed?

Another powerful illustration of the issue is a tactic that one executive calls the ‘warehouse dust test’:

We take our sales people through our warehouse when they come to us asking for new products and promotions and show them the dust levels on other promotional products and product variations that we stock. We ask them ‘which products can be discontinued when we introduce a new product?’ or ‘do we need the new product to begin with?’

### *Lowering the cost of complexity: avoiding overly expensive agility*

The purpose of responding to customer demand is fundamental to the role of logistics. In this sense, agility is a natural goal. A key qualification is:

**not at any cost, nor to compensate for mismanagement elsewhere in the organisation.**

Many organisations face challenges related to the risk of driving responsiveness over the top in the wrong areas of focus. Three examples illustrate the cost of complexity:

- Product, packaging and stock keeping unit proliferation, leading to extremes of 80 per cent or more of products not even generating 1 per cent of revenue.

- Delivery speed is too high, resulting in increased costs for the customer because products arrive too early. This increases handling, storage and related costs.
- Promotions and special events that cause upswings in demand based on sales efforts, not on true customer demand. This leads in turn to downswings shortly thereafter.

In general, complexity in the supply chain is made worse at an organisational level because of aggressive global and international sourcing of materials and products. This reduces the cost of goods sold. However, complexity adds substantial distance, time and dependence on the international logistics pipeline. These increase the risk of supply chain failures.

There are two key issues at stake here. First, agile capabilities are not the excuse for other functions (such as sales) to ignore supply capabilities in running the business. Second, agility should not be driven by the need for supply chains to compensate for mismanagement in other parts of the business. Cost of complexity is the term that captures the negative consequences of agility in poor organisational contexts. It refers to the costs resulting from unnecessary complexity in the supply chain that agility can reduce. But the key questions are:

- Where is the *value* in this complexity to begin with?
- What customer need does it address to have warehouses with products and materials from old promotions collecting dust?
- Does every shipment really need to be a rush shipment or can some shipments be allowed a bit more time and consolidation with other shipments in cheaper modes of transportation?
- Are promotions and resulting short-term peaks in demand a way to boost short-term revenue, or a way to raise long-term sustainable revenue growth?

Here are some examples of actions to help reduce non-value-added costs of complexity:

- Has the organisation conducted an analysis of revenue contribution by sku?
  - *Consider using a revenue threshold for maintaining a given sku*
- Does the organisation have a process for reviewing the product portfolio at least annually?
  - *One-off sku reductions do not address the ongoing tendency to proliferate skus over time.*
- Are there hard revenue forecasts related to promotion requests that can be evaluated?
  - *Revenue upside potential is most often used to justify adding events and skus; reviewing real impact after some time or after the event helps force discipline.*
- Are the people ordering shipments aware of the cost of rush orders and are they asked to organise shipment around real and explicit customer requests?
  - *Ticking the 'ASAP' ('as soon as possible') box on a shipment form may become standard behaviour, irrespective of customer need.*

In addition to such actions, driving forecast accuracy will assist in avoiding inventories of unsaleable product and panic shipments.

### *Forecasting: reducing the need for last minute crises*

As important as fast response may be, organisations cannot make all of their operational decisions in real time and in response to events already taking place. Some advanced preparation and planning is required. Hence, even in the most agile supply chains, forecasting is needed and can be used to avoid expensive panic shipments against orders that could have been anticipated.

Based upon assessment of market potential of new and existing products, promotions and services, a demand forecast can be developed (section 6.1.1). This can be used to prepare and offer input to several internal forecasts.

The financial forecast (communicated to financial markets) is affected by the operational demand forecast and the plan for capacity and asset utilisation. The capacity plan is used in both mid (for example, which warehouse will hold which products from the assortment?) and short term (for example, how many products can we make tomorrow?). Asset footprint/forecast is the mid- to long-term plan for capacity needed in the supply chain to cope with volume of demand and nature of demand for services (for example, how many warehouse spaces do we need in Europe?).

The more accurate the demand forecast, the better a company can prepare in advance of demand occurring. Not only does this reduce the need for last minute responses to unexpected demand, it also helps to cut the cost of preparing for demand that might never occur. However, it is probably impossible to anticipate demand fully and correctly at all time horizons and in all markets, for all products and services – even if the IT systems support, such as forecasting tools and enterprise resource planning software, were perfect. There are several management approaches to forecasting that will enhance its accuracy and relevance. These include:

- *A 'one forecast' approach.* Aggregating product/market-specific forecasts to a single global forecast allows the 'big picture' to be developed. It also forces differences in local forecasts to be discussed and resolved. Further, it ensures that the firm executes against a single number, not against several.
- *Ensure forecast accountability.* Most often, revenue groups will be asked to develop or crucially impact the demand forecast. These groups have limited incentives to drive forecast accuracy. They do not have to live with the consequences, so under-forecasting makes it easier to hit sales targets. In order to drive accountability a focal firm should therefore consider adding a review of quality, and accuracy of forecasting input to performance evaluation.
- *Make forecasting business-relevant.* In addition to the above, linking demand and operational forecasts to financial forecasts and effort to drive business improvement (such as long-term cost savings) adds relevance to the forecasting process.
- *Use one process.* Establishing a single forecasting process for the global supply chain (allowing for minor local variations if need be) allows for consistency in approach, interpretation and measurement.

### 7.1.4 Summary

This section has offered insights into the questions ‘when’ and ‘where’ agile capabilities should be considered in a supply chain management. Our framework offers both insights and diagnostics for developing logistics strategies. Some supply chains will be better positioned to support the markets they serve by means of lean approaches – for example in low-variety, high-volume situations. An increasing number of markets will be better served by agile strategies that require responsiveness – for example, because variety is increasing and volumes are decreasing. The next section addresses the question of what capabilities are needed to support this responsiveness in more detail

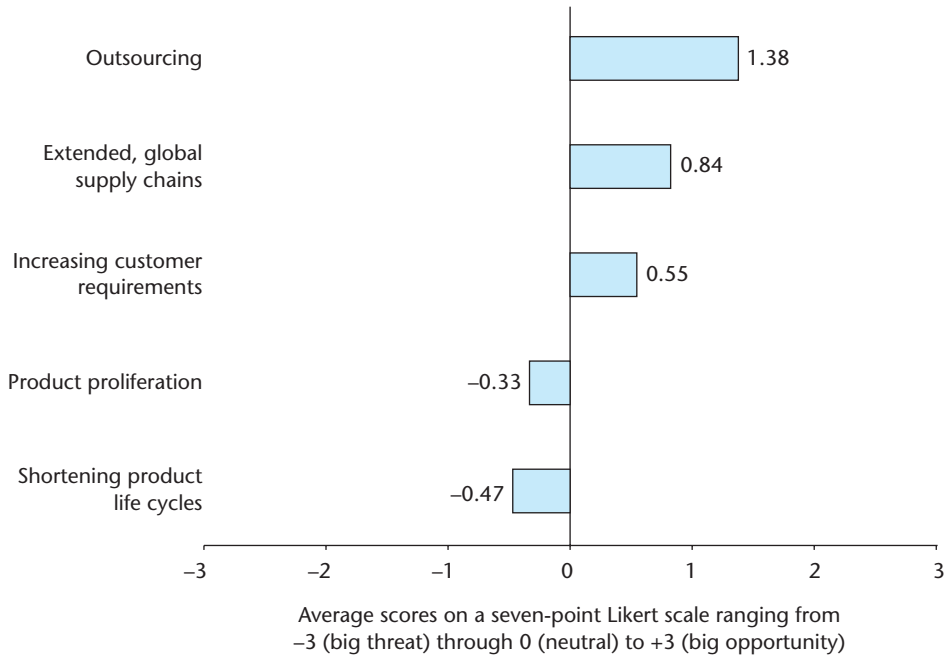
## 7.2 Agile drivers and practices

**Key issue: How can we use agile practices to benefit from turbulence in the marketplace?**

Figure 7.7 offers average scores from a recent survey of agile capabilities on five selected external drivers that create the need for an agile supply chain. The scale ranges from  $-3$ , representing a big threat to the organisation, through  $0$ , representing a neutral factor, to  $+3$ , representing a big opportunity for the organisation. The reason for using this scale is that the need to become more agile can be driven by both risk and by opportunity; that is, it can be a way to cope with challenges in the operating and market environment or a way to capture competitive premium from opportunities. Product proliferation and shortening product life cycles are among the drivers for the need to become more agile in responding to volatile markets. The fact that these two drivers net out as a challenge indicates that companies are being forced into becoming more agile in order to cope with the market environment.

The second area of interest is that of global sourcing and outsourcing. As discussed in Chapter 4, this is an area of great importance in many supply chains and it affects the need for agile capabilities. Together these drivers require supply chain managers to deal with much longer supply chains that encompass more external parties, which means that market requirements have to be met but in a much more complex supply chain management environment. These factors were seen by survey respondents as net opportunities for leveraging supply chain capabilities. Perhaps the fact that these drivers are seen in a positive, not a negative light might have to do with the fact that these factors are more under the direct control of supply chain managers, whereas product proliferation and life cycles are more at the mercy of marketing and product development. Still, it shows that there are positive considerations driving the creation of agile supply chain capabilities, not just negative forces.

A further sign of increased strength and optimism in the approach of the operating environment is the fact that increasing customer requirements are evaluated as a net opportunity. This means that, from a supply chain perspective, the



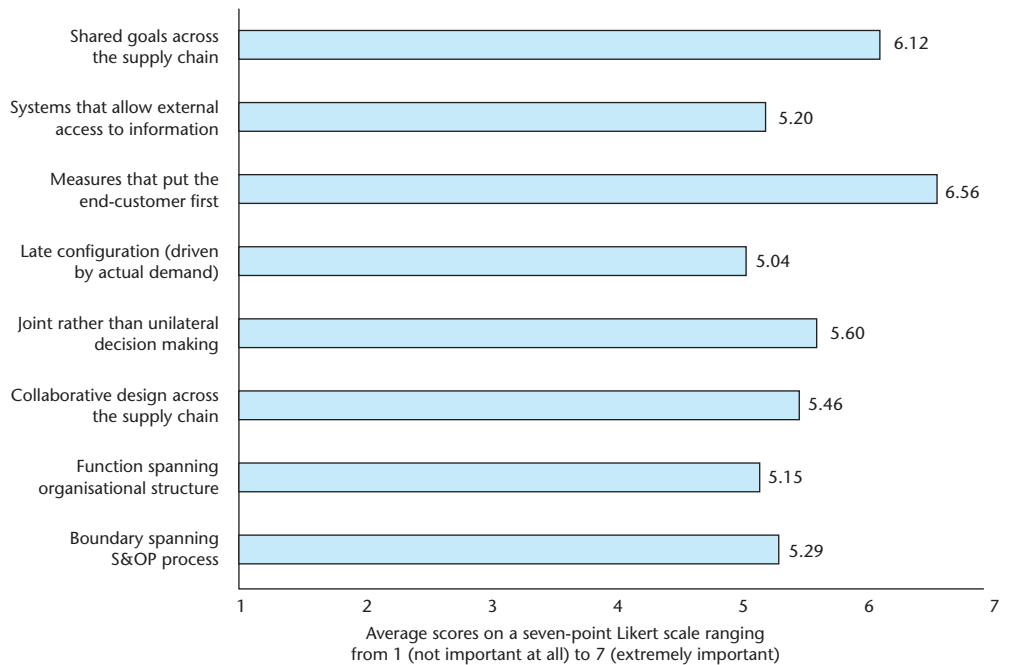
**Figure 7.7 Drivers behind the need to create an agile supply chain**

(Source: Chapman and van Hoek, 2007)

market environment is seen as a positive factor. It suggests that amongst survey respondents there is confidence in the ability to cope with increasing customer requirements due to increased responsiveness and agile capabilities. It certainly implies that respondents are looking at increasing market requirements and see the fact that the performance bar is rising as an opportunity to promote responsiveness in their supply chain in order to achieve competitiveness.

Figure 7.8 shows average scores across all respondents on selected capabilities grouped by dimensions of the original agile supply chain framework shown in Figure 7.7. The data indicate that there is high importance associated with items from all four dimensions as all score close to or over 5 out of 7.

The lowest score was assigned to late configuration capabilities or the postponement domain. This could be because more progress has been made in this area, but it is also possible that, since this is only one of the ways to develop market sensitivity and responsiveness, there are other more important capabilities. These may well be the development and implementation of performance measures that put the customer first, which is the other item in the market sensitivity dimension and is also the highest scoring item across all eight considered. The third lowest scoring item is technologies and systems that allow for sharing of and external access to information in the supply chain. This is an important reflection on all the work done on enterprise-wide resource planning systems (ERP), indicating it is not necessarily the most important area for progress in the eyes of the respondents. Nor should technology be considered the obvious solution to supply chain challenges, there are a lot more important areas to focus on.



**Figure 7.8** Relative importance of agile capabilities

(Source: Chapman and van Hoek, 2007)

Turning to the higher scoring items, market sensitivity is an obvious starting point for creating the agile supply chain and there is a clear need to begin with the customer and build the supply chain back from there. Building the supply chain back from the customer in this way provides a definitive marker that distinguishes the agile supply chain from its competitors.

This guiding principle dictates the need for a supply chain that is capable of responding to market demand and assessing its performance against customer demands and requirements first. The second most important item is the establishment of shared goals across the supply chain, preferably working back from customer-centric measures of success, so that the supply chain can be virtually integrated, operating across functions and companies as one. Thus, whereas the technology aspect of virtual integration is graded near the bottom of the list, the management aspect of integration is graded near the very top of the agenda. The same thing goes for other management- and process-related items such as joint decision making and boundary spanning sales and operations planning (SOP) processes. Hence it might be concluded that companies have moved beyond the technology and the techniques such as late configuration and that they are now addressing management and process development issues.

It is no surprise then that when asked about the importance of training staff for agility respondents gave this an overall average score of 6.20 on the same seven-point scale as used in Figure 7.8. Additionally, when asked about the need to sustain productivity focus on lean capabilities, respondents gave this an overall average score of 5.49, implying that it is still important to get the basics right and not to lose sight of efficiency when enhancing responsiveness. On top of



that, the development of staff is even more crucial to make progress in creating the agile supply chain; developing staff that can exploit new opportunities is a key area to make real progress happen and Chapter 10 will revisit this.

The next section offers case examples of companies that have navigated the minefield of some of the toughest agile practice areas which are viewed as being of greatest importance by survey respondents.

### 7.2.1 Joint decision making to improve external network integration

With agility being a market-centric strategy to begin with, joint decision making to improve network or external integration should start with decision making around customer needs and focus on involving the customer's perspective in decision making. It is common practice for companies to measure customer service in multiple ways in an effort to do so. However, there are several challenges with customer service and satisfaction measurement and surveys:

- Averages scores hide extremes at the end (problems and excellence).
- What opinions and strategies are behind subjective measures?
- Who is speaking? There are many different voices within the customer organisation.
- What is the value of individual responses averaged out? (innovators, key accounts, marginal accounts?)
- A lack of clear implications for service (what does a 3.75 mean in comparison to a 3.95 score?)

In response to these challenges, companies like GE, Honeywell and Ford Motor Company have developed voice of the customer (VoC) processes (for example, Delgado-Hernandez *et al.*, 2007). These aim to go beyond customer satisfaction measurement by crafting a more comprehensive exchange with selected customers. Typical features of this exchange include:

- senior-to-senior meetings to avoid leaving the exchange to revenue-stressed situations, to signify commitment and to elevate the conversation;
- expanding the interaction to an ongoing exchange, to drive beyond measurement at points in time only and to establish sustained improvement and alignment;
- involving additional functions including logistics and engineering and multiple contacts on the customer side in order to broaden the exchange into a bi-directional learning and alignment opportunity.
- establishing joint improvement initiatives to turn the exchange into more than a listening exercise, including so-called 'at the customer – for the customer' teams.

The key distinctions between voice of the customer processes and customer satisfaction measurement are:

- It is based upon conversation, not surveys, which helps capture the story behind the survey scores and learn more about what actually drives scores.

- It is not the task of the customer service department but often starts with a senior executive sponsor talking to a customer peer and is followed by cross-functional work groups at a management and execution level working together on improving responsiveness and process alignment where that matters to the customer.
- It is ongoing, not a point measurement, as initial conversations are followed up with reviews of process improvements.
- It is customer-centric as opposed to measuring average market performance scores.
- It captures multiple inputs from the customer, not just a single respondent. This is important because there are many voices of the customer, i.e. it matters who is talking.
- It is linked to action; project teams are deployed 'at the customer, for the customer', hence the outcomes of the review are not internalised but are used as a basis for customer-focused action.
- It improves customer relations due to improved learning about the customer, relationship development and resource investments to actually address service issues and improvement opportunities.

Voice of the customer helps to achieve enhanced market sensitivity while mitigating the risk of misguided interpretations of market input, which result from weak links with real customer-centric improvements.

## 7.2.2 Developing measures that put the end-customer first

All companies include customer service in some form in their performance measurement system. However, almost all operationalise this measurement internally, leading to responsiveness that is misguided and focused wrongly. This usually means that measurement is not effectively focused on end-customers, thereby limiting network integration. In particular, most companies measure delivery service in one or many ways based upon their internal definition of 'success'. Typically, the measures focus on how reliably and fast the company delivered against the timetable it put forward. This misses the point, as this timetable might not be aligned with end-customers' needs. This means that firms are not tracking responsiveness to these needs. It is much better to ask customers for their desired delivery window and measure execution against that customer-defined measure of success. General Electric realised this when it presented high delivery reliability scores from its internal measurement system to customers, and received a negative reaction. Customers said performance was not nearly as high according to their own measurement systems.

GE changed its measurement system towards what it calls 'Span measurement'. Span stands for the range of delivery around customer-requested due dates. Essentially, the company now measures, across all deliveries globally, how close it was to the delivery date the customer requested when ordering. In its plastics business the company brought Span down from 30 days to just a few days within

a matter of months. This means that every customer can now depend on GE delivering any product, anywhere in the world, when they ask for it, with a maximum variation of just a few days.

The experience from GE suggests the value of several actions to improve measurement for agility:

- Share measurement dashboards with customers.
- Do not measure against your own measures of success – ask customers what defines success for them.
- Hold all parts of the supply chain accountable against the customer-defined measure of success so that there is no escape from market sensitivity.

### 7.2.3 Shared goals to improve virtual integration

Agility requires the ability to be able to respond to local market demands and opportunities. However, companies should still aim to employ skills and capabilities across the regions in which they operate. This means they need to establish and strive for shared goals across their business units as a form of virtual integration, with local operations remaining in place and the focus staying on local customer service (van Hoek *et al.*, 2001).

Most often, however, companies tend either towards local responsiveness or to strong global standardisation and organisation. Hewlett-Packard used to be in the former camp. At one point, for example, the company found that there were dozens of similar B2B exchange efforts under way across the company with at best informal coordination between teams. HP did not respond with a centralisation of efforts and control. Instead, it developed a distributed governance approach that allows for local responsiveness, but that also uses lessons learned for the company and avoids duplication of efforts.

In order to find a way to balance proliferation of businesses and divisions with high divisional autonomy and complexity in organisation, HP launched a supply chain governance council. The charter that was set up by its executive committee aimed to implement company-wide efficiency initiatives and to uncover supply chain-based revenue opportunities. Specific goals include establishing and driving a coordinated approach to investments pertaining to opportunities that have an enterprise-wide scope and impact, and supporting executive awareness of key initiatives to avoid ‘reinventing the wheel’.

This means that the HP governance council does *not* get involved with initiatives that are specific to an individual business or region. It does not centrally control supply chain governance, but it does support larger initiatives from which many parts of the organisation can and should benefit. It also provides senior management with a method for supporting and steering the company’s direction regarding the most important opportunities.

Four key operating rules of the council are:

- Mandated senior participation;
- Focus on enterprise-wide initiatives;

- Driving initiative development through divisional sponsorship;
- Fund initiatives from divisional budgets.

The last two are particularly interesting as they help avoid creating a ‘corporate centre’ approach that could dictate policy without the businesses caring or paying for it.

Keys to success in a governance approach like this include the need to avoid layering a governance council on top of existing structures. If it generates more governance this can only conflict with existing structures and might enhance bureaucracy rather than agility. Further to that, it is important to keep the structure simple and crisp, the governance council serves the purpose of being more agile as a company as opposed to just being agile locally. In order to accomplish that, there should be minimal procedure and rules. And finally, what is purely local should remain local; if there is no benefit to following a particular initiative through to the global/corporate level then keep it local.

#### 7.2.4 Boundary-spanning SOP to improve process integration

The purpose of the sales and operations planning (SOP, section 6.1.1) module is to set sales forecasts and to translate them into operations plans via the master production schedule. SOP requires internal integration, at least between sales and operations, to achieve its purpose. Forecasting is not just a numbers game – it is a key business process that supports supply chain readiness for market demand.

Alcoa has made some great strides across a very diverse set of autonomous businesses to develop a boundary-spanning SOP system to support process and internal integration. Three aspects are particularly noteworthy:

- *Forecast by market, not by business unit.* Alcoa realised that a lot of its businesses were supplying the same markets with all of them developing their own forecast, often varying hugely, based upon a view limited to one business. So what they did was form a so-called market sector lead team that operates across businesses, by market, to come up with one forecast for where that market is going based upon a much more comprehensive view of the market.
- *Coordinate between source–make–deliver.* Alcoa not only translates the forecast into production runs for the factory; in a true process integration fashion it also translates the forecast into what needs to be sourced and what can be expected of the customers’ business. This helps to drive integration *across* the process, not just at selected points.
- *Link forecasts to improvement goals.* Forecasting is never going to be fun but it can become more relevant. In that spirit, Alcoa links the forecast to 18-month business improvement goals, and has the forecast roll towards that goal. The forecast disaggregates to six-month, four-week and one-week plans, but it also maps to the longer-term improvement goal. At Alcoa people are very excited when the new rolling forecast comes out because it tells them if they are on track to hit targets. That is much better than the more usual approach where the sales team just does a forecast for the sake of colleagues in manufacturing

– while trying not to spend too much time on it because it distracts them from selling!

Additionally, the sales and operations planning process is seen as a great way to begin to drive cross-functional integration. One firm just setting out on its journey to develop supply chain management started with SOP because it found it a good place to start that links many functions to a key business activity. Hence ‘buy-in’ is easily gained and joint ownership is quickly established. The firm also found that SOP meetings are an effective way to persuade people from functional silos to start talking and working together. A few ground rules for effective SOP meetings include:

- All key functions (sales, finance, production, logistics, procurement) must attend. Additional functions such as R&D and engineering can be invited if needed.
- All attendees need to come to the meeting with real decision-making authority.
- The discussion needs to focus not just on generating a forecast, but also on diagnosing forecast errors from the past to learn from them and to discuss trade-offs.
- There needs to be a structured agenda and agreed set of measures used – most typically including forecast error, forecast volumes and sales quantities, capacity utilisation, new products and upcoming events, and sku review.

The vision of creating an agile supply chain is a valuable starting point, but until recently it was mostly just vision. The experiences and cases presented in this section show how the vision can be supplemented, and how implementation of agility can be approached practically.

## Summary

### *What is agility, and how does it contribute to competitiveness of the supply network?*

- Agility is a supply-chain-wide capability that aligns organisational structures, information systems, logistics processes and, in particular, mindsets. It means using market knowledge and a responsive supply chain to exploit profitable opportunities in a volatile marketplace. Agile supply is concerned with developing capabilities proactively to position a supply chain to benefit from marketplaces in which product life cycles are shrinking, product variety is increasing, and the ability to forecast demand is reducing.
- Lean thinking (Chapter 6) is concerned primarily with the elimination of waste. The order winners that are especially supported by this mindset are cost and quality. Agility is concerned primarily with supporting order winners of speed and flexible response. Time compression is a fundamental requirement for leanness, but only one of the enablers of agility.

- A key difference in supply strategy is that lean thinking is concerned with placing orders upstream for products that move in a regular flow. Agile strategy is concerned with assigning capacity so that products can be made rapidly to meet demand that is difficult to forecast.

### *What are the agile practices that help to underpin the agile supply chain?*

- First, it is key to understand the sources and causes of uncertainty in demand, and to take steps to position the supply chain to benefit from this uncertainty. The easy option is high-volume, low-variety, low-demand uncertainty. The tough option is the opposite of all three. Agility seeks to increase responsiveness to volatility and end-customer demand uncertainty.
- Second, it is vital to develop capabilities for dealing with shrinking time windows for customer demand fulfilment. Speed of replenishment is usually much better downstream than upstream. Developing upstream time sensitivity is therefore a major enabler. And information dissemination and alignment bring capabilities of dealing with rapid and accurate response using supply-chain-wide dissemination and exchange.
- Third, it is necessary to facilitate servicing the ‘market segment of one’ by investing in flexible processes, modularity at the product and process level, and capabilities to support the information and knowledge content of products and services. Specific practices outlined here include capturing the voice of the customer, aligning metrics with true customer needs, establishing supply chain governance that allows for decentralised action with central support and coordination and developing effective S&OP tables.

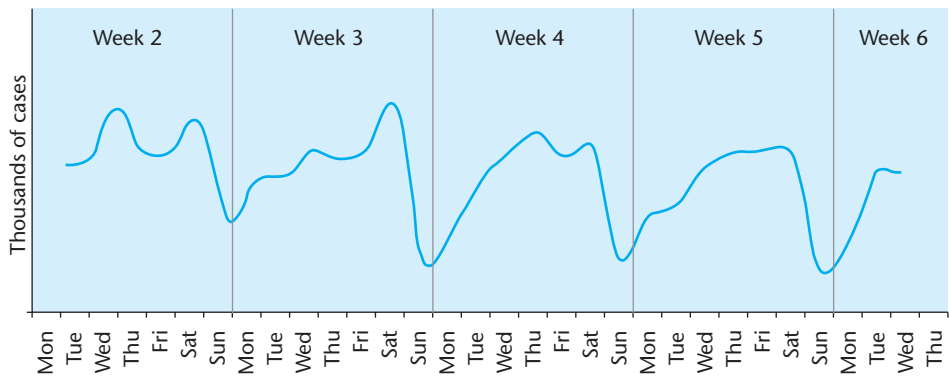
## Discussion questions

- 1 Suggest order winning and order qualifying criteria for the following product environments:
  - a reprocessing nuclear fuel;
  - b upstream petroleum refining;
  - c downstream manufacture of petroleum products;
  - d premium automotive products such as Land Rover Discovery or BMW 5 series.

To what extent would lean and agile mindsets contribute to the support of such products in the marketplace?

- 2 Figure 7.9 shows a demand series for a high-volume grocery product with a comparatively stable demand. The vertical lines mark the end of each trading week, which is Sunday midnight.

Suggest key features of this trading pattern. The retailer now wishes to implement two stock-replenishment ‘waves’ each day from the supplier: one in the morning (7 per cent of volume) and the other in the afternoon (25 per cent of volume). Previously, only one



**Figure 7.9** Demand series for a high-volume grocery product

replenishment delivery was made per day. What are the potential benefits to the retailer, and what are the likely risks to the supplier?

- 3 Explain the difference between surge and base demands. Multi Electronique SA (ME) produces a range of electrical connectors for the automotive industry. Currently, the six production lines at its factory in Toulouse are fully loaded, operating a three-shift system for five days per week. One of ME's major customers wants to place an order that would add loading equivalent to a seventh production line, but only for the summer months (May to September). Sales are keen to accept the new order, but it would need to be taken at prices that are no higher than for current business. Suggest options for how ME might manage this order if they accepted it.
- 4 Refer back to Figure 2.1 in Chapter 2: it shows a Pareto curve for the sales per sku of a book stockist. A small number of 'hot sellers' constitute most of the sales, while there is a lengthy tail of slow-selling lines and new introductions. The operations people are pressing for the 'tail' to be chopped in half, arguing that it adds cost, not value, to the business. They argue that each order is taken at fixed cost, regardless of size. Sales order processing and pick and dispatch from the warehouse are examples of such fixed costs. 'Instead, we should focus on the core of the business: 90 per cent of our business comes from just 10 per cent of the titles,' the operations director argues. 'We could chop our costs in half and only lose 5–7 per cent of the business. Think of the effect on margin!' Sales, on the other hand, are reluctant to give up any of the titles, arguing that it is customer choice that drives the business. 'We have built up this business on the strength of our product range,' the sales director argues. 'Retailers come to us because we are a one-stop shop. If we haven't got it in stock, we get it.' Explain the above in terms of a lean versus agile debate, using the concepts of order winners and qualifiers.

## References

- Aitken, J., Childerhouse, P., Christopher, M. and Towill, D. (2005) 'Designing and managing multiple pipelines', *Journal of Business Logistics*, Vol. 26, No. 2, pp. 73–97.
- Chapman, P and van Hoek, R. (2007) 'Creating the agile supply chain – eight years on', working paper, Cranfield School of Management.
- Delgado-Hernandez, D.J., Benites-Thomas, A. and Aspinwall, E.M. (2007) 'New product

- development studies in the UK', *International Journal of Product Development*, Vol. 4, No. 5, pp. 413–29.
- Harrison, A., Christopher, M. and van Hoek, R. (1999) *Creating the Agile Supply Chain*. Corby: Institute of Transport and Logistics.
- Holweg, M. and Miemczyk, J. (2002) 'Logistics in the three-day car age: assessing the responsiveness of vehicle distribution logistics in the UK', *International Journal of Physical Distribution and Logistics Management*, Vol. 32, No. 10, pp. 829–50.
- Magretta, J. (1998) 'Fast global and entrepreneurial: supply chain management Hong Kong style', *Harvard Business Review*, September/October, pp. 102–14.
- Mason-Jones, R., Naylor, B. and Towill, D.R. (1999) 'Agile, or leagile: matching your supply chain to the marketplace', in *Proceedings of the 15th International Conference on Production Research*, Limerick, pp. 593–6.
- Naylor, J.B., Naim, M.M. and Berry, D. (1999) 'Leagility: interfacing the lean and agile manufacturing paradigm in the total supply chain', *International Journal of Production Economics*, Vol. 62, pp. 107–18.
- Sharifi, H., Ismail, H. and Reid, I. (2006) 'Achieving agility in the supply chain through simultaneous design of and design for supply chain', *Journal of Manufacturing Technology Management*, Vol. 17, No. 8, pp. 1078–96.
- Skipworth, H. and Harrison, A. (2004) 'Implications of form postponement to manufacturing: a case study', *International Journal of Production Research*, Vol. 42, No. 1, pp. 2063–81.
- van Hoek, R. (2001) 'The rediscovery of postponement: a literature review and directions for research', *Journal of Operations Management*, Vol. 19, No. 2, pp. 161–84.
- van Hoek R., Harrison A. and Christopher M. (2001) 'Measuring agile capabilities in the supply chain', *International Journal of Operations and Production Management*, Vol. 21, No. 1–2, pp. 126–47.

### Suggested further reading

- Cusumano, M. and Nobeoka, K. (1998) *Thinking Beyond Lean*. New York: Free Press.
- Goldman, S., Nagel, R. and Preiss, K. (1995) *Agile Competitors and Virtual Organizations*. New York: Van Nostrand Reinhold.
- Gunasekaran, A. (2001) *Agile Manufacturing: the 21st century competitive strategy*. Oxford: Elsevier



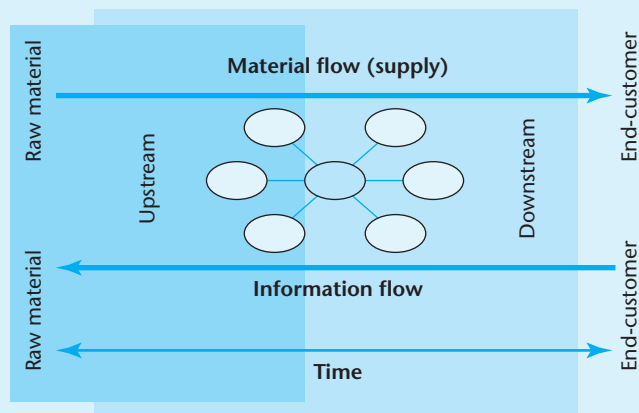


# Part Three

## WORKING TOGETHER

In a supply network, no firm is an island that stands on its own. Nor does it compete on its own. A focal firm depends on its network partners for components to assemble, for products to sell, for the movement of goods, and so on. While Part Two focused on the central logistics task of achieving responsiveness to customer demand, most firms cannot achieve this without the support of their network partners. Complete vertical integration of an industry is unusual today – although ‘vertical retailers’ have developed a similar strategy, as we saw in Case study 4.4. Functional specialisation of suppliers on those parts of the value proposition in which they excel, coupled with integration into the supply network, is more common.

This is becoming especially relevant today. Some manufacturing firms, for example in the electronics and automotive industries, add only 10–20 per cent of total added value internally. The rest is created in the supply base – by commodity suppliers, by co-designers and co-manufacturers, by main suppliers, and by their supply partners. Chapter 8 offers approaches to integration and collaboration in the supply chain, and Chapter 9 offers insights into purchasing and supply relationships.





## CHAPTER 8

# Integrating the supply chain

### Objectives

*The planned objectives of this chapter are to:*

- explain the need to coordinate processes, and the opportunities for collaboration between partners within supply chains;
- show how the management of supply chains can be leveraged by improving new product introductions, promotions, product ranges and replenishment;
- identify methods for implementing collaborative planning between supply chain members;
- develop a framework for managing the supply chain.

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

- the benefits of collaboration within supply chains;
- ways to improve responsiveness to the end-customer;
- key aspects of managing the supply chain.

### Introduction

Chapter 6, on supply chain planning and control, explains how supply chain processes can be prepared for better performance by detailed planning and control of supply processes, and by cutting out the sources of waste. Such improvements offer the opportunity to produce and deliver goods cheaper, faster, and with better quality. Chapter 7, on creating the agile supply chain, explains how the development of agile capabilities by supply chain partners helps to provide fast response to new market opportunities. This chapter draws on these ideas and suggests a vision of *flow* logistics based on end-customer demand, whereby only the end-customer is free to place an order whenever he or she wants. After that, the system takes over. Flow logistics offers the customer:

**immediate availability of products at the point of sale**

or

**rapid configuration and delivery of customer-specified products.**

The challenge is to design and manage 'a network of interdependent relationships developed and fostered through strategic collaboration' (Chen and Paulraj,

2004: 119). Two of the key factors in developing closer, more integrated relationships between buyers and suppliers in a network are reducing the number of suppliers and developing long-term relationships with the chosen few. As an example of such interdependence, GM Mexico (GMM) has followed GM's global policy of externalising auto parts and subassemblies, and maintaining final assembly and the production of engines in-house. It has also reflected GM's policy of maintaining fewer but more closely integrated suppliers such as Delphi (a GM spin-off specialising in parts and components), replicated along the upstream supply chain. Evolution of the relationship with Delphi has created 'third generation' plants which can innovate in products and processes, and which are globally competitive on costs and quality (Carillo, 2004). Such interdependency has also created a situation where the firms are vulnerable to each other's wider problems. Investment in closely integrated supply relationships is heavy – and as always benefits from a careful analysis of risks and returns.

The overall aim of this chapter is to show how the supply chain can be managed to maximise the opportunities for integrated processes focused on achieving superior quality of service.

### Key issues:

**This chapter addresses six key issues:**

- 1 Integration in the supply chain:** the benefits of internal and external coordination.
- 2 Efficient consumer response:** the total supply chain working together with an objective to fulfil the demands of the end-consumer.
- 3 Collaborative planning, forecasting and replenishment:** an approach to effective supply chain and organisational strategy.
- 4 Vendor-managed inventory:** delegating to the supplier the responsibility for controlling inventories and replenishments.
- 5 Quick response:** improving communications between retailers and the rest of the supply network.
- 6 Managing supply chain relationships:** the objective of deeper, closer relationships in the supply chain and the factors for achieving them.

## 8.1 Integration in the supply chain

*Key issue: How can we integrate internally, externally and electronically?*

What drives integration in the supply chain? Procter & Gamble's desire is to design the supply chain to meet the needs of end-customers, starting from point of sale and working backwards to deliver the right product, in the right place, at the right time, of the right quality. The following are four principles of Procter & Gamble's supply chain strategy:

- Produce every product that needs to be produced every day through short cycle production.

- Communicate with suppliers in real time – suppliers with whom we have built long-term relationships and with whom we have integrated systems.
- Draw demand data from the point nearest to the end-customer – in this case, the retail cash register.
- Collaboration between all supply chain partners using a multifunctional approach (commercial and supply chain working together), and aligned metrics focusing on delivering to the end-customer.

All of these principles involve integration – both internal and external. ‘Integration’ in the context of the supply chain is concerned with *coordination*: establishing the ‘rules of the road’ whereby material and information flows work in practice.

Evidence that improved integration (both upstream and downstream) leads to improved performance for the supply chain as a whole has been found by survey research for firms in fabricated metal products, machinery and equipment manufacturing (Frohlich and Westbrook, 2001). Integration was measured across eight variables as follows:

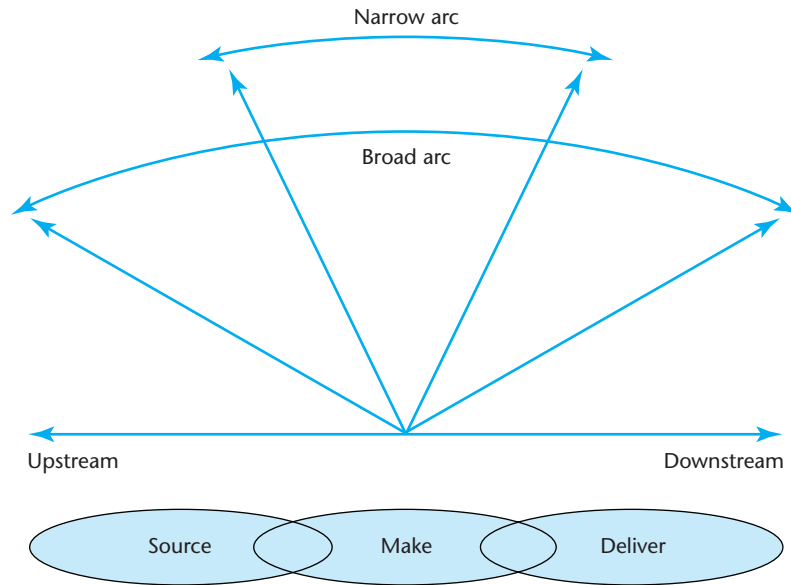
- 1 Access to planning systems.
- 2 Sharing production plans.
- 3 Joint EDI access/networks.
- 4 Knowledge of inventory mix/levels.
- 5 Packaging customisation.
- 6 Delivery frequencies.
- 7 Common logistical equipment/containers.
- 8 Common use of third party logistics.

The authors found that the broadest integration strategies led to the highest rates of significant performance improvements. They pictured this in terms of ‘arcs of integration’, our version of which is shown in Figure 8.1. We can propose that broader integration reduces uncertainty of material flow through the supply network. In turn, this improves efficiency and reduces the P-time (Chapter 5).

### 8.1.1 Internal integration: function to function

Another survey – this time of over 300 organisations in the United States – probed integration between marketing and logistics functions within a focal firm (Stank *et al.*, 1999). More frequent integrative behaviour between marketing and logistics resulted in better performance and better interdepartmental effectiveness. This may seem obvious, but the improvements in performance included cycle time reduction, better in-stock performance, increased product availability levels, and improvements in order-to-delivery lead times.

Firms with higher internal integration demonstrated higher relative logistics performance compared with less integrated firms. There was no difference between ‘high’ and ‘low’ integration firms on basic service: that is, consistent



**Figure 8.1** Arcs of integration

(Source: After Frohlich and Westbrook, 2001)

delivery on request data and advance notification of delays and shortages. However, on the 'higher value' service elements, such as delivery reliability, there was a significant difference. High-integration firms had higher performance in terms of meeting customer needs, accommodating special customer requests, and new product introductions. This resulted in an enhanced customer perception of the organisations. Similar conclusions are arrived at by Windahl and Lakemond (2006), especially where the firm is developing integrated products and services such as 'power for life' (see Case study 2.5). And a study of Spanish food manufacturers by Gimenez (2006) shows that the highest levels of external integration are achieved by firms which have already achieved the highest levels of internal integration between logistics, production and marketing.

The implications of this research are that firms should continue to work at improving internal integration. For example, functional barriers between purchasing, manufacturing and distribution may lead to the following scenarios:

- Purchasing buys castings on the basis of low price, but the supplier has a poor record for delivery reliability and quality. Manufacturing is faced with uncertain deliveries and high reject rates.
- Manufacturing aims to keep machine and labour productivity high, so batch sizes are kept high. Distribution is faced with poor availability, especially of class B and C parts.
- Distribution wants to maintain a fast throughput warehousing operation, so resists carrying out any post-manufacturing operations. Manufacturing is faced with the additional complexity of customising products.

Internal integration is the key starting point for broader integration across the supply chain. As Robert Lynch said (Kirby, 2003: 69), 'For some reason alliance

professionals find it easier to create alliances with their major competitors than with other divisions in their own companies. We don't deal with our own internal integration. How can we integrate externally if we can't do it internally?'

### Activity 8.1

Taking your business (or one well known to you) as an example, how well do the internal functions integrate? Consider the purchasing–manufacturing–distribution example above and develop a scenario for the company, using the company's names for the functions concerned. What impact does your scenario have on material flow?

## 8.1.2 Inter-company integration: a manual approach

If significant improvements can be achieved by internal integration, potential for the benefits of external integration could be even higher. This was demonstrated by the Bose Corporation (a US-based manufacturer of hi-fi equipment) in the early 1990s when they developed the *JIT2* concept. Bose recognised that, if the traditional buyer–supplier relationships were to be made more effective, more people would be required in their organisation. However, budget constraints meant that no additional people could be employed in this role. This acted as a driver to develop the *JIT2* concept.

A logical extension of the just-in-time concept described in Chapter 6 is to place customer and supplier processes closer together. The *JIT2* approach goes a stage further by eliminating the buyer and the salesman from the customer–supplier relationship, thus fostering increased communication between the parties. The principle is simple: a supplier employee who resides full time in the customer's purchasing office replaces the buyer and supplier. This *supplier-in-plant* is empowered to use the customer's scheduling system to place orders with their own company. In addition, the supplier-in-plant does the material planning for the materials supplied by his company.

The 'supplier in-plant' is also part of the production planning process, so production is planned concurrently with the supplier organisation. This form of integration streamlines the supply process by removing the multi-level planner–buyer–salesman–supplier plant process by making this the responsibility of one individual. This dramatically reduces the demand uncertainty experienced by the supplier organisations. The benefits of this streamlining have also resulted in major business improvements for Bose. These include:

- 50 per cent improvement in terms of on-time deliveries, damage and shortages;
- 6 per cent reduction in material costs;
- 26 per cent improvement in equipment utilisation;
- major reductions in inventory holdings.

The Bose supplier-in-plant concept demonstrates how collaboration and integration can benefit the supply chain. The supplier-in-plant can, to a large degree, be superseded by today's electronic integration techniques.



**Activity 8.2**

What are the opportunities for the JIT2 supplier-in-plant principle in your chosen company? Could the principle help to improve integration, either by a company representative working in the customer's organisation, or by representatives from major suppliers working in your chosen company?

**8.1.3 Electronic integration**

Much of the pioneering work for electronic integration has been in the fast-moving consumer goods (FMCG) sector between retailers and manufacturers. The traditional way to exchange orders and delivery information has been by means of electronic data interchange (EDI). But EDI systems are generally incompatible with each other, and have high development and installation costs. Technologies based on the Internet offer worldwide connectivity and relative ease of access.

Achieving visibility throughout the supply chain is of paramount importance in the search for competitive advantage. The exponential development of Internet technology together with the increased power of the personal computer offers organisations a relatively cheap means of integrating information systems across the supply chain.

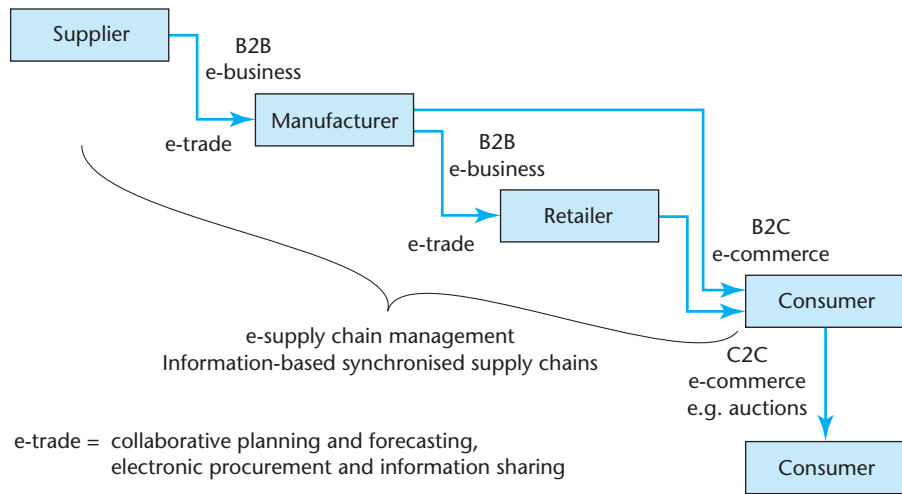
The Internet provides a platform-independent communications highway that can be used as a cross-company interface to enable electronic commerce. Thereby, it fosters operationally efficient, connected and cooperative relationships among manufacturers, suppliers and distributors. Using the Internet can provide an easy and cost-effective answer that is available to all partners in a network.

E-business is a term used to cover trading with a firm's suppliers and business customers – that is, business-to-business – by electronic means. A feature of B2B is the formation of online trading communities (see for example Ariba, [www.ariba.net](http://www.ariba.net)) and electronic marketplaces. Such structures have been enabled by the explosion of Internet technology and seek to offer cost reductions in procurement of both direct and indirect goods and also in the processing of such transactions. The relationship of these terms in the context of the 'e-supply chain' is shown in Figure 8.2.

Trading partners can integrate electronically in three ways: transactional, information sharing and collaborative planning.

***Transactional: the electronic execution of transactions***

This is usually found in business to business (B2B) e-commerce, with the trading partners focusing on the automation of business transactions such as purchase orders, invoices, order and advanced shipment notices, load tendering and acknowledgements, and freight invoices and payments. These transactions involve the electronic transmission of a fixed-format document with predefined data and information fields.



**Figure 8.2** E-Business terminology

### *Information sharing: the electronic sharing or exchange of information*

Trading partners are given access to a system with shared information. Often, however, one partner transmits shared information to another. The information is sent on a 'for your information' basis; the recipient uses the data as it stands, and no feedback is given. Shared information may include product descriptions and pricing, promotional calendars, inventory levels, shipment tracking and tracing. This type of arrangement only supports independent planning by each partner. Uncertainty is reduced by each partner becoming aware of other partners' activities. However, trading partners do not have the opportunity to comment on or change the plan in any way.

### *Collaborative planning: strategic, tactical and operational exchange*

Collaborative planning embraces electronic integration at all levels: strategic, tactical and operational. This is the most sophisticated form of electronic integration. It enables trading partners to work together to understand future demand better and to put plans in place to satisfy such demand profitably. The trading partners collaborate on new product planning, demand forecasting and replenishment planning, and work closely to align their organisations' plans.

The discussion on collaborative planning is developed later in section 8.3. Here, the concept of information sharing is developed by means of a case study in *continuous replenishment (CR)*. Continuous replenishment logistics is a pioneering approach to using developments in IT to supply demand quickly from the manufacturer. Using electronic point of sale (EPOS) data to track customer demand through the till, CR shares data from retailer to supplier. The aim is for the supplier to replace quickly what has been sold today, so that stock availability on the shelf is maintained at the retailer. Case study 8.1 gives a view of where fashion logistics is heading.

CASE STUDY  
8.1

## Continuous replenishment in the apparel industry

Case study 4.4 describes some of the competitive pressures in the apparel industry and trade-offs in developing global 'vertical' supply strategies. (Vertical strategies aim to emulate retailers like Zara, which source everything from set manufacturing plants that are situated close to their retail outlets in Europe). Setting up a similar operation in the US would be problematic – for a start, there is not much left of the apparel manufacturing base because it went overseas long ago for cost reasons. Competitive pressures are constantly increasing: 80 per cent of the industry is fashion-driven – and fashion changes every 6–8 weeks. Thus, time-to-market is increasingly important. But lead times from catwalk to customer for such a fast-moving industry are often a leisurely six months or more. Average markdowns increased to 30 per cent, and missed sales opportunities go unrecorded. Chappel (in Lewis, 2001) states

professional buyers are often measured on the difference between buying and selling prices; merchandisers on maximising sales of a fixed amount of stock, and distribution professionals on achieving the lowest unit cost. No one takes the overall supply chain into account and creates a balanced view of the trade-offs between bought-in product cost, achievable sales, the cost of mark-down and the cost of operating the supply chain from end to end.

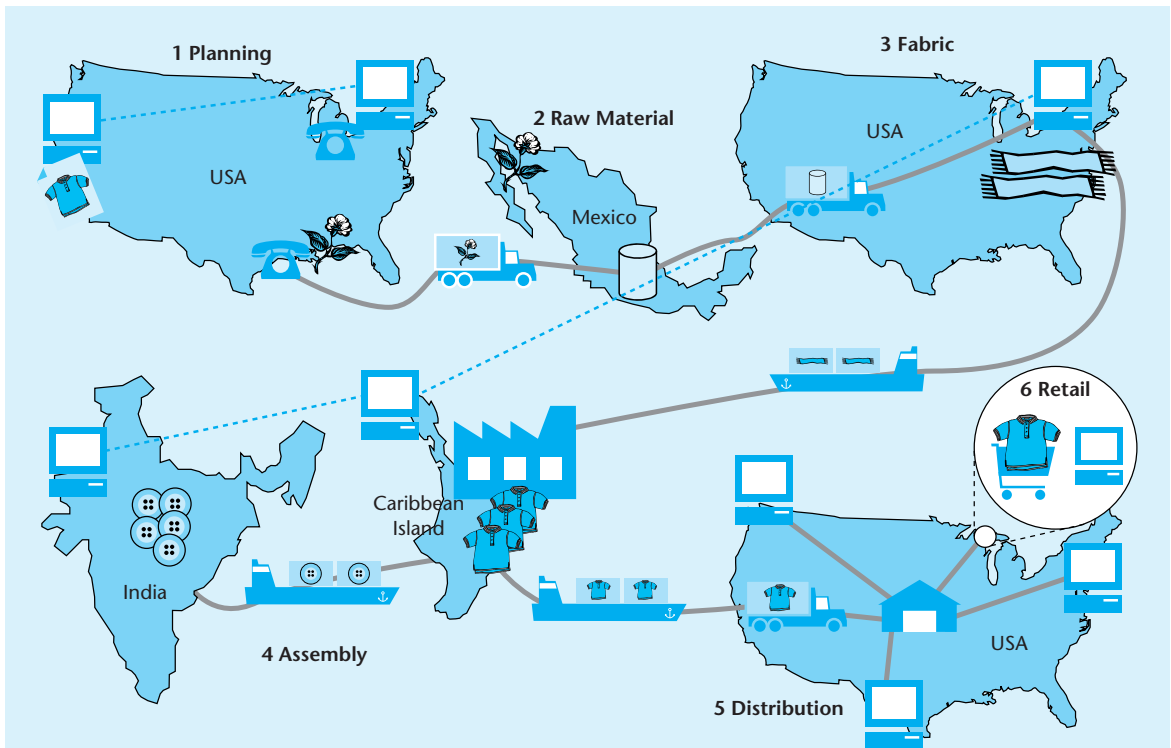
Retailers drive the industry, and in a fragmented and very competitive marketplace, they are moving quickly to address its long-standing logistics problems. Increasingly, they are turning to suppliers to respond faster to better quality information. Kuhel (2002) quotes Agit Patel, CIO of Chico, a fast-growing designer and retailer of women's apparel and accessories:

we're in the stone age right now, but we're going to convert this place and bring it into the 21st century. Today, our suppliers don't have much visibility except for what we provide them through our current communications technology – and that happens to be e-mail primarily. But going forward they will be able to see exactly what we have and what's selling and what's not, and we'll be able to see where they are within a production cycle for any particular order.

Kuhel proposes an apparel supply chain of the future that is based on continuous replenishment, which we have adapted. Let us assume a designer and retailer of fashion apparel is situated in the north-eastern US. A new range has been designed, and early sales are encouraging. These early sales figures are used to refine forecasts quickly, and to prime the logistics pipeline with a flow of product that matches expected demand. After this, it is essential to regulate the flow of finished goods to match actual demand. This is how it is done.

As soon as an item is purchased, the retailer collates the the electronic point of sale (EPOS) data from its stores, and sends the data upstream. The 'pull' signal (Chapter 6) goes back all the way to the yarn manufacturer. Figure 8.3 represents the path that a garment might take from concept to delivery. Six stages are involved.

**1 Planning:** apparel retailer determines design for a product, evaluates costing and then sends demand data and forecast upstream. These signals set the supply chain in motion. Later, once the product has gone to market, a web-based link from the retailer's EPOS system to the manufacturer triggers replenishment responses.



**Figure 8.3** Continuous replenishment in the apparel industry

(Source: After Kuhel, 2002)

- 2 Raw material:** suppliers respond to demand signals via phone, fax or e-mail. Raw cotton is compressed into bales, and fitted with radio frequency identification device (RFID) tags (see section 8.2.3) to specify source and type.
- 3 Fabric:** manufacturers weave and ship product in response to demand from the retailer. Inventory/shipment tracking starts here. In-transit data is passed downstream via the Internet.
- 4 Assembly:** fabrics and trims come together at the final assembly plant, which in this example is situated in the Caribbean. (Manufacturers situated within short shipping times of the US are favoured over Far East suppliers.) The plant has an ERP system that processes orders received electronically. Finished goods are assembled and bar-coded by store prior to despatch. All suppliers to the apparel retailer use compatible systems.
- 5 Distribution:** the product is shipped by container to the retailer's national distribution centre (NDC). Here, store orders are cross-docked using the bar-code to identify the destination store. They are then forwarded to regional distribution centres (RDCs) that serve 50–100 stores.
- 6 Retail:** as items are purchased, EPOS triggers replenishment responses.

### Questions

- 1 Summarise the 'current state' problems that are typical of the apparel industry, and their implications for supply chain integration.
- 2 Identify potential barriers to executing the proposed apparel 'supply chain of the future'.

## 8.2 Efficient consumer response (ECR)

**Key issue:** How can collaboration be extended across the supply chain to focus on meeting consumer demand?

Established as a grocery industry initiative, *efficient consumer response* (ECR) is designed to integrate and rationalise product assortment, promotion, new product development and replenishment across the supply chain. It aims to fulfil the changing demands and requirements of the end-customer through effective collaboration across all supply chain members, in order to enhance the effectiveness of merchandising efforts, inventory flow and supply chain administration.

The origin of ECR can be traced back to work carried out by Kurt Salmon Associates (in the United States) for the apparel sector (Salmon, 1993), and subsequently in the grocery sector (Ferne, 1998). Since then, ECR has increased industrial awareness of the growing problem of non-value-added supply chain costs.

Originating within the consumer products industry, ECR emerged partly because of the increased competition from new retail formats entering the traditional grocery industry in the early 1990s, as well as through the joint initiatives between Wal-Mart and Procter & Gamble. In Europe, ECR programmes commenced in 1993 with the commissioning of a series of projects, for example the Coopers & Lybrand survey of the grocery supply chain (Coopers & Lybrand, 1996).

The focus of ECR is to integrate supply chain management with demand management. This requires supplier–retailer collaboration – but in spite of the apparent emphasis on the end-consumer, a lot of the early ECR studies focused on the supply side. Subsequent increased focus on demand and category management, however, has led to the adoption of a more holistic view of the supply chain when discussing ECR initiatives. In addition, ECR has stimulated collaborative efforts that have increased the emphasis on key areas such as EDI, cross-docking and continuous replenishment.

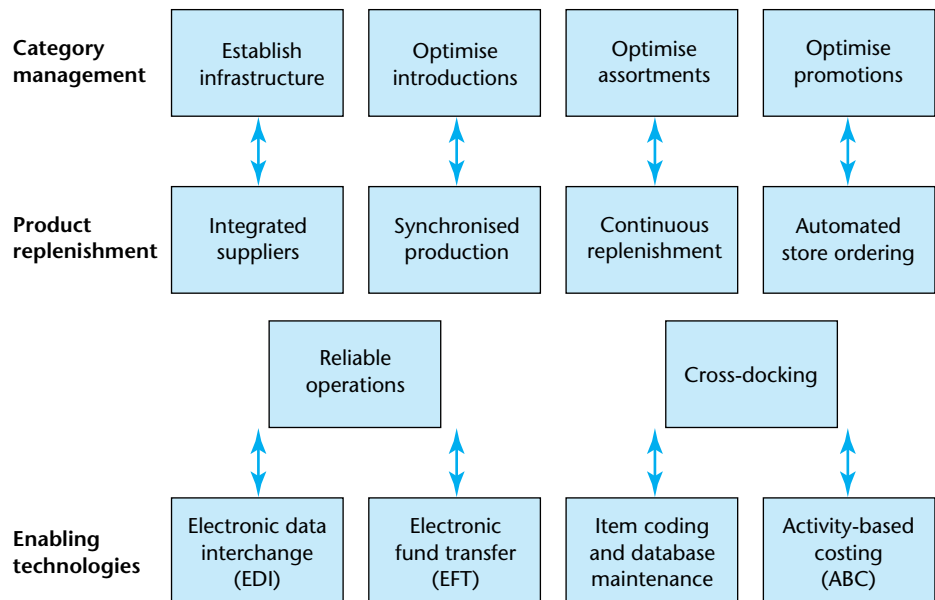
Other examples of studies sponsored by ECR-Europe initiatives include an *Optimal Shelf Availability* report (Roland Berger Consultants, 2003) and the *Shrinkage in Europe* report (Beck, 2004). Generally, ECR initiatives aim to promote greater collaboration between manufacturers and retailers. Effective logistics strategies as well as administrative and information technology are essential for its successful implementation. These techniques are available within most firms, but the most frequent issue is to ensure that existing tools are customised in order to achieve their maximum potential.

The main areas addressed under ECR initiatives are category management, product replenishment and enabling technologies. These can be broken down into 14 areas where individual as well as well-integrated improvements can be made in order to enhance efficiency (see Figure 8.4).

## 8.2.1 Category management

As demand management principles have become more important to supply chain initiatives, the category management process has increased in popularity. With an objective of preventing stockout situations and improving supplier–retailer relations, category management aims to balance retailers’ product volume and variety objectives. Among activities included in the category management process are the capture and utilisation of knowledge of the drivers behind consumer attitudes and choices.

By focusing on category management and measuring promotional efficiency, ECR enables organisations to utilise their joint resources to reduce supply chain inventory levels, streamline product flows, and use cross-dock options where appropriate. Thus category management represents a focus on the development of at least some of the following capabilities:



**Figure 8.4** ECR improvement categories

(Source: Fernie, 1998: 30)

- account management;
- demand management;
- multifunctional selling teams;
- price list restructuring;
- effective and customised promotions.

## 8.2.2 Continuous replenishment

Continuous replenishment offers both retailers and their suppliers the opportunity to manage their inventory in a more efficient manner (Mitchell, 1997; PE

International, 1997). Each of the six stages that make up the product replenishment process (illustrated in Figure 8.4) represents a link that integrates the supply chain from product suppliers right through to end-consumers. In addition, effective replenishment strategies require development of the following capabilities:

- joint inventory management;
- cross-dock operations;
- continuous replenishment;
- effective logistics strategies and product flows;
- quick response.

### 8.2.3 Enabling technologies

These drive ECR and make it work. They include scanning data, data warehousing and data mining, which have facilitated our understanding of customer requirements. Examples include EDI, which is increasingly about synchronising trading data among supply chain partners in advance of doing business as it allows the transmission of forecasting data back up through the supply chain. Other capabilities required by organisations in order to implement an effective ECR initiative include:

- effective information sharing;
- automated order generation;
- bar-coding and the use of other scanning technology.

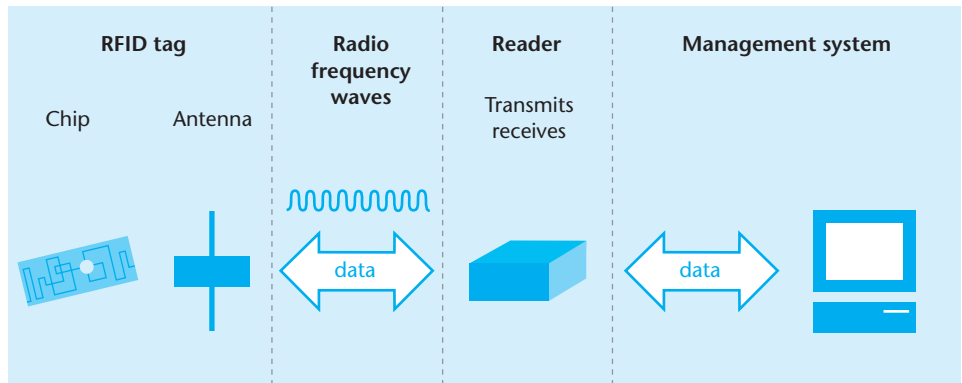
In addition, the data to be shared and communicated at various stages in the supply chain depend on what will provide the most overall benefit. These data should include:

- demand/consumption/sales information;
- cash flow;
- stocks of finished goods/work in progress;
- delivery and output status.

However, many of the problems in sharing and using these data and implementing EDI networks are related to difficulties in achieving a critical mass of companies sufficient to generate substantial benefits.

#### *Radio frequency identification devices (RFIDs)*

Radio frequency identification (RFID) is a product tracking technology that will soon become nearly universally applied. An RFID device, often called a *tag*, can be attached to a piece of merchandise and inform a reader about the nature and location of what it is attached to. Figure 8.5 shows how the reader can



**Figure 8.5** An RFID system

(Source: After Beck, 2004)

relay this information to a management system that can create a picture of what merchandise is where at a level of detail that has not previously been possible.

An active tag has a power source; a passive tag does not. Active tags use a battery, have a limited life and cost far more. The *antenna* is a device that uses radio waves to read and/or write data to the tags. The *reader* manages the interface between antenna and management system. A big advantage of RFID technology over bar-codes is that the tag does not have to be directly in the line of sight of the reader. Tags can be detected by readers remotely because the radio waves can pass through many materials (see, for example, [www.ems-rfid.com](http://www.ems-rfid.com)). Experiments are being conducted across a broad range of frequencies – 125 KHz to 2.45 GHz for chip-based tags – but standards are still being debated in many sectors. The *management system* enables data from tags to be collected and sorted for the purposes of management information and action.

The key piece of information held on a tag is the *electronic product code* (EPC, standards for which were developed by the Auto-ID Center). This 'number plate' is unique to each tag. The unique number can then be linked to information about the product to which it is attached, for example about when and where the product was made, where its components came from and shelf life details. Some tags may hold this additional information on board however the intention is that most tags will only hold the EPC and additional information will be stored remotely, on a database linked to the management system.

Readers tell us *what* the product is and *where* it is located in the supply chain. The management system compiles this information and allows us to know *how many* products are present at that location for each time bucket. This translates into dynamic data that allows us to know rates of consumption, and stock data at a given point in time – together with what needs to be done. One can already envision that such data will enable supply chain planning and control to be transformed.



Product tagging allows for several interesting applications including:

- tracking products throughout the distribution pipeline ('asset tracking') to provide continuous quantities and position by sku in the supply chain;
- tracking products through back of store to the shelf;
- intelligent shelves, whereby 'sweeping' of product by thieves from shelves in store shows up automatically and raises alarm signals;
- registering sales without involving a cashier: a fancied future state is one where shoppers push their trolley past readers that automatically read EPCs for each item in the trolley, and present the bill for credit card payment to the shopper without the need for retailer personnel to be involved.

Benefits for manufacturers include the ability to understand when products are in the store but not on the shelf (a source of lost sales that manufacturers cannot control), and reducing the opportunities for theft. Retailer benefits include ability to track products in the pipeline against delivery schedules, automation of the checkout process and ability to expand customer information on buying patterns.

Technically, products can be tracked all the way to the customer's home and into it. However, when Benetton planned to track products after the sale, with an eye on returns, it was met with customer resistance on grounds of privacy. This caused Benetton to delay plans for rolling out this idea. The other major hurdle to implementation is the price of the tags. Price/margin levels in most consumer packaged goods tags need to be low enough to be affordable at the individual product level. However, with Wal-Mart mandating tag application from its major suppliers, critical mass will be accomplished sooner rather than later. Beyond product-level tagging in retail channels, many other applications are already in place at case-level, and in higher-value goods such as automotive parts.

## CASE STUDY 8.2

### ECR in the UK

Dutchman Paul Polman did a stint as General Manager of Procter & Gamble UK and Eire from 1995 to 1999. While admiring the UK's advanced retailing systems, he saw opportunities for all four of the 'pillars of ECR' – range, new items, promotions and replenishment. The following is extracted from the text of a speech he made to the Institute of Grocery Distribution.

#### Range

The average store now holds 35 per cent more than five years ago, yet a typical consumer buys just 18 on a trip. A quarter of these skus sell less than six units a week! The number of skus offered by manufacturers and stores has become too large and complex. My company is equally guilty in this area. No question, we make too many skus. I can assure you we are working on it. Actually, our overall sku count in laundry is already down 20 per cent compared to this time last year. What's more, business is up.

Clearly, we have an opportunity to rationalise our ranges. As long as we do this in an ECR way – focusing on what consumers want – we will all win. The consumer will see a clearer range. Retailers and manufacturers will carry less inventory and less complexity. The result will be cost savings across the whole supply chain and stronger margins.

### New items

There were 16,000 new skus last year. Yet 80 per cent lasted less than a year. You don't need to be an accountant to imagine the costs associated with this kind of activity. And look how this has changed. Since 1975, the number of new sku introductions has increased eightfold. Yet their life expectancy has shrunk from around five years in 1975 to about nine months now. We can hardly call this progress.

### Promotions

In promotions it's the same story. Take laundry detergents. This is a fairly stable market. Yet we're spending 50 per cent more on promotions than two years ago, with consumers buying nearly 30 per cent more of their volume on promotions. This not only creates an inefficient supply chain, or in some cases poor in-store availability, but, more importantly, has reduced the value of the category and likely the retailers' profit. We're all aware of the inefficiencies promotions cause in the system, such as problems in production, inventory and in-store availability. They all create extra costs, which ultimately have to be recouped in price. But there's a higher cost. As promotions are increasing, they are decreasing customer loyalty to both stores and brands by 16 per cent during the period of the promotion. We commissioned a report by Professor Barwise of the London Business School. He called it 'Taming the Multi-buy Dragon'. The report shows us that over 70 per cent of Laundry promotional investment goes on multi-buys. The level of investment on multi-buys has increased by 60 per cent over the last three years. There's been a 50 per cent increase behind brands and a doubling of investment behind own labels. Contrary to what we thought, most of this volume is not going to a broad base of households. It is going to a small minority. Seventy-one per cent of all multi-buy volume is bought by just 14 per cent of households. Just 2 per cent of multi-buy volume goes to 55 per cent of households. We really are focusing our spending on influencing and rewarding a very small minority of people indeed.

### Replenishment

Based on the escalating activity I've just [referred to], costs are unnecessarily high. There are huge cost savings also here, up to 6 per cent, by removing the non-value-added skus and inefficient new brand and promotional activity.

### Questions

- 1 Cutting down on range, new items and promotions is presumably going to lead to 'everyday low prices'. Does this mean ECR is lean thinking by another name?
- 2 Procter & Gamble's major laundry brand in the US is Tide. This is marketed in some 60 pack presentations, some of which have less than 0.1 per cent share. The proliferation of these pack presentations is considered to have been instrumental in increasing Tide's market share from 20 to 40 per cent of the US market in the last five years. Clearly, this is a major issue within P&G. What are the logistics pros and cons of sku proliferation?

## 8.3 Collaborative planning, forecasting and replenishment (CPFR)

*Key issue: How can collaboration be extended to strategic as well as to operational levels?*

Collaborative planning, forecasting and replenishment (CPFR) is aimed at improving collaboration between buyer and supplier so that customer service is improved while inventory management is made more efficient. The trade-off between customer service and inventory is thereby altered.

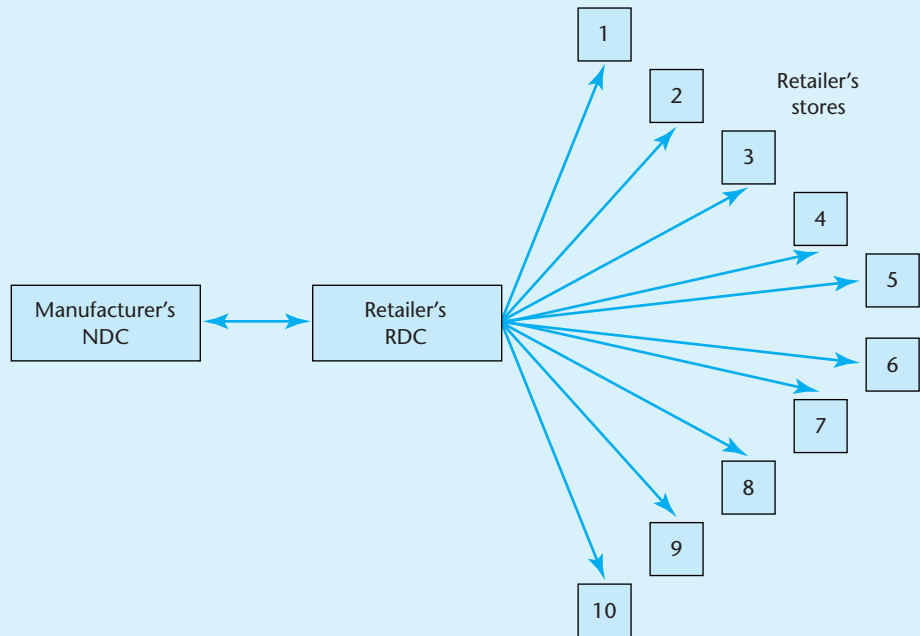
The CPFR movement originated in 1995. It was the initiative of five companies: Wal-Mart, Warner-Lambert, Benchmarking Partners, and two software companies, SAP and Manugistics. The goal was to develop a business model to collaboratively forecast and replenish inventory. An initial pilot was tested between Wal-Mart and Warner-Lambert using the Listerine mouthwash product and focusing on stocks kept in the retail outlets. The concept and process was tested initially by exchanging pieces of paper. This generated clear visibility of the process required and the requirements for the IT specification. The two companies later demonstrated in a computer laboratory that the Internet could be used as a channel for this information exchange.

In 1998 the Voluntary Inter-industry Commerce Standards Committee (VICS) became involved in the movement, which enabled it to make major strides forward. VICS was formed in 1986 to develop bar-code and electronic data interchange standards for the retail industry. The involvement of VICS meant that other organisations could participate in the validation and testing of the CPFR concept. With VICS support, organisations including Procter & Gamble, Kmart and Kimberly-Clark undertook pilots to test the idea of sharing information to improve inventory handling. One of the pilots in the UK grocery sector is described in Case study 8.3.

### CASE STUDY 8.3

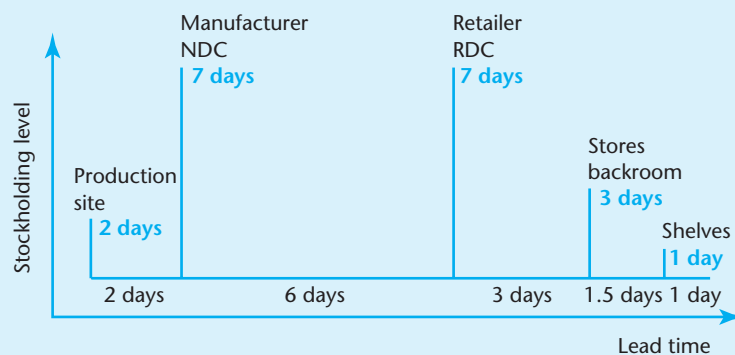
#### CPFR trials in the UK grocery sector

CPFR pilots have been a popular diversion in the UK grocery sector. Often, they show – as in this case – that considerable opportunities for improvement exist, but that the problems of scaling up the pilot are too great. The scenario for this pilot, researched by one of our Masters students, Alexander Oliveira, was a manufacturer that supplied a major grocery retailer in the UK. Figure 7.9 (page 228) shows the typical demand series for one of the ten products in the study, all of which were in the high-volume ambient category. Total sales through the till (EPOS) for a given week were really quite stable. While there is apparent high demand variation, most of this is due to predictable behaviour such as that due to different store opening hours. The day-by-day demand for this product was actually relatively stable over the course of a year. Figure 8.6 places the pilot in context. The manufacturer's national distribution centre (NDC) supplied one of the retailer's regional distribution centres (RDCs), which in turn served 10 stores in the pilot.



**Figure 8.6** A collaborative planning pilot

The starting situation that Alexander found was that forecasting methods were based on a history of the last 2–3 months. While this gave the correct day-by-day pattern, it was insensitive to actual demand during a given week. As can be seen in Figure 7.9, the actual demand pattern varies from day to day across the series due to a proportion of randomness in the pattern. The replenishment cycle was unresponsive because daily deliveries were based on forecasts. This resulted in high safety stocks and poor on-shelf availability. Figure 8.7 provides an inventory profile across the supply chain. The sum of the vertical (average days of stock) and horizontal (average lead time in days) gives the total time for a new batch of product to progress from manufacturing site to shelf. This totals a massive 4–5 weeks!

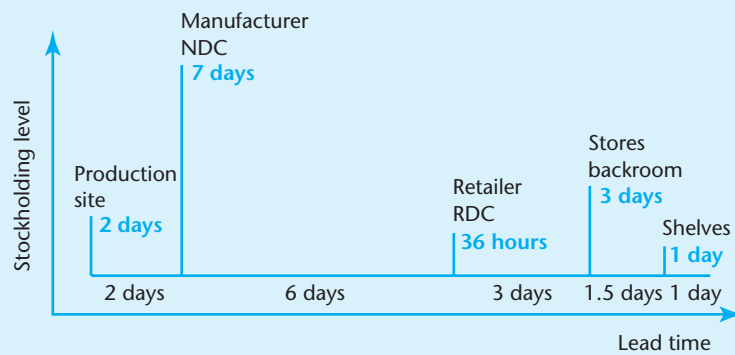


**Figure 8.7** Pipeline map at start

Alexander coordinated the provision of forecast data from both manufacturer and supplier. Both forecasts were posted on a web site, and he was asked to provide instruc-

tions as to how much product the manufacturer should supply each day. Stock for the 10 stores was 'ring fenced' at the retailer's RDC – that is, it could not be supplied to any other than the 10 stores in the pilot.

Alexander soon found that current forecast data did not take daily fluctuations into account, and was based on far too long a history period. By tracking daily demand, it was possible to allow for the randomness without anything like the current quantity of safety stock in the system. He developed a new replenishment algorithm that was based on the daily error between forecast and actual, and which added an extra day's buffer stock. It soon became obvious that it was possible to run the system on far lower stock levels at the retailer's NDC, as shown in Figure 8.8:



**Figure 8.8** Pipeline map at end of pilot

Alexander's work had succeeded in reducing the stock level at the NDC from 7 days to 36 hours. In spite of the huge potential savings, the retailer did not go ahead with scaling up the pilot. This can be attributed to several factors. First, many other improvement initiatives were under way. The CPFR initiative would have needed further scarce resources. Second, scaling up would have required a different operating routine at all NDCs and the supporting IT infrastructure would need to have been changed. Third, what worked with one relatively efficient manufacturer may not have worked with others. Nevertheless, Alexander came up with the following five enablers for CPFR implementation (Barratt and Oliveira, 2002):

- 1 *Define single point of contact for each trading partner*: to ensure that information is neither lost nor deteriorates during the exchange.
- 2 *Define agenda for collaboration (short–medium–long term)*: to stabilise the collaborative goals over time.
- 3 *Expand collaborative projects (scope and complexity)*: to gain critical mass.
- 4 *Ensure continuous sharing of information*: a key enabler of collaborative planning.
- 5 *Development of trust*: this takes time. Smaller problems are gradually removed from the CPFR process to help partners develop confidence that the long-term goal is achievable.

### Questions

- 1 Suppose that the retailer's total sales were €20 bn, and that the ten skus together accounted for 0.4 per cent of these sales. Calculate the approximate savings in inventory to the retailer.
- 2 Do you consider that the reasons given for not scaling up the pilot are valid?
- 3 Would there be any benefits to the manufacturer?

In Autumn 1999 VICS published a tutorial for CPFR implementation. This is available in hard copy, or can be accessed on its web site at [www.cpfr.org](http://www.cpfr.org). This 'road map' offers organisations a structured approach to CPFR implementation based on the experiences of the companies involved in the CPFR pilots.

Having shown that the CPFR concept can have bottom-line impact on their businesses, companies are looking to expand the programmes from the handful of items involved in the pilots to the hundreds or thousands of items covered in most trading relationships. This has been a challenge for all organisations, including the software providers, for whom a major focus has been to ensure that software is scaleable: that is, that there are no barriers to the number of organisations and products involved in the CPFR network.

When implementing CPFR, a significant amount of time and effort is required up-front to negotiate specific items such as goals and objectives, frequency of updates to plan, exception criteria and key performance measures. The result is a published document defining the relevant issues for each organisation that has been jointly developed and agreed.

A nine-step business model has been developed that provides an insight into the effort required by both supplier and customer. The model is as follows:

- 1 Develop front-end agreement.
- 2 Create joint business plans.
- 3 Create individual sales forecasts.
- 4 Identify exceptions to sales forecasts.
- 5 Resolve/collaborate on exception items.
- 6 Create order forecast.
- 7 Identify exceptions to order forecast.
- 8 Resolve/collaborate on exception items.
- 9 Generate orders.

In summary, CPFR focuses on the process of forecasting supply and demand by bringing various plans and projections from both the supplier and the customer into synchronisation. CPFR requires extensive support in the form of Internet-based products, which can result in major changes to the key business processes. An academic survey of the success of CPFR (Oliveira and Barratt, 2001) found a significant correlation between companies with high information systems capabilities and the success of CPFR projects. The firms with high levels of CPFR implementation use information systems capable of providing timely, accurate, user-friendly and inter-functional information in real time. Skjoett-Larsen *et al.* (2003) propose that CPFR should be seen as a general approach to integrating supply chain processes, and not as a rigid, step-by-step model as proposed by VICS.

### 8.3.1 Benefits of electronic collaboration

Nestlé UK states that the advantages of collaborative systems are significant, and lists the following benefits:

- There is improved availability of product to the consumer, and hence more sales.
- Total service is improved, total costs are reduced (including inventory, waste and resources), and capacities can be reduced owing to the reductions in uncertainty.
- Processes that span two or more companies become far more integrated and hence simple, standard, speedy and certain.
- Information is communicated quickly, in a more structured way, and is transparent across the supply chain to all authorised users. All users know where to find up-to-date information.
- An audit trail can be provided to say when information was amended.
- E-mail prompts can update users of variance and progress, and can confirm authorisations.
- The data that are in the system can be used for monitoring and evaluation purposes.
- The process can be completed in a quick timescale, at a lower total cost.
- All trading partners become more committed to the shared plans and objectives. Changes are made with more care, and are immediately visible to all.

Many of these benefits are being experienced by those implementing the CPFR philosophy. Wal-Mart and Sara Lee experienced sales increases of 45 per cent and a decline in weeks-on-hand inventory of 23 per cent. The benefits experienced by Procter & Gamble and its retail partners include a reduction in replenishment cycle time of 20 per cent. The increased visibility of the supply chain resulted in a reduction of in-store availability from 99 to 88 per cent being detected with sufficient lead time to respond. This saved three to four days of stockouts for the retailer. Forecast accuracy improvements of 20 per cent have also been experienced.

## 8.4 Vendor-managed inventory (VMI)

*Key issue: How can suppliers help to reduce waste in the customer's process?*

Vendor-managed inventory (VMI), is an approach to inventory and order fulfilment whereby the supplier, not the customer, is responsible for managing and replenishing inventory. This appears at first sight to counter the principle of pull scheduling, because the preceding process (the manufacturer) is deciding how many and when to send to the next process (the retailer). In practice, the basis on which decisions will be made is agreed with the retailer beforehand, and is

based on the retailer's sales information. Under VMI, the supplier assumes responsibility for monitoring sales and inventory, and uses this information to trigger replenishment orders. In effect, suppliers take over the task of stock replenishment.

*Automated VMI* originated in the late 1980s with department stores in the USA as a solution to manage the difficulties in predicting demand for seasonal clothing. Prior to this *manual VMI* had been around for many years – particularly in the food industry. Under manual VMI, the manufacturer's salesman took a record of inventory levels and reordered products for delivery to the customer's store, where the manufacturer's representative would restock the shelves. As product variety has increased and life cycles have shortened, manual VMI has been replaced by automated VMI.

### 8.4.1 How VMI works

The supplier tracks their customers' product sales and inventory levels, sending goods only when stocks run low. The decision to supply is taken by the supplier, not the customer as is the case traditionally. The supplier takes this decision based on the ability of the current level of inventory to satisfy prevailing market demand, while factoring in the lead time to resupply. The smooth running of VMI depends on a sound business system. It also requires effective teamwork between the retailer and the manufacturer. In order for both parties to gain full benefit from the system, appropriate performance measures need to be used. The top priority measure is that of product availability at the retailer. It is in both parties' interests to maximise product availability, avoiding lost sales in the short term and building customer buying habits in the long term. By emphasising the supplier's responsibility for maximising product availability, VMI aims to achieve this with minimum inventories. In order to combine both of these apparently conflicting goals, it is necessary to have access to real-time demand at the customer.

The most widely used technology for broadcasting demand data from the customer is *electronic data interchange* (EDI). This provides the means for exchanging data from customer to suppliers in a standard format. Internet-based applications using EDI protocols are increasingly popular, providing the same facility at lower cost. Customer demand and inventory data are often processed through software packages to automate the application of decision rules and identify stock lines that need replenishment.

### 8.4.2 Potential benefits

The immediate benefit to a supplier engaged in VMI is access to data on:

- customer sales;
- inventory levels at the customer.



The assumption is that the supplier can use these data to provide better control of the supply chain and so deliver benefits for both the customer and themselves.

Having the supplier take the decision on replenishment aims to minimise the impact of *demand amplification*. This critical problem erodes customer service, loses sales, and increases costs. The ability to dampen demand amplification caused by infrequent, large orders from customers is key to the success of VMI. The surplus capacity and excess finished goods held by suppliers to counteract such variation can then be reduced.

In the longer term, suppliers should integrate demand information into their organisation and develop the capability to drive production with it. This helps to replace the traditional push scheduling, based on forecasts and buffer stocks, with pull scheduling, based on meeting known demand instantaneously out of manufacturing.

### Activity 8.3

There are a number of different ways in which the use of VMI can benefit the supplier and the customer. Make a list of those benefits you think exist under the headings of 'supplier benefits' and 'customer benefits'.

## 8.4.3 Potential problems in setting up a VMI system

Other than the practical difficulties of setting up a VMI system, a number of problems can prevent the attainment of the above benefits. Five of them are listed below.

### *Unwillingness to share data*

Retailers may be unwilling to share their marketing plans and product range strategies with manufacturers. This is particularly true in the UK, where supermarkets have strong own brands that compete with those of the manufacturers.

Retailers continue to be the owners of information on actual demand passing through their tills. An inability to forward this information, whether due to reluctance or to procedural and technical problems, will prevent suppliers from responding effectively, leading to the need for buffer stocks and increasing the risk of stockouts.

### *Seasonal products*

The benefits of VMI are quickly eroded in fashion and seasonal products, especially apparel. VMI in these cases can involve suppliers making to stock based on a pre-season forecast with little scope for manufacturing in season. Small quantities are delivered from this stock to the retailers over the season. Naturally the forecast is regularly at odds with actual demand, so products will be frequently understocked or overstocked. In effect all that has happened is that the burden of owning inventory and disposing of excesses has been moved onto the supplier.

### *Investment and restructuring costs*

Adopting a VMI approach incurs a high investment by the customer and supplier. Setting up the processes and procedures for undertaking this new way of working takes time and effort. The customer will need to close their materials management function if they are to make cost savings, while the supplier will need to develop the capability to take over this task.

### *Retailer vulnerability*

The process of outsourcing materials management to suppliers makes the retailer more dependent on them.

### *Lack of standard procedures*

The practicalities of the processes and procedures that underpin VMI may not be transferable from one customer to another. Customers may ask for different tagging methods or bespoke labelling. With many industrial products there is no bar-code standard.

### *System maintenance*

Errors creep into inventory records due to incorrect part counts, mislabelling, damage, loss and theft. These records need to be maintained through manual methods such as stock counts.

## 8.5 Quick response (QR)

### *Key issue: How can capabilities across the supply chain be aligned to meet end customer demand?*

Another application of just-in-time and lean thinking is *quick response logistics*. Quick response (or QR for short) is an approach to meeting customer demand by supplying the right quantity, variety and quality at the right time to the right place at the right price. This concept originated in the US textile and apparel industry in response to the threat posed by overseas competitors. The concepts behind QR are based on taking a total supply chain view of an industry. From this perspective it is possible to understand overall performance and the causes of poor performance, and to identify opportunities for improvement.

Understanding overall performance involves mapping the processes needed to convert raw material into the final product (see Chapter 5). The performance of the process is also assessed to determine its effectiveness. In the case of the apparel industry, mapping followed the process of converting raw material into fibre, then into fabric, then into apparel and finally delivery to the retailer. Key measures of the process were lead times, inventory levels and work in progress.

This investigation found that the total process of converting raw material into clothing took 66 weeks. A basic analysis of the process identified that 55 weeks were taken up with product sitting in various stores as inventory. The principal cause of the need for this inventory was identified as being lack of communication between the organisations in the supply network.

Such analysis is similar to that described in Chapter 5, with the process considered in this case being the whole supply chain from end to end. There are two main differences between QR and a time-based approach to improvement. First, there is an emphasis on using actual customer demand to pull products through the distribution and manufacturing system. Second, there is extensive use of information technology as the preferred way to achieve pull. These two issues are explored in more detail below.

### 8.5.1 JIT/QR relationship

Quick response has much in common with the principles behind just-in-time described in section 6.2. The same principle of making only to demand is applied to different parts of the supply network. QR applies the pull principle to the front-end process of distribution management between the retailer and the supplier. JIT applies this principle throughout the supply network. In the case of QR, items are supplied to the retailer in response to consumer demand. Deliveries are made just-in-time for them to be sold. Delivery to the retailer triggers the supplier to produce another item, so pulling further parts through the supply chain in a JIT manner.

This process is very different from the traditional approach of the apparel industry. It has been commonplace to make the whole of a season's forecast demand in advance, and to deliver to store in line with the forecast. While a true 'make to demand' approach has not been achieved, applying QR has led the industry to make two important changes:

- Development lead times have been compressed. This allows designs to be released later, and thus more in line with the latest fashion trends.
- Production lead times are shorter. This allows smaller pre-season inventories to be built up. Instead, high-demand items are supplemented by production during the season. The effect is to maintain high availability of popular lines while minimising stocks of items which prove to be less popular and which would otherwise have to be discounted.

### 8.5.2 Role of enabling technologies

High variety in clothing markets – due to different sizes, styles and colours – and in grocery markets has led these industries to use information technologies as a means of enabling QR. These technologies are based around the use of uniform product codes and electronic data interchange (EDI). The process involves collecting merchandise information at the point of sale from the product bar-code.

Data are sent to the supplier via EDI, where they are compared with an inventory model for the store concerned. When appropriate, production is ordered for the specific items needed to restock the store to the requirements of the model. Once these items have been made, the cycle is completed when they are packed, shipped to the store and delivered to the shelf.

This process has enormous implications for links across the supply chain. With each retailer having a range of suppliers and each supplier servicing a number of retailers there is the need for common bar-code standards across the industry. The retailer needs to have a scanning and data capture system to identify the item being sold. It will need to have a reordering system that links the item to its manufacturer, and which places an order. Information needs to be exchanged between the parties in a common data format, which can be read by different IT systems. The high volume of transactions means that the systems handling the data exchange need to be robust and reliable. Having been informed of the sale, the supplier inputs this information to its manufacturing planning system in order to schedule production and the ordering of supplies.

It is hardly surprising that it is extremely difficult to achieve this integration across the whole of a supply network. There are significant implications for small businesses, which have difficulty justifying the cost of the IT system and the associated training. These set-up costs can deter new companies with innovative products from being able to supply. Recent developments in Internet-based applications are helping to resolve this situation because the implementation and data transfer costs are much lower.

## 8.6 Managing supply chain relationships

*Key issue: How can broader-based relationships be formed between trading partners in the supply chain?*

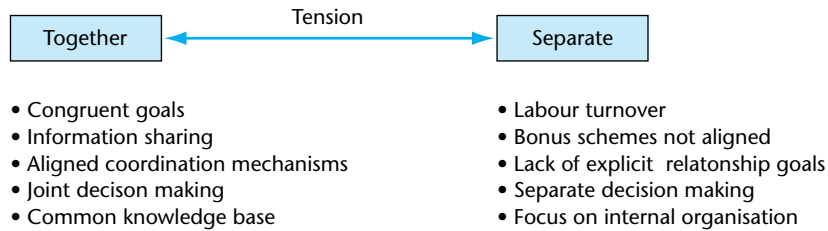
### 8.6.1 Creating closer relationships

The traditional supplier–customer relationship has been limited to contact primarily between the customer’s buyer and the supplier’s salesperson. Other functions, such as information systems, are kept very much at arm’s length. Indeed, the customer’s buyer argues that dealings with the supplier should only go through him or her: in that way, they ensure that sensitive communications, such as those affecting price, are limited to a single channel.

This traditional style of relationship (‘bow tie’) is contrasted with a multiple-contact model (‘diamond’) alternative in Figure 2.4. In the ‘diamond’ version, contacts between different functions are positively encouraged, and the arm’s length relationship of the ‘bow tie’ is replaced by active relationship management and supplier development processes. This is exemplified by the remarkable changes in the supplier portfolio at the UK High Street retailer B&S. In the early 1990s B&S had over 1,000 suppliers. Now it has just 50. But the nature of the

relationship with the 50 is quite different. There are now multi-level connections between the supply chain players, and a high level of electronic collaboration. There is also a much greater involvement by the remaining 50 suppliers in high-level strategy development at BHS.

We found that even the closest and most interdependent supply relationships in practice exhibit a tension between *togetherness* (a tendency to see the requirements for working together in the supply relationship) and *separateness* (the frustration of joint work or the positive aspects of working separately (Koulikoff-Souviron and Harrison, 2007). Figure 8.9 shows this tension as an arrow that connects two contrasting behaviours.



**Figure 8.9** Creating closer relationships

(Source: After Koulikoff-Souviron and Harrison, 2007)

We concluded that logistics disciplines provide a focus for coordination around which other aspects of a supply relationship revolve. If failures such as product quality and process breakdowns did not happen, then adjustments would not be necessary. It is the *failures* inherent in the management of physical product flows that make these adjustments necessary, and which encourage the partners to work together. Management of physical flows demands heavy-duty coordination mechanisms between supply partners. This can be overlooked by senior managers – who tend to focus on contractual aspects of a relationship, and to overlook its procedural implications and the necessary resource commitment.

Coordination manifests itself as a tension between mechanisms that bring the partners together – hence stressing the benefits of achieving shared success – as well as mechanisms that drive the partners apart. Separateness can be derived either from a failure to coordinate (because of various technical or organisational reasons), or from the need to focus on the requirements of the internal organisation.

However attractive such processes of bonding may appear, in practice the organisational boundaries and vested interests inhibit the rate at which relationships deepen. These have been described as a series of factors as a result of research in the auto industry.

## 8.6.2 Factors in forming supply chain relationships

Lamming (1993) proposed nine factors for analysing customer–supplier relationships, which have been modified and extended below:

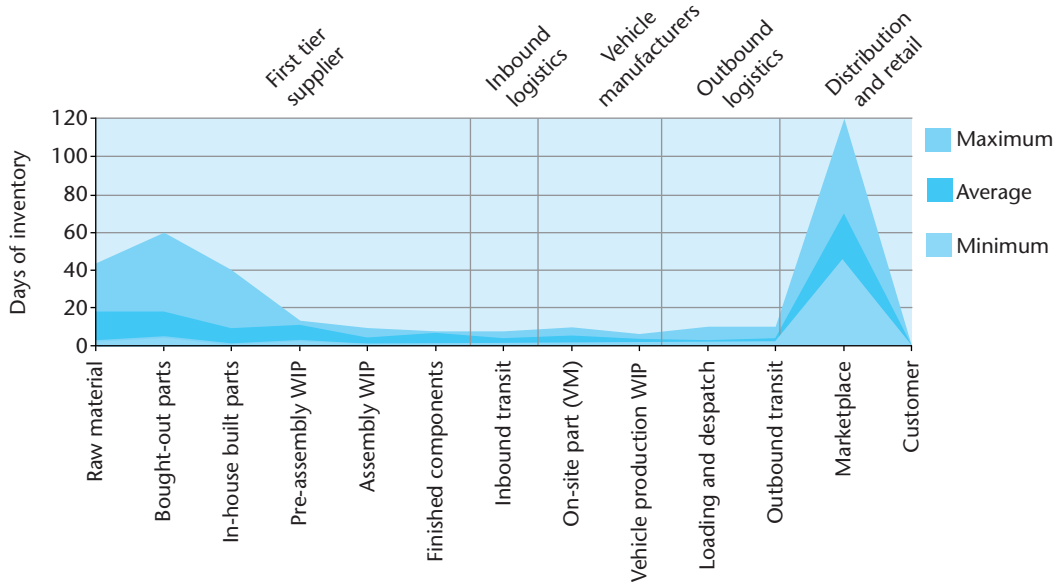
- *What the order winners are:* for example, price, product range, technology advantage, superior product quality.
- *How sourcing decisions are made:* is it, for example, competitive tender, auctions, supplier accreditation, and sole source?
- *The nature of electronic collaboration:* is it transactional, information sharing or collaborative?
- *The attitude to capacity planning:* is this seen as the supplier's problem, as a problem for the buyer (tactical make/buy/additional sources), or as a shared strategic issue?
- *Call-off requirements:* does the customer (for example) alter schedules with no notice, require JIT delivery against specified time windows, or require synchronised deliveries of major subassemblies to the point of use?
- *Price negotiations:* are price reductions imposed by the buyer subject to game playing by both parties, the result of joint continuous improvement projects, etc.?
- *Managing product quality:* does the customer help the supplier to improve process capability? Are aggressive targets (e.g. 50 ppm defects) set by the customer? Is the supplier responsible for quality of incoming goods and warranty of the parts in service?
- *Managing research and development:* does the customer impose new designs and have the supplier follow instructions? Does the supplier become involved in new product development? Is the supplier expected to design and develop the complete product for the next model?
- *The level of pressure:* how far does the customer place pressure for improvement on the supplier to avoid complacency (e.g. 30 per cent price reduction in the next two years)?

Within the European auto industry at present, the most significant factor seems to be the last. Overcapacity among the assemblers has created massive pressures for cost reduction. The supply chain accounts for 70–80 per cent of an assembler's costs, so this is the primary target. Figure 8.10 shows the inventory profile for volume assemblers in Europe.

It is apparent that assemblers have been using their power in the supply chain to optimise inventories around their own processes. Meanwhile, component manufacturers upstream and dealers downstream are carrying huge inventories. Dealer networks are holding some €18bn of stock in disused airfields around Europe! While long-term mutually beneficial relationships are often talked about, the reality can be very different.

#### Activity 8.4

Select an industry of your choice and, within this, review the nine factors listed in section 8.6.2. How would you classify the state of supply chain relationships in this industry?



**Figure 8.10** Automotive supply chain: inventory profile

(Source: After Holweg and Miemczyk, 2002)

## Summary

### *What are the benefits of integration in the supply chain?*

- Integration in the supply chain is developed through improved coordination upstream and downstream. Coordination is concerned with establishing the 'rules of the road', whereby material and information flows work in practice.
- Research has shown that improved coordination between marketing and logistics results in better performance in areas such as cycle times, inventories, product availability, and order-to-delivery lead times. Internal integration is the essential precursor to external integration.
- Benefits of electronic collaboration listed by Nestlé UK include improved availability of product to the consumer, and hence more sales. The total service is improved, total costs are reduced (including inventory, waste and resources), and capacities can be reduced owing to the reductions in uncertainty achieved. In addition, processes that span two or more companies become far more integrated and hence simple, standard, speedy and certain. Trading partners become more committed to the shared plans and objectives.
- The closest supply relationships exhibit both 'together' and 'separate' tensions. Separation, especially during periods when the relationship is under pressure as a result of logistics failures, demands continuous remedial work. Research in the auto industry indicates that heavy downward cost pressures on suppliers limit the progress at which relationships deepen.

### *How can integration be put into practice?*

- JIT2 aims to achieve inter-company collaboration manually by placing customer and supplier together as supplier-in-plant.
- Electronic collaboration can be undertaken in three ways: transactional (the transmission of fixed-format documents with predefined data and information fields); information sharing (a one-way process of providing access to information such as product description and pricing, sales information, inventory and promotional calendars); and collaborative planning (electronic collaboration at strategic, operational and tactical levels).
- Efficient consumer response (ECR) aims to integrate and rationalise product range, new product introductions, promotions, and replenishment across the supply chain. It is an industry-wide initiative that has many followers in retailing and manufacturing of fast-moving consumer goods across Europe and the US. ECR seeks to operationalise its aims by means of category management, product replenishment and enabling technologies.
- Collaborative planning, forecasting and replenishment (CPFR) is aimed at 'making inventory management more efficient and cost-effective, while improving customer service and using technology to significantly improve profitability'. CPFR focuses on the process of forecasting supply and demand by synchronising the plans and projections of both the supplier and customer. Replenishment of products is then more accurate and timely.
- Under vendor-managed inventory (VMI), suppliers take responsibility for monitoring sales and inventory in the retailer's process. This information is used to trigger replenishment orders. VMI is facilitated by willingness to share data, the use of integrated systems, and standard procedures. It is made more difficult by such factors as long replenishment lead times, inaccurate data, and unwillingness by either party to invest in systems support.
- Quick response (QR) logistics take the lead from time-based mapping, and adopt a total supply chain view to following sales trends: for example, in the fashion industry. Instead of making a season's product in advance, QR aims to be responsive to market trends. This has had the effect of compressing development lead times and shortening production lead times to greatly improve the responsiveness of the supply network as a whole.

## Discussion questions

- 1 What is the purpose of integration in the supply chain, and why should it lead to value-added from the end-customer perspective?
- 2 In the Procter & Gamble case study (Case study 8.2), the advice is to cut down on the number of skus on offer in order to improve replenishment. Is this integration or defeatism?
- 3 Compare and contrast the aims of ECR and CPFR. Does CPFR represent a more advanced set of logistics concepts?



- 4 'You can talk collaboration as much as you like: at the end of the day, it's a raw struggle for power, and the retailers are winning hands down.' Discuss the relative merits of the factors in forming supply chain relationships (section 8.6) from both the suppliers' (manufacturers) and retailers' viewpoints.
- 5 Explain the thinking behind quick response (QR) logistics. How could QR help a retailer to plan and control product lines for a new fashion season?

## References

- Barratt, M. and Oliveira, A. (2002) 'Supply chain collaboration: exploring the early initiatives', *Supply Chain Planning*, Vol. 4, No. 1, pp. 16–28.
- Beck, A. (2004) 'Shrinkage in Europe 2004: a survey of stock loss in the FMCG sector', ECR-Europe, Brussels. See [www.ecrnet.org](http://www.ecrnet.org).
- Carillo, J. (2004) 'Transnational strategies and regional development: the case of GM and Delphi in Mexico', *Industry and Innovation*, Vol. 11, Nos. 1–2, pp. 127–53.
- Chappell, G. (2001) 'Agility on the catwalk', in Lewis, C. (ed.), *Logistics Europe*, June, pp. 20–4.
- Chen, I.J. and Paulraj, A. (2004) 'Towards a theory of supply chain management', *Journal of Operations Management*, Vol. 22, pp. 119–50.
- Coopers & Lybrand (1996) *European Value Chain Analysis Study: Final report*. Utrecht: ECR Europe.
- Fernie, J. (1998) 'Relationships in the supply chain', in Fernie, J. and Sparks, L. (eds), *Logistics and Retail Management: Insights into current practice and trends from leading experts*, pp. 23–46. London: Kogan Page.
- Frohlich, M. and Westbrook, R. (2001) 'Arcs of integration: an international study of supply chain strategies', *Journal of Operations Management*, Vol. 19, No. 2, pp. 185–200.
- Gimenez, C. (2006) 'Logistics integration processes in the food industry', *International Journal of Physical Distribution and Logistics Management*, Vol. 36, No. 3, pp. 231–49.
- Holweg, M. and Miemczyk, J. (2002) 'Logistics in the "three day car" age: assessing the responsiveness of vehicle distribution logistics in the UK', *International Journal of Physical Distribution and Logistics Management*, Vol. 32, No. 10, pp. 829–50.
- Koulikoff-Souviron, M. and Harrison, A. (2007) 'The pervasive human resource picture in interdependent supply relationships', *International Journal of Operations and Production Management*, Vol. 27, No. 1, pp. 8–27.
- Kirby, J. (2003) 'Supply chain challenges: building relationships', *Harvard Business Review*, July, pp. 65–73.
- Kuhel, J. (2002) 'Clothes call', *Supply Chain Technology News*, Vol. 4, No. 2, pp. 18–21.
- Lamming, R. (1993) *Beyond Partnership: Strategies for innovation and lean supply*. New York: Prentice-Hall.
- Mitchell, A. (1997) *Efficient Consumer Response: A new paradigm for the European FMCG sector*. London: FT/Pearson Professional.
- Oliveira, A. and Barratt, M. (2001) 'Exploring the experience of collaborative planning initiatives', *International Journal of Physical Distribution and Logistics Management*, Vol. 31, No. 4, pp. 266–89.
- PE International (1997) 'Efficient Consumer Response – supply chain management of the new millennium', Institute of Logistics, Corby, UK.
- Roland Berger Strategy Consultants (2003) *Optimal Shelf Availability*, ECR-Europe, Brussels. See [www.ecrnet.org](http://www.ecrnet.org).

- Salmon, K. (1993) *Efficient Consumer Response: Enhancing consumer value in the supply chain*. Washington, DC: Kurt Salmon.
- Skjoett-Larsen, T., Thernøe, C. and Andresen, C. (2003) 'Supply chain collaboration: theoretical perspectives and empirical evidence', *International Journal of Physical Distribution and Logistics Management*, Vol. 33, No. 6, pp. 531–49.
- Stank, T.P., Daugherty, P.J. and Ellinger, A.E. (1999) 'Marketing/logistics integration and firm performance', *The International Journal of Logistics Management*, Vol. 10, No. 1, pp. 11–24.
- Windahl, C. and Lakemond, M. (2006) 'Developing integrated solutions: the importance of relationships within the network', *Industrial Marketing Management*, Vol. 35, No. 7, pp. 816–18.

### **Suggested further reading**

- Brown, S. and Cousins, P. (2004) 'Supply and operations: parallel paths and integrated strategies', *British Journal of Management*, Vol. 15, No. 4, pp. 302–20.
- Fawcett, S. and Magnan, G. (2002) 'The rhetoric and reality of supply chain integration', *International Journal of Physical Distribution and Logistics Management*, Vol. 32, No. 5, pp. 339–62.
- Fernie, J. and Sparks, L. (eds) (2004) *Logistics and Retail Management*, (2nd edn.). London: Kogan Page.
- Randall, G. and Seth, A. (2005) *Supermarket Wars: Global strategies for food retailers*. Basingstoke: Palgrave Macmillan.



## CHAPTER 9

# Purchasing and supply relationships

### Objectives

*The planned objectives of this chapter are to:*

- introduce a range of options for buyer–supplier relationships;
- describe the spectrum of supply relationships;
- describe the implications for suppliers of entering into partnerships.

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

- understand the range of alternative inter-company relationships;
- understand the benefits and challenges of operating supply chain partnerships;
- understand ways of approaching implementation issues.

### Introduction

A number of alternative supply chain structures have emerged, based upon networks and the degree of inter-firm collaboration. A well-known view is that of Sako (1992), who distinguishes a ‘spectrum’ of possible supply relationships, ranging from:

- *arm’s length*: a detailed contract specifies the responsibilities of both parties including terms and conditions. Undue familiarity is avoided, and neither party is controlled by the other. Divorce is a readily available option when the contract finishes.
- *obligational*: individual contracts are still in evidence, but embedded within a broader relationship of mutual trust. Outline specifications are more common, but there is ‘an incentive to do more than is expected’.

Optimising the supply chain process inevitably leads to a growing interdependence among supply chain partners, and obligational behaviour becomes more in evidence. With this interdependence, a realisation develops that increasing levels of *adaptation* are necessary to achieve long-term mutual benefit. Adaptation means making changes to a firm’s internal processes in order to accommodate the needs of supply partners. Supply partners may have to develop a common set of control mechanisms. Hunter *et al.* (1996) comment:

**The two organisations will still be subject to independent governance, but will have in common a similar set of governance procedures and mechanisms specific to**

their joint working relationship, thus replicating in some measure the conditions within an integrated organisation.

Such common governance is more in keeping with the obligational view. The implications for competitive strategy of this growth of collaborative supply chains are considerable – in particular the need to develop those skills that enable a company to re-engineer established buyer–supplier relationships and to manage them successfully on a day-to-day basis.

But a one-sided view of the relationship may be the norm elsewhere, and have quite different implications for the firms involved. For example, Rubery *et al.* (2004) studied the way that a customer firm may ‘extend its tentacles inside the [supplier firm] to reshape the internal human resource practices’. The customer firm may exert pressure on a supplier’s HR practices in areas such as hours worked (to fit with their own), performance assessment and associated bonus payments.

Centralised purchasing decisions may also greatly affect supplier relationships. While operations and logistics are developing supplier relationship management, purchasing may replace current suppliers with new ones with whom there is no existing relationship. And while centralisation lowered purchasing costs overall, manufacturing and logistics costs were increased (Pagell, 2004). Purchasing may be measured on the visible reductions in piece part prices, but the invisible costs of longer transport times, extra inventories and poor delivery reliability go unchallenged.

The overall aim of this chapter is to review different types of supply relationship, the impact on the firms involved, and the situations where a given type of relationship is most relevant to a supply chain’s competitive position.

## Key issues

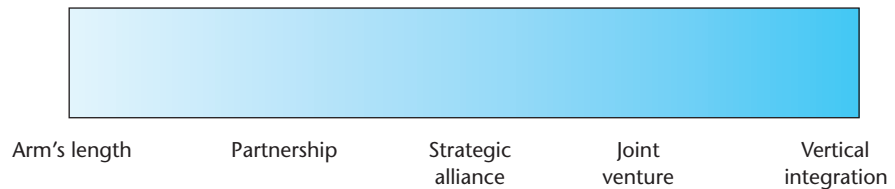
This chapter addresses six key issues:

- 1 **Choosing the right relationship:** which relationship is appropriate in different circumstances – bottleneck items, strategic items, non-critical items and leverage items.
- 2 **Partnerships in the supply chain:** cooperative, coordinated and collaborative relationships; their advantages and disadvantages.
- 3 **Supply base rationalisation:** dealing with a smaller number of suppliers to enable high-intensity relationships to develop.
- 4 **Supplier networks:** the development of supplier associations, and the Japanese equivalent, *keiretsu*.
- 5 **Supplier development:** managing upstream suppliers through integrated processes and synchronous production.
- 6 **Implementing partnerships:** the potential pitfalls in moving from open market negotiations to collaborative relationships.

## 9.1 Choosing the right supply relationships

*Key issues:* What types of supply relationships can be adopted? How can each type of relationship be tailored to different types of product?

There are many possible types of relationship in the supply chain. A development of Sako's view mentioned in the introduction to this chapter is that the different options can be viewed in the form of a continuum. This can range from *arm's length*, where the relationship is conducted through the marketplace with price as its foundation, to *vertical integration*, where the relationship is cemented through ownership. Vertical integration can *extend* for one or more tiers and its *direction* may be upstream, downstream or both. A continuum of relationship options is shown in Figure 9.1. Each of these relationship styles has motivating factors that drive development, and which govern the operating environment. The duration, breadth, strength and closeness of the relationship vary from case to case and over time.



**Figure 9.1** Relationship styles continuum

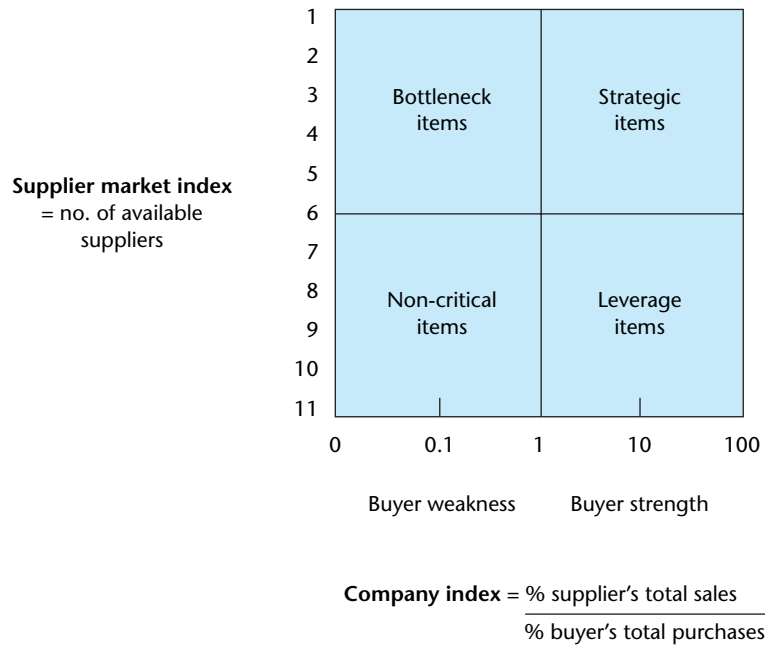
(Source: After Cooper and Gardner, 1993)

A focal firm may not have the same type of relationship with all of its customers and suppliers. The firm may adopt a range of styles: choosing which type of relationship to adopt in a given supply chain situation is an important strategic issue. For example, grocery retailers often adopt an arm's length style for 'own brand' goods like kitchen paper, and use on-line auctions (Smart and Harrison, 2003) to obtain lowest price solutions. Elsewhere, they may use a strategic alliance to develop petrol forecourts, such as the Esso–Tesco Express alliance referred to in Case study 1.1.

Companies tend to deal with a large number of suppliers, even after the supply base has been rationalised. Treating them all in the same way fails to recognise that some have different needs to others. Differentiating the role of suppliers and applying appropriate practices towards them allows a focal firm to target purchasing and supply chain management resources to better effect.

A popular view is that Japanese companies consider all of their tier 1 suppliers as partners. This is not really true: for example, Japanese automotive manufacturers do not regard all of their suppliers as equal. In fact among the typical 100–200 tier 1 suppliers to an OEM only about a dozen will enjoy partnership status. Typically, these elite few tend to be large organisations.

A number of approaches seek to segment suppliers into categories. The *purchase portfolio matrix* presented in Figure 9.2 is based on the notion that a customer will seek to maximise purchasing power when it can. This approach assumes that the key factors that affect the relationship are the strength of the buying company in the buyer–supplier relationship, and the number of suppliers able and willing to supply a product in the short term.



**Figure 9.2** Purchase portfolio matrix

(Source: Syson, 1992)

### Strategic items

Strategic items are those for which the buyer has strength but there are few available suppliers. In this situation, purchasing should use its strength carefully to draw suppliers into a relationship that ensures supply in the long term.

### Bottleneck items

Where the buyer has little power and there are few alternatives then these items are termed *bottlenecks*. The aim of purchasing in this situation is to reduce dependence on these items through diversification to find additional suppliers, seek substitute products and work with design teams to ensure that the bottleneck items are avoided in new products where possible.

### Non-critical items

With a good choice of suppliers, possibly through following a strategy of using standardised parts, the traditional buying mechanism of competitive tendering is most valid for non-critical items. Such items are the ones with the following characteristics:

- not jointly developed;
- unbranded;
- do not affect performance and safety in particular;
- have required low investment in specific tools and equipment.

### Leverage items

Where there are a large number of available suppliers and the buyer has high spending power then the buyer will be able to exercise this power to reduce prices and to push for preferential treatment. Naturally, care should be taken not to antagonise suppliers just in case these favourable market conditions change.

This approach is heavily weighted towards the buyer's viewpoint. It is also a little unfashionable because it uses the term 'power' in supplier relationships, and assumes that traditional market-based negotiations will be used for some product groups. However, it applies to many firms today, and reflects the tough approach taken by purchasing teams of some of their customers. Accepting that these sorts of conditions are likely to prevail, it is clear that suppliers need to work on their relative strategic importance to a focal firm in order to strengthen their position in a supply relationship.

#### Activity 9.1

Selecting an organisation of your choice, use a copy of the purchase portfolio matrix (Figure 9.2) and plot on it the names of its top 10 customers and top 10 suppliers. Which position would your chosen company prefer to be in? Suggest actions that would make the situation better.

Inspired by the Japanese version of supply relationships with partners, outlined in the introduction to this chapter under Sako's 'obligational' description, Western auto manufacturers have been developing their own versions. The model for these has been the *keiretsu* structure shown in Figure 9.6 below, which is similar to the structure we showed in Figure 1.2. A number of lead suppliers like Robert Bosch and Delphi supply to their customers worldwide and have developed sophisticated marketing, development and logistics capabilities.

This leads to the development of another type of supplier in addition to the 'lead' product/service suppliers. This is the group of firms which have been 'demoted' to the second tier. Here, they will have to compete against global players on price, delivery and flexibility. Case study 9.1 explains some of the dynamics in automotive inbound supply chains and the changing roles and responsibilities of suppliers.

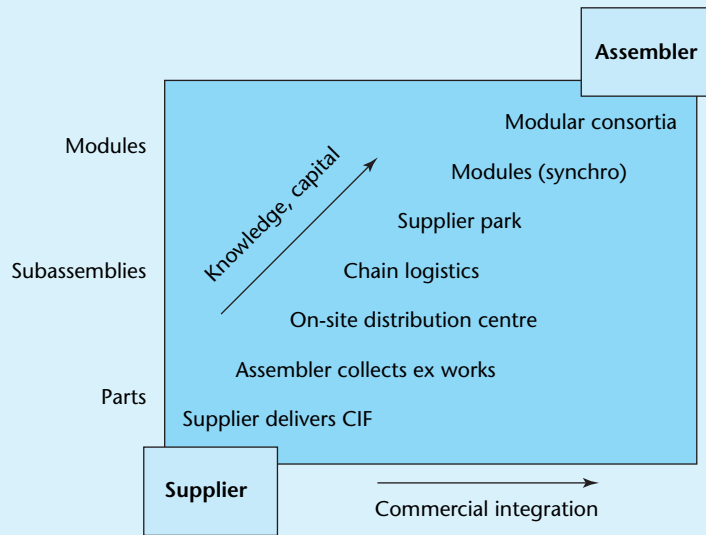
#### CASE STUDY 9.1

### Automotive supply chains: a range of inbound logistics solutions

Automotive assemblers and their inbound supply chains have developed many solutions to orchestrate the manufacturing and delivery of the thousands of parts that go to make up a vehicle. The many potential inbound logistics solutions are summarised in Figure 9.3.

These changes are of increasing value to the assemblers. The complexity of the logistics operation has been greatly downsized by slashing the number of tier 1 suppliers by broadening their responsibilities. Yet the ability of the assemblers to customise their





**Figure 9.3** Evolving inbound relationships

finished products has increased. Quality consistency increases towards 25 ppm, while tough price reduction targets are demanded.

### Supplier delivers CIF (carriage, insurance and freight)

The supplier delivers the ordered parts to the assembler's factory, and includes the distribution costs in the piece part price.

### Assembler collects ex works

The assembler subcontracts the process of parts collection from a number of suppliers, who are visited at a predetermined frequency (e.g. daily). The parts are taken to a consolidation centre, where they are decanted into trailers destined for different assembly plants. An example of this is the Ford operation that is run by Exel at Birmingham in the UK. Parts collections are made from the Midlands region of the UK, and dispatched to 22 Ford plants around Europe.

### On-site distribution centre

Instead of delivering parts directly into the assembler's plant, the logistics partner may instead deliver into a distribution centre positioned close to the assembler's plant. The advantages are much more controlled inbound parts movements into the plant. The assembler is able to call up loads of parts that are needed for a relatively short time period, and thus greatly improve material flow into the plant and reduce vehicle congestion. Additional value-adding activities may also be carried out in the DC. Thus, for example, suppliers carry out some final assembly and sequencing tasks in the Integrated Logistics Centre at BMW, Cowley.

### Chain logistics

Here the objective is to increase the *speed* of the inbound supply chain. If not planned and managed, drivers' hours regulations across Europe can lead to waste as the supply chain stops to allow for rests. The higher the speed of inbound supply, the lower the stock that needs to be held at the assembly plant. A useful further advantage is that the higher the speed, the less packaging and containers are needed in the supply chain. An example of chain logistics is the ALUK operation that supports the Toyota plant at Burnaston in the UK. Parts movements from a supplier in southern Spain are planned in four-hour stages, where the full trailer is swapped for an empty one in a similar fashion to the Pony Express in the days of the Wild West!

### Supplier park

Major tier 1 subassembly manufacturers are positioned on a supplier park close to the assembly hall. Major subassemblies are then sequenced into the assembly hall in response to a 'drumbeat' (based on the master schedule – see Chapter 6), which identifies the precise specification of the next body to be dropped onto the trim and final assembly track. Suppliers then have a finite amount of time to complete assembly and deliver to the point of use on the track. An example here is the Exel operation at the VW–Seat plant at Martorell near Barcelona, where material movements on the supplier park are specified and orchestrated by means of Exel's IT systems.

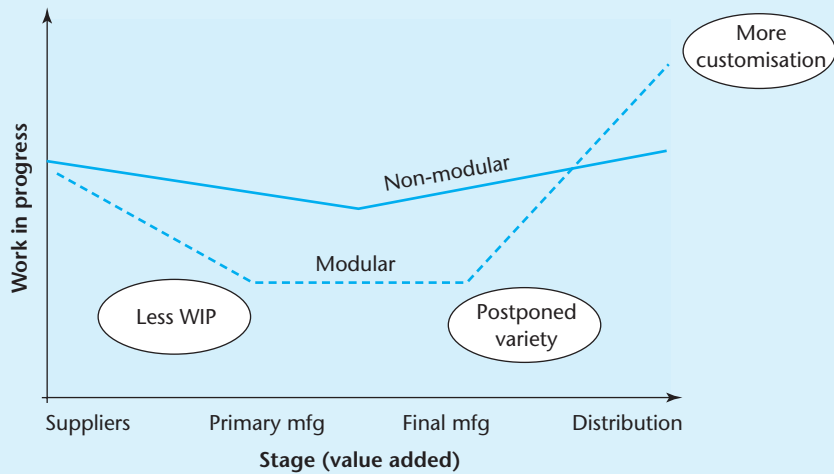
### Modules

The VW–Seat plant at Martorell demonstrates a further advance in logistics thinking. Instead of delivering a large number of subassemblies, why not get the tier 1 suppliers to coordinate all the parts needed to produce a complete module that can then be simply bolted onto the car? Product variety can be increased by customisation of the modules. The advantages are shown in Figure 9.4.

Modular designs offer less WIP and a considerably downsized process for the assembler, and greater variety for the customer. Downsizing of the assembly process means that it is shorter, and can be positioned closer to customer demand. Complexity can then be added later in the pipeline between customer order and delivery of the specified car into the customer's hands – a concept called postponed variety. The term *synchro supply* has been used to describe the delivery of modules not just at the correct quality and correct time, but on a real-time basis with the assembler and with the added challenge of zero safety stock.

### Modular consortia

The VW bus and truck plant in Brazil is an experiment in the further development of the modular concept. The truck assembly operation has been divided into seven modules, with a supplier responsible for each. All the direct workers are on the supplier's payroll, and the supplier not only assembles the module, but also performs final assembly of the vehicle. The assembler's task has been downsized to engineering, design, supervision and administration. The Mercedes plant at Hambach in France, which produces the micro-compact Smart car, divides the vehicle into five main modules. Seven suppliers



**Figure 9.4** Modularisation: doing more with less

(Source: van Hoek and Weken, 1998)

are fully integrated into the final assembly plant, while 16 non-integrated suppliers deliver submodules and parts. The whole information system – which supports manufacturing, logistics and distribution – is outsourced to Accenture.

### Implications for suppliers

The demands on tier 1 suppliers increase in proportion to the various logistics solutions described earlier. A clear trend towards supplier parks and modularisation can be seen in the logistics strategies of automotive assemblers. Increasingly, tier 1 suppliers are being expected to control subsequent tiers in the supply chain, while ensuring delivery and quality to the assembler. At the same time, challenging cost reduction targets are being set, while the whole process is facilitated by tier 1 outbound defect levels that are less than 25 ppm. Many suppliers question whether the draconian demands for ‘cost down’ targets are compatible with such defect levels.

Three distinct stages can be seen in the development of capabilities by tier 1 suppliers:

- *Tier 1 basic*: suppliers with in-house design capability and project management capability who can ensure timely delivery and reasonable quality reliability (25 ppm). An example would be a tyre manufacturer who holds 4–5 days’ stock and who delivers to set time windows: that is, limited logistics capability.
- *Tier 1 synchro*: suppliers who provide all of the basic capabilities, but with virtually no safety stock. Additional capabilities for the supplier are synchro logistics and IT expertise which is closely integrated with the assembler, greater flexibility and more secure emergency procedures. They operate through ‘clone’ plants that are situated on supplier parks no more than 10 minutes’ travel time from the assembler’s production line.
- *Tier 0.5*: full service providers, who integrate component manufacturing through supply chain management to achieve the optimum design of a given module. They carry out pre-emptive market research and develop innovative designs through shelf

engineering (designs that are prepared proactively in advance of need and placed 'on the shelf', thus saving time in the event that the need does arise). They are partners in major cost reduction projects at each model change, and in continuous improvement projects in between.

There is a substantial passing of risk from the assembler to the tier 1 supplier at each stage. Increasingly, the supplier takes responsibility for designing and developing new products of increasing complexity in advance of new model programmes. And there is no guarantee that the supplier will get the work, because competitive tenders are issued for each new model. This forces suppliers to keep primary manufacturing and core business at a 'home' location, and to construct low-cost, late-configuration 'postponement' plants near the OEM's assembly hall to enable synchro deliveries. The decision by BMW to switch R50 (Mini) assembly from Longbridge to Cowley left a number of suppliers with £2m synchro assembly units in the wrong place.

The strategic dilemma for tier 1 suppliers who currently supply the assemblers directly is whether to expand into system integrators ('tier 0.5'), or to become indirect suppliers to such organisations. Siegfried Wolf of Magna International described the tier 0.5 transition as follows (Lewis and Wright, 2004):

To become part of this new tier, companies will require a worldwide presence, global sourcing, programme management, technology, JIT and JIS know-how and specialist production knowledge. They will also require a high level of R&D spend.

(JIS = just in sequence: the capability to supply a module in accordance with the drum-beat requirements of an assembler.) So, after tier 0.5, where do the competitive challenges lie? Tier 2 suppliers will still be largely low-overhead, product-based companies who have limited service capability. Price pressure will continue to be severe, and return on sales often little above break-even. Tier 2 suppliers often cannot afford expensive inspection and test resources, so defect levels will continue to be relatively high, often in the range 1,000–2,000 ppm (i.e. 1–2 per cent). This will present major challenges for tier 0.5 suppliers, who must also guarantee delivery reliability to the assembly track, and a module that fits perfectly at all times.

As an example of tier 0.5 evolution, the joint venture between Canada's Magna International and Japan's CalsonicKansei ('Magna Kansei') produces the complete fascia ('cockpit module') for the Nissan Micra at a new facility close to Nissan's Washington plant in north-east England. Sales of the joint venture have almost trebled as it assumes responsibility for all of the components and subassemblies that make up the module. CalsonicKansei designed, developed and tested the Micra fascia from a Nissan-engineered concept design. Co-location of supplier engineers at the Nissan development HQ in Atsugi City meant that Nissan product development teams supervised the design and development process. Magna Kansei assumes responsibility for parts it makes itself, for sourcing externally made parts, and for final module assembly and shipment JIS to the Nissan plant. There are 32 tier 2 suppliers: 18 are *imposed*, where Nissan sets the price and commercial details. The rest are *nominated* by Magna Kansei. This effectively limits the amount of integration that can take place at the design stage. Imposed suppliers that have been selected mainly on price act as barriers for improvement of quality capability.

(Source: Harrison, 2000 and 2004)

### Question

1 Summarise the advantages and risks to suppliers who want to achieve 'tier 0.5' status.

## 9.2 Partnerships in the supply chain

*Key issues: What are partnerships, and what are their advantages and disadvantages?*

So far, we have used the term ‘partners’ in a supply chain to apply to all firms who are involved in a given network. In section 9.6, we develop the term ‘strategic partners’. Here, we review the added value that partnerships may bring. Generally, cooperative relationships or ‘partnerships’ have been characterised as being based upon:

- the sharing of information;
- trust and openness;
- coordination (see Chapter 8) and planning;
- mutual benefits and sharing of risks;
- a recognition of mutual interdependence;
- shared goals;
- compatibility of corporate philosophies.

Amongst these, perhaps the key characteristic is that concerning the sharing of information. This should include demand and supply information. Chapter 8 showed how collaborative planning is being used to share information between retailers and manufacturers.

### 9.2.1 Economic justification for partnerships

Entering into a partnership with a company, to whatever extent, implies a transition away from the rules of the open marketplace and towards alternatives. These different structures must demonstrate benefits otherwise they will not deliver competitive advantage.

Open market relationships are typified by short-term contracts, arm’s length relations, little joint development, and many suppliers per part. Observing that Japanese practice – and consequently the ‘lean’ model of supply – differs significantly from this indicates that other, non-market mechanisms must be operating.

The Japanese tend to infuse their transactions with the non-economic qualities of commitment and trust. These characteristics are important in successful partnerships. While this may increase transaction costs and risks, it appears that the ‘non-economic qualities’ help to secure other economic and strategic advantages that are difficult to achieve through the open market system.

### 9.2.2 Advantages of partnerships

Within partnerships, savings come in the form of reduced negotiations and drawing up of separate contracts, reduced monitoring of supplier soundness, includ-

ing supply quality, and increased productivity. These are accompanied by strategic advantages of shortened lead times and product cycles, and conditions amenable to longer-term investment.

These advantages, however, need to be set against the problems that can be associated with the introduction of commitment and trust.

### 9.2.3 Disadvantages of partnerships

Examples of potential disadvantages of partnerships include the following:

- the inability to price accurately qualitative matters such as design work;
- the need for organisations to gather substantial information about potential partners on which to base decisions;
- the risk of divulging sensitive information to competitors;
- potential opportunism by suppliers.

In the long term, additional factors occur when companies enter into partnerships. With the outsourcing of the R&D of components and subsystems, buyers benefit from the decreased investment they have to make. Working with suppliers who fund their own R&D leads to their earlier involvement in new product development where buyers benefit from suppliers' ability to cut costs and develop better-performing products. This scenario leads to greater buyer risk owing to dependence on a smaller number of suppliers for designs, and also the potential for opportunism through the smaller number of other companies able to compete with the incumbent suppliers for their work.

#### Activity 9.2

Consider the reasons why a company would wish to enter into a partnership with a customer or supplier. List the advantages and disadvantages you can think of.

## 9.3 Supply base rationalisation

**Key issue:** What are the drivers for reducing the numbers of direct suppliers?

Integrating a supply chain means that a focal firm's processes align with those of its upstream and downstream partners. It becomes impractical to integrate processes of the focal firm with the processes of a substantial inbound network of suppliers. Instead, high-intensity relationships can be managed with a limited supplier base. Such considerations argue for the appointment of a limited number of lead suppliers, each responsible for managing their portion of the inbound supply chain. Clearly, one of the key concerns for logistics management is the criteria by which lead suppliers are chosen.

### 9.3.1 Supplier management

Supplier management is the aspect of supply chain management that seeks to organise the sourcing of materials and components from a suitable set of suppliers. The emphasis in this area is on the 'suitable set of suppliers'. The automotive case study above explains some of the considerations in this process, as does the Global Lighting case in Chapter 2 (Case study 2.6).

Generally, companies are seeking to reduce the numbers of suppliers they deal with by focusing on those with the 'right' set of capabilities. The extent to which companies have undertaken this and have tiered their supply chains is exceptional. Even in the early 1990s, two-thirds of companies were reported to be reducing their supplier base. Anecdotal accounts of the reductions abound. For example, Sun Microsystems was reported to have consolidated the top 85 per cent of its purchasing spend from across 100 suppliers in 1990 to just 20 a few years later.

#### Activity 9.3

Consider an organisation of your choice: have its major customers consolidated their supply base over the past five years? If so, by how much? What criteria did these customers use to decide which companies to keep and which to 'demote' to a lower tier?

### 9.3.2 Lead suppliers

While true single-sourcing strategies are the exception rather than the rule, the concept of the *lead supplier* is now widely accepted. Over the past 10 years many large companies have consolidated their supplier base. In some cases this has seen the number of suppliers reduce from around 1,000 to 200 or so. However, many of the original suppliers still contribute to the OEM's products, but from lower tiers. The responsibility for managing them now lies with the suppliers left at the first tier. For some of them, this responsibility is new and has had to be learnt.

#### Activity 9.4

Has the position of your selected organisation changed in the supply chain? If it has risen up the supply chain, or remained at the same tier whilst others were 'demoted', what new capabilities had to be developed? If it was demoted, why did this happen? Was it a good thing or a bad thing to happen?

## 9.4 Supplier networks

*Key issues: What are supplier associations, and the Japanese keiretsu?*

Supplier networks can be formal or informal groups of companies whose common interest is that they all supply a particular customer, or support an entire industry. Three such networks are considered here:

- supplier associations;
- Japanese *keiretsu*;
- Italian districts.

### 9.4.1 Supplier associations

Aitken (1998) defines a supplier association as:

**the network of a company's important suppliers brought together for the purpose of coordination and development. Through the supplier association forum this company provides training and resources for production and logistics process improvements. The association also provides the opportunity for its members to improve the quality and frequency of communications, a critical factor for improving operational performance.**

Supplier associations may be traced back to the late 1930s with the oldest known group being one linked to Japanese automotive manufacturer Toyota. This early group consisted of 18 suppliers producing basic commodity items such as screws, nuts and bolts. These suppliers formed the group for the benefit of themselves. The Toyota organisation itself did not perform an active role in the beginning of the association. However, the distant role of Toyota was to change, as raw materials became scarce during the Second World War. As part of wartime control by the Japanese government, small and medium-sized firms were directed to supply larger firms, which were being utilised as distributors of raw materials by the government. Prescribing the flow of materials forced the movement of scarce raw materials to key manufacturers. Through this direct interventionist approach the government tried to force assemblers and the subcontractors to work together to increase the efficiency of the supply chain.

The policy employed by the government therefore encouraged assemblers to establish links with suppliers to ensure component supplies. The carrot and stick approach of the government assisted the foundation of several associations. The institutionalist approach by government succeeded in determining the future structure of the supply chain for Japanese automotive companies. Japanese car assemblers changed their modus operandi to align with the prevailing governmental coercive isomorphic forces, thereby obtaining social legitimacy. However, it was not until the early 1940s that assemblers began to recognise the potential benefits of becoming active members of the associations. In 1943 Toyota became interested in the management of the association. Through the provision of management support Toyota started to develop and improve confidence and trust between members and itself.



**Table 9.1** Primary objectives for establishing and developing supplier associations

Objective	Rationale
The provision of manufacturing tools and techniques such as JIT, kanban and TQM	Improve knowledge and application of best practice tools and techniques within the supply base
Produce a uniform supply system	Remove muda (waste) from the system then standardise process management in all parts of the supply chain
Facilitate flow of information and strategy formulation	The assembler assists the suppliers in formulating an improvement strategy by providing best practice information
Increase trust between buyer and supplier	The result of gaining improvements in the first three objectives is an improvement in trust
Keep suppliers and customers in touch with market need	Assemblers aid their suppliers in understanding the needs of the customer through sharing market intelligence, sales plans and development opportunities
Enhance reputation of assembler within supply base	Assemblers attempt to prove to their suppliers that they are worth dealing with
Aid smaller suppliers	Some supplier associations are established to aid smaller associations who could not support the development or improvement programmes necessary to achieve world-class manufacturing standards from their own internal resources
Increase length of trading relationship	Through supporting suppliers in the development of their operations the assembler needs to invest resources. Through committing resources the assembler increases the asset specificity of the supplier and it is therefore important that the relationship is maintained
Sharing development benefits	The association forum supports not only supplier–assembler improvements but, also supplier–supplier knowledge sharing
Providing examples to suppliers of how to develop their own supply base	The performance of the entire supply chain is improved by cascading supply chains management techniques into it

There can be many improvement objectives of a supplier association, and these will vary between associations and industry sectors. Research has identified 10 primary objectives for establishing and developing an association, as shown in Table 9.1.

## CASE STUDY 9.2

### Supplier association

A major supplier of digital telecommunications systems, which we shall call ‘Cymru’, had established a successful manufacturing plant in Wales. The European region had been restructured into five customer-facing divisions, which would provide major cus-

tomers with a single point of contact for integrated solutions. This would in turn focus operations by key account, and boost Cymru's commitment to quality and customer satisfaction. Cymru's major customer was TELE, a national telecommunications service provider. Following deregulation of markets in Europe, TELE started to buy telephone handsets in the global market at prices that were well below those of Cymru. A two-year contract was replaced by a four-month contract, and call-off quantities became much more uncertain for Cymru and its suppliers.

In order to compete, Cymru decided that it would have to improve customer service in terms of availability, speed of new product introduction and cost. A new logistics programme was conceived whereby Cymru bypassed TELE's internal distribution structure and delivered direct to TELE's customers. This meant that TELE carried no inventories and that Cymru took over the distribution task with superior service levels. TELE signed a five-year deal with Cymru, and both parties enjoyed better margins.

In order to support the better service levels, it was essential that Cymru's supply base was integrated into the new logistics programme. This meant that the relationship style (Figure 9.1) would need to be moved from arm's length to strategic. As the procurement manager commented:

I quickly realised that the old way of communicating on a one-to-one basis would no longer work. I'd never get round the suppliers quickly enough to get them all in a mindset of what had to change and when.

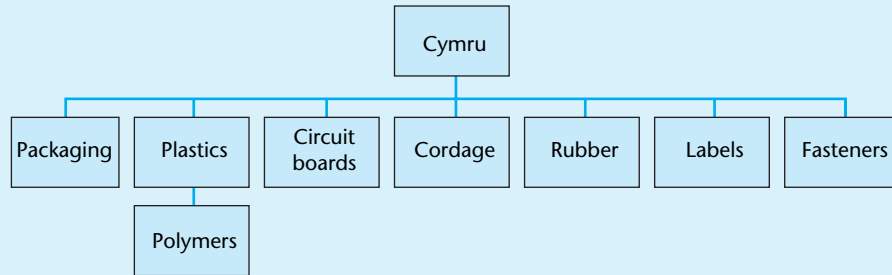
Suppliers had previously been informed of future plans on a 'need to know' basis through their organisational 'gatekeepers' in the purchasing department at Cymru. New work was put out to tender, and the lowest-price bid secured the business.

Setting up a supplier association was viewed as the best way to address the needs and timescales for changing the supply chain. Suppliers could be involved simultaneously in reducing lead times from 2 weeks to 2 days (receipt of order from TELE to delivery at end user's site). This would be achieved through improved responsiveness, both inbound and outbound. Far Eastern competitors would be unable to match such service levels and total logistics costs.

In setting up the supplier association, priority was given to suppliers who provided parts for final assembly of the telephone, especially those who made colour-related and mechanical parts which would have maximum impact on lead-time reduction. Seven tier 1 suppliers and one tier 2 supplier agreed to take part, and the network is shown in Figure 9.5.

The Cymru supplier association was therefore formed from a wide variety of companies, in terms of both size and industry sector. In a marked break with the past, Cymru kicked off the association with an inaugural meeting that presented confidential product development and market information. The aim of the association was 'to promote best practice, improve overall supply chain performance and support product development'. This was to be achieved by self-help teams committed to sharing knowledge and experience in an open and cooperative manner. Many suppliers were concerned that the association was being formed 'as a disguise for margin reduction', and were reassured when Cymru insisted that the main task was cost reduction. More open communications and an emphasis on mutual cost reduction were seen by suppliers as essential foundations for the new association.

The initial activity was to benchmark all members to 'gain an understanding of the strengths and weaknesses of current processes and practices relative to a best practice



**Figure 9.5** Cymru supplier association

model'. Areas for benchmarking were those that Cymru had itself already established as competitive priorities. They were:

- *Quality*: ppm of components received, goods produced and goods shipped;
- *Productivity*: value added per employee, throughput and operation times;
- *Delivery*: percentage of deliveries on time to customer and from suppliers;
- *Stock turns*: stock turn ratio;
- *Continuous improvement*: improvement plans, team activities and employee development programmes.

The results of the benchmarking process stimulated much interest among the suppliers. The account manager of one of them commented:

'Benchmarking is very important. We need to know from the customer what he thinks of us. How do we rate against other suppliers in the association? I want to know because it could be I've got something to learn from another supplier.'

Following the benchmarking phase, suppliers met every quarter to formulate strategy, share market and product development information, and share plans for implementing best practice. The new plans were then deployed within individual supplier companies by training workshops. In turn, these plans spawned improvement projects aimed at achieving the competitive priorities.

(Source: Aitken, 1998)

### Question

- 1 The supplier association described above eventually collapsed. What factors do you think might have led to this collapse?

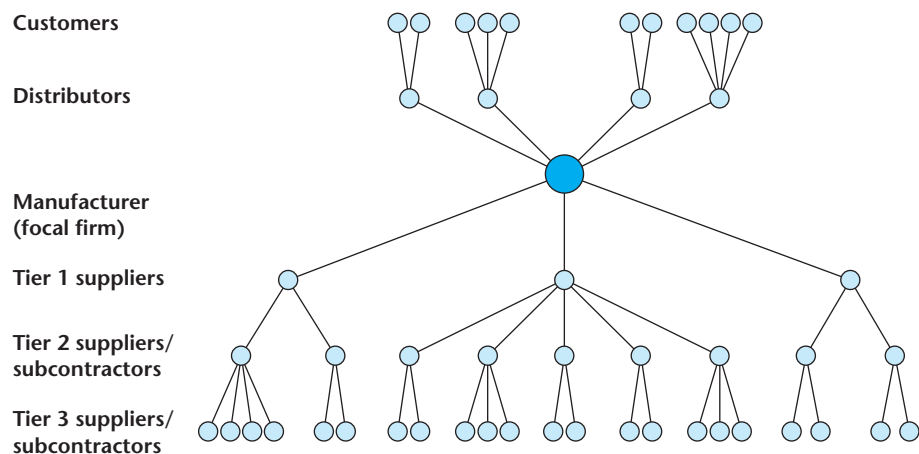
## 9.4.2 Japanese *keiretsu*

One of the Japanese business structures that has received interest from Western business is the *keiretsu*. *Keiretsu* is a term used to describe Japanese business consortia based on cooperation, coordination, joint ownership and control.

The *keiretsu* possesses the particular characteristic of having ownership and control based on equity exchanges between supply chain members. Despite the complexities of their ownership structure, *keiretsu* represents a supply chain model that helps to explain the organisation of most companies in the automotive and electronics sectors in Japan.

The supply chain *keiretsu* is a network in which activities are organised by a lead firm. The typical supplier networks of large automobile and electronics firms are managed and led by the major assemblers, as shown in Figure 9.6.

The formation of *keiretsu*s occurred as a result of the strategy in the 1960s of assemblers outsourcing subassemblies to increase capacity, leading de facto to the emergence of a tiered structure. The *keiretsu* became instrumental in developing the pyramidal structure of the supply base with its tiered arrangement to ensure that the assembler only works directly with a reduced number of suppliers. These suppliers in turn take responsibility for managing the next level down, and so on. The tiered *keiretsu* style of arrangement has now become the favourite supply structure in the automotive industry worldwide.



**Figure 9.6** Japanese *keiretsu* structure

(Source: Aitken, 1998)

### Activity 9.5

Brazilian-born Carlos Ghosn was despatched to Nissan after Renault took a 36.8 per cent stake in the Japanese car maker in 1999. What he has done in turning round Nissan's €15bn of debt and chronic losses has sent shock waves through Japanese business thinking. One of his main targets for change has been the *keiretsu* system, which he described as a 'gross waste of capital'. Ghosn has broken up Nissan's *keiretsu* system, and is reducing the number of suppliers from 1,200 to 600. Masaaki Kanno, head of economic research at JP Morgan's Asian office, is quoted as saying: 'While many people in Japan realised this system should be changed, it has taken a foreigner to change it. I am not exaggerating when I say Ghosn is a hero in Japan now. People believe that he has saved Nissan from death.'

The system that has acted as a model for Western auto inbound logistics is being dismantled by Nissan. What are the implications for Western supply chains? Discuss.

### 9.4.3 Italian districts

A third way of organising supply partnerships has been popularised and led by industrial districts in Italy (Becattini, 2002). Porter (1990) commented on the

strengths of the Italian ceramic tile 'cluster' in the Sassuolo district in his Competitive Advantage of Nations. Producers benefited from 'a highly developed set of suppliers, support industries, services and infrastructure', and the geographic concentration of firms in the district 'supercharged the whole process'. Districts are characterised by hundreds or even thousands of small, family-owned firms with a handful of employees working single shifts. The great majority of firms are led by entrepreneurs who are craftsmen, often relying on the most basic planning and control tools. Concern currently focuses on the ability of districts to adapt to changes in global competition, as Case study 9.3 explores.

### CASE STUDY 9.3

## Supply chain internationalisation in the Marche shoe district

The National Association of Italian Footwear Manufacturers (ANCI – [www.anci-calzature.com](http://www.anci-calzature.com)) explains:

The success of the footwear sector in Italy is linked to an enterprising spirit and to the structure of the sector. The structure is a 'web' of raw material suppliers, tanneries, components, accessories, machinery manufacturers, model makers and designers. This has resulted in a territorial concentration of firms and the formation of shoe manufacturing districts such as Marche, Tuscany, Venetia and Lombardy. The leading position of the Italian shoe industry is due to superior product quality and high levels of innovation.

The Marche shoe district is the largest concentration of producers of shoes and accessories in Europe. There are more than 3,000 shoe firms, almost 500 shoe components firms and more than 100 leather firms employing almost 50,000 workers, with combined sales of over €3bn. The district is export-oriented, with more than 75 per cent of production going abroad – mainly to Germany, the USA, Russia and increasingly to Asia, including China.

District firms are mostly small family businesses with fewer than 20 employees, but there are also a few larger firms with internationally recognised brands. The district leader, Della Valle Group, produces high-quality shoes and bags, matching a classic style design with comfort and a sporty look. Traded on the Milan Stock Exchange, it has sales of €570m, and has developed strong international brands – such as Tod's, Hogan and Fay, plus a growing network of directly owned stores. Leading positions in specific market niches are occupied by Fornari (focused on trendy female teenager shoes with its brand Fornarina), by Falc (specialising in top-quality children's shoes under Falcotto and Naturino brand names) and by Santoni (focused on top-quality handmade shoes with prices up to €1,500). Top fashion firms such as Prada, Dolce & Gabbana and Hugo Boss have signed licensing agreements with Marche district firms for the production of their shoe collections. Figure 9.7 shows two products from Santoni web site.

The shoe district has developed as an integrated supply network, offering the vast and competitive range of components and equipment required for making shoes – from leather processing to soles, from cutting machinery to packaging. Logistics is simplified by the geographical concentration of firms in the district and the personal knowledge and trust that characterises relationships among district entrepreneurs. Flexibility by the small firms supply network enables the ups or downs of fashion to be met.

Since the 1990s, however, the district network has had to come to terms with an outsourcing trend to low-labour-cost countries that is always a threat to mature and



**Figure 9.7** Italian style from the Santoni collection

Source: ([www.santonishoes.com](http://www.santonishoes.com))

labour-intensive industries in developed economies. As a result, production of low-cost shoes has been almost fully outsourced, first to Eastern Europe and then to the Far East. In low-price product ranges, district companies retain only high-value activities of design, marketing and distribution in the Marche district.

Outsourcing has also affected the core district products in medium- to high-quality footwear. Here, however, foreign partners are involved only in less complex tasks to preserve Italian style and quality. The result is an increasingly widespread network. Processed leather is brought into the district after initial processing in Asia (mainly India and China). The leather is then checked, cut and prepared to be sent to Eastern Europe for further processing (mainly to Romania and Albania for sewing and hemming). Prepared leather is returned to the district for finishing and assembly. Such partial outsourcing – called outward processing traffic – preserves the high quality standards of district shoes while cutting down on costs.

This makes logistics a critical activity. Transportation costs per unit have increased, and responsiveness has been put at risk. This is of particular concern to a business that is linked to fashion, where seasonal collections and sales campaign deadlines cannot be missed. While offshore sourcing has led to significantly longer lead times, increasing inventories and lot sizes are not an effective answer. Most district firms offer differentiated products based on fashion trends, and would therefore face a high risk of mark-downs at the end of season. Therefore, firms normally order only 25–30 per cent of forecast requirements for a seasonal collection from their suppliers. Orders for the rest of the collection are made in line with incoming orders from distributors and boutiques.

The new international network (including a sales network that is progressively extending towards Asia) has become so complex that even large companies find it difficult to manage. Leading district firms are tackling logistics issues through increased information processing capabilities and through advanced services from logistics service providers. In order to manage a production network spanning from nearby district suppliers to Eastern Europe (mainly for shoes) and China (for clothing), Fornari has installed SAP-AFS (Apparel and Footwear Solution). This new ERP system has allowed the company to improve visibility over production planning and to tighten control over suppliers. Fornari has outsourced outbound logistics, and is considering a logistics platform to handle information exchange for district subcontractors and foreign suppliers to reduce costs, an RFID system to improve responsiveness to European customers and a logistics network to support its strong selling presence in China.

However, most district companies are not large enough to become attractive propositions for IT or logistics service providers. While they cannot afford to lose outsourcing

opportunities, these small firms risk being unable to manage the more complex networks that result. Moreover most district entrepreneurs do not fully support the potential advantages of sharing outsourced services. Since they lack the accounting tools for getting a complete picture of logistics costs, they do not perceive logistics as a competitive weapon. They do care about emergencies when a rush order is required or when a planned delivery is late, but solving such emergencies becomes more difficult when distant foreign partners are involved. Therefore the district committee is supporting development of a new logistics approach through its service company and through regional incentives. Such a radical change in international supply chain management cannot be limited to setting up new infrastructures and new services alone, but will also require cultural changes that – led by larger firms – alter the mindsets of district entrepreneurs.

(Source: Professor Corrado Cerruti, University of Rome)

### Question

- 1 Analyse strengths and weaknesses of the Italian shoe district logistics model.

## 9.5 Supplier development

**Key issue: How can upstream supply processes be integrated to improve material flow?**

One of the keys to increased responsiveness in the supply chain is a high level of integration with upstream suppliers. Analysis of the supply chain often shows that product lead time is usually measured in weeks rather than days. This is caused by excessive inventories of raw materials, packaging materials and intermediate products being held upstream of the final point of manufacture. Not only does this represent a cost burden, it also increases the P-time of the supply chain as a whole.

Where suppliers appear unable to make improvements, or fail to do so sufficiently quickly, customers who feel their own performance is being hampered – yet remain committed to the relationship with the supplier – often seek ways to remedy the situation. Many buying firms actively facilitate supplier performance and capability through supplier development. This typically results in activities aimed at developing and improving the overall capabilities and performance of the supplier towards the goal of meeting and serving the needs of the customer.

Supplier development consists of any effort of a buying firm with a supplier to increase its performance or capabilities and meet the buying firm's short-term or long-term supply needs. Unfortunately the temptation for buyers to gain short-term advantage still exists in supplier development to the detriment of long-term partnerships. Also, meeting the needs of buying firms is not necessarily linked to development that would enhance overall supply chain competitiveness. Therefore care must be taken not to lose sight of end-customer needs in the transactions between specific pairs of companies.

Various trends are observable as leading-edge companies seek to improve their management of the upstream supply chain, including:

- integrated processes;
- synchronous production.

### 9.5.1 Integrated processes

A key focus of supplier development should be the alignment of critical processes: that is, new product development, material replenishment and payment. This alignment needs to consider collaborative planning and strategy development.

It is perhaps the concept of joint strategy development that distinguishes integrated supply chains from mere ‘marriages of convenience’. While the customer will always be pre-eminent in the determination of joint strategic goals, involvement of key suppliers in this process benefits all parties.

Process integration can be enhanced through the creation of *supplier development teams*. The purpose of these teams is to work with suppliers to explore ways in which process alignment can be achieved: for example, seeking to establish a common ‘information highway’ between the vendor and the customer, or working to establish common product identification codes. Nissan in the UK reports that supplier development teams have been a significant element in its success in creating a more responsive supply chain.

### 9.5.2 Synchronous production

Linking upstream production schedules with downstream demand helps to improve material flow. The creation of a ‘seamless’ network of processes aims to dramatically reduce inventories while greatly enhancing responsiveness. The Japanese concept of *heijunka* seeks coordination of material movements between different processes in the supply network. *Heijunka* is often referred to as ‘levelled scheduling’, which involves distributing volume and mix evenly over a given time period. Output of each major process in the supply chain therefore matches end-customer demand as closely as possible throughout that time period (Harrison, 2005).

Transparency of information upstream and downstream is essential for synchronisation to work. For example, the supplier must be able to access the customer’s forward production schedules, and the customer must be able to see into the supplier’s ‘stockroom’. The *virtual supply chain* envisages partners in the chain being linked together by a common information system, so that information replaces the need for inventories.

Another approach that seeks to improve synchronous supply chain processes is that of *vendor-managed inventory* (VMI). Here, the supplier takes responsibility for planning and controlling the customer’s inventory (see section 8.4). The advantage is that a large element of uncertainty in the supply chain is removed

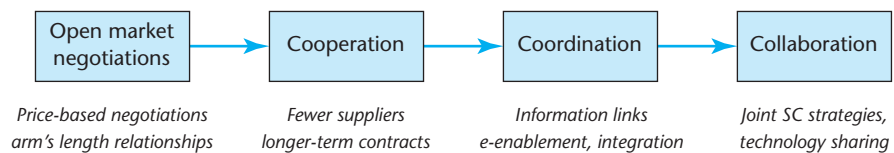


through shared information. The need for safety stock can thereby be dramatically reduced.

## 9.6 Implementing strategic partnerships

**Key issue: What are the barriers to achieving strategic partnerships in the supply chain?**

In earlier chapters, we referred to ‘partners’ as other firms that happen to share the supply network with a focal firm. And in section 9.2 we started to develop the term ‘partnership’ to address the evolution of additional features from a basic, arm’s length relationship. Here, we use the term ‘strategic partner’ to refer to a supply partner with whom a focal firm has decided to develop a long-term, collaborative relationship. ‘Collaboration’ may be the ultimate objective of a number of phases through which a supply relationship may evolve. A transition route from open market negotiation to collaboration is shown in Figure 9.8.



**Figure 9.8** The transition from open market to collaboration

(Source: After Speckman *et al.*, 1998)

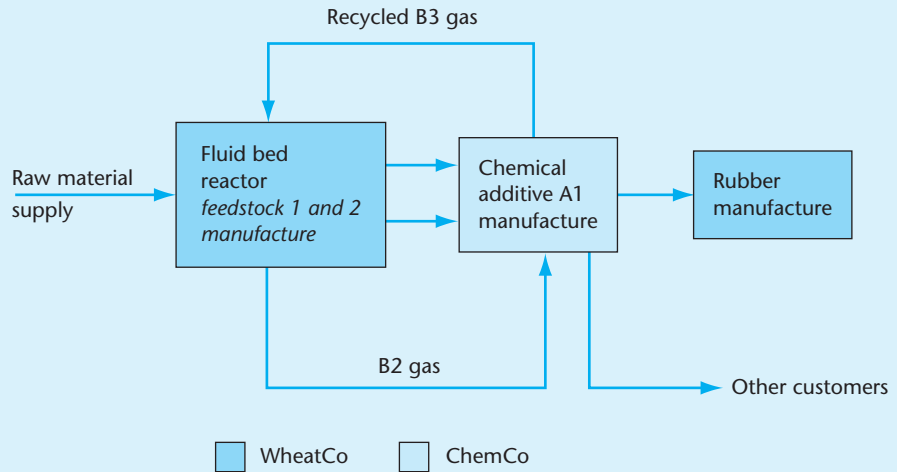
Obligational aspects of the relationship increase from cooperation to collaboration. In Chapter 8, we defined coordination in terms of establishing ‘rules of the road’, whereby partners can work together. This is the key step to integrating the supply chain. Collaboration goes beyond integration by including long-term commitments to technology sharing and to closely integrated planning and control systems. The two firms become interdependent, that is, they adapt to each other and develop common logistics governance processes. Case study 9.4 describes what happened in one such relationship.

### CASE STUDY 9.4

#### A Strategic Partnership at WheatCo–ChemCo

WheatCo and ChemCo are two US chemical corporations, both leaders in their fields and with similar sales (around \$2bn per year). Eight years prior to our study, the two companies formed a 20-year strategic partnership with the objective of gaining competitive advantage through mutual access to low-cost raw materials. One outcome was the establishment in the UK of a small ChemCo facility (70 employees) on a large WheatCo site (700 employees). The ChemCo facility was located next to the WheatCo ‘Basics’ unit, and linked by a bridge. While a fence divided the two plants, selected employees were able to pass between the two by means of swipe card access. A ChemCo manager commented:

We are symbiotically linked. If you take away the ChemCo and WheatCo signs, we're really one site . . . we have a relationship and it's an umbilical cord.



**Figure 9.9** WheatCo–ChemCo relationship

ChemCo was dedicated to production of a chemical additive used in the production of rubbers, paints and other compositions. The feedstock used in the ChemCo process was supplied by the WheatCo 'Basics' unit. The manufacturing process of the additive generated a gaseous by-product, which was recycled back into the WheatCo feedstock. Half of the additive made on the ChemCo site was sold to WheatCo's 'Rubber' unit, and the rest to other customers in Europe and the USA (see Figure 9.9). The two firms thereby formed a 'closed loop' supply chain – whereby they were both customer of, and supplier to, each other. The production processes operated on a round-the-clock basis and there was very little buffer stock within the supply loop: 'if we have a problem, then ChemCo has a problem 10 seconds later'. This close interdependency of logistics processes meant that operating teams were in contact on a 24-hour basis. There was a direct telephone link between WheatCo and ChemCo operators to allow easy communication and instant warning of changes in either of the processes, or to inform of production stoppages.

The supply relationship was multifaceted, with interactions taking place at many levels. Locally it included plant management, engineers and operators. In the USA, an executive contact was appointed by each firm to manage the relationship at a strategic level. This applied in particular to the global contract agreement, which provided the commercial terms for the relationship. A joint steering committee determined the local operational strategy for the relationship and provided guidelines to two other joint teams: 'quality improvement' and 'technical'.

Eight years after the supply relationship began, the upstream WheatCo process had become unreliable. There were also quality issues with the chemical additive supplied by ChemCo, which affected rubber production at the downstream WheatCo unit. In the early days of the relationship, operators had been encouraged to socialise through company events and plant visits. This allowed a common language to be developed, through interaction:

‘we may spend a day there, they spend a day here’ and thus ‘we didn’t need to communicate where if something did go wrong they would automatically take care of it’.

More recently, the relationship had developed some disturbing ‘arm’s length’ characteristics. Both partners were implementing internal programmes which drew attention away from the supply relationship. At shop floor level, less interaction and fewer visits were allowed. This was made worse by employee turnover. As a consequence, operators felt that they could no longer ‘put a face to a name’. Lack of interaction, together with the recurring technical issues, put a strain on the overall relationship. Recognising that a blame culture had developed, site management from WheatCo and ChemCo decided to organise a ‘team day’ to ensure that operators, shift managers and engineers from the three manufacturing units could meet, socialise and be trained on the specifics of the supply loop. However, the ‘team day’ was cancelled due to a company-wide workforce reduction plan announced by WheatCo: given the circumstances, such a socialisation event was seen as inappropriate.

(Source: Koulikoff-Souviron and Harrison, 2007)

### Question

- 1 Use the template shown in Figure 8.9 to help describe what had happened to the relationship between ChemCo and WheatCo.

Here it is important to offer a word of warning. It is apparent from our research (Koulikoff-Souviron and Harrison, 2007) that strategic partnerships are very demanding and resource-intensive. So it is necessary to determine where is the most appropriate point along the route in figure 9.8 for a given supply relationship. There is no point in pursuing a partnership just because it is ‘more to the right’ in Figure 9.8. In some cases, as stated earlier, open market negotiations will be most appropriate.

The transition from multiple sourcing and arm’s length negotiation of short-term, purchase-price-allocated contracts to a relationship based on cooperation, collaboration, trust and commitment requires a supply chain process to be put in place which needs designing, developing, optimising and managing. A key step in achieving this is to ensure that supplier development and purchasing teams are fully involved in the changes.

Failure to do this often leads to purchasing executives undertaking behaviour incompatible with fostering successful strategic partnerships. While many are familiar with – and voice support for – partnerships, in fact their approach and practices are not supportive. Barriers that have been identified include the following:

- There is an inappropriate use of *power* over the supply chain partner.
- There is a focus on the *negative implications* of entering into partnership.
- While buyers value trust, commitment and reliability, they continue to be *opportunistic* and seek gains at their partner’s expense.

- Buyers focus on their own company's *self-interest*, often because they are incentivised to do so.
- *Price* is viewed as the key attribute in supplier selection.

These barriers, which are explained below, show that the decision criteria used by buyers retain a legacy of the traditional approach where the choice of lowest price remains the most defining characteristic. Unless such behaviour is changed, it prevents supply chain relationships from developing beyond a crude application of commercial power, where the free market is used to instil discipline and promote a supply base in which it is assumed that the fit survive. An explanation of the above barriers is as follows.

### *Power*

The ability of one member in the supply chain to control another member at a different level can be detrimental to the overall supply network, and can provide a source of conflict. Conflict is clearly associated with power, arising when one organisation impedes the achievement of the goals of another. For example, in retailing, shelf space is a key resource that has potentially conflicting implications for the retailer and for its suppliers. The retailer looks for maximum return on space and contribution to its image, while the supplier seeks maximum shelf space, trial for new products, and preference over competitors.

### *Focus on negative implications of partnership*

Buyers consider the benefits gained through heightened dependence on a smaller number of suppliers less favourably, and tend to highlight the risks. Buyers also consistently view the cost-saving aspects of supply chain management as more important than the revenue-enhancing benefits.

### *Opportunism*

A key issue that prevents partnerships from enduring appears to be the gap between the strategic requirements of long-term partnerships and tactical-level manoeuvring – in particular, opportunism. It is a problem to resolve this, given that the dimensions that characterise close working relationships also provide both opportunity and increased incentive for opportunistic behaviour. This is caused when partners cannot easily obtain similar benefits outside the relationship and when specialised investments have been made. Buyers often assume that suppliers will take advantage if they become too important, and therefore act to prevent this. The consequences for the partnership relationship come second in their considerations.

### *Self-interest*

Companies face difficulties in establishing and maintaining supply chain partnerships. Even in the automotive industry, often considered the supply chain

exemplar, companies keen to implement single sourcing still continue to multi-source, particularly for non-critical items and commodity items. They rarely enter into collaboration even when the customer is dependent on the supplier – that is, when the product is strategically important and alternatives are limited – and instead set their self-interest higher than the need to act according to common best interest.

### *Focus on price*

The focus on price may be due in some part to buyers having trouble valuing matters such as know-how, technological capability, a particular style of production or a spirit of innovation, and therefore being unable to price them accurately. Their concern that suppliers may act opportunistically tends to lead them to avoid entering into areas where these factors prevail. Significantly, one of the key areas that feature these traits is that of design and development. It seems that, in this area, buyers find it extremely difficult to measure designer performance or the amount of productive time spent during design, and therefore feel the need to guard against high bids from suppliers.

## Summary

### *What are the different types of relationship in the supply chain?*

- Supply chain relationships can vary from arm's length (characterised by a focus on price, and by few points of contact between the organisations concerned), to vertical integration at the other (characterised by integration of processes, and by contacts at all levels).
- The choice of the appropriate relationship is helped by recognising that some suppliers are more strategic than others. One way to segment the supplier base is to use the purchase portfolio index, and to divide suppliers according to strategic, bottleneck, non-critical and leverage characteristics.
- Partnerships may bring added value to supply relationships, and have been described using seven factors: the sharing of information, trust and openness, coordination and planning, mutual benefits and sharing of risks, a recognition of mutual interdependence, shared goals, and compatibility of corporate philosophies.
- Three stages of the development of partnerships have been defined: cooperation, coordination and collaboration. The move towards collaborative partnerships is characterised by increases in the time horizon and the scope of activities involved.

### *How can closer supply chain relationships be implemented?*









- Supply base rationalisation seeks to reduce the suppliers with which an organisation deals directly to a smaller number of strategic suppliers. Rationalisation involves re-tiering the supply chain so that other suppliers are placed under a lead supplier, or 'tier 1' supplier.

- Supplier associations bring suppliers to an OEM or tier 1 supplier together for the purpose of coordination and development. They also aim to improve the quality and frequency of communications between members. In practice, association companies benchmark each other, and formulate improvement projects aimed at increasing the competitiveness of the overall network.
- *Keiretsu* is the term used to describe the supplier association in Japan. Here, the additional characteristics are that ownership and control of the network are based on equity exchanges between members. *Keiretsu* structures have attracted recent criticism because of their relative inflexibility and high capital cost.
- Districts are a distinctly Italian solution to competitive advantage that involve the clustering of numerous SMEs in a focused network with close geographic distances between partners. Again, flexible response to globalisation issues is proving to be a challenge.
- Improved responsiveness from supply chains is facilitated by integrated processes (including joint strategy determination) and synchronisation (coordinated flow facilitated by transparency of information upstream and downstream).
- Barriers to implementation include the inappropriate use of power, self-interest, a focus on negative implications, opportunism, and a preoccupation with price.

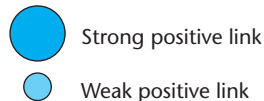
## Discussion questions

- 1 Consider the use of partnerships with customers to improve competitiveness. Discuss this within a group scenario using the following guidelines:
  - a Make a list of companies in your chosen company's industry known to undertake supplier development. This should include all its customers and other companies that are potential customers.
  - b Make a list of all the types of development and improvement that your chosen company would like help with.
  - c Assemble these lists along the two sides of a grid, following the example shown in Figure 9.10. Mark on the grid where each of the companies is able to provide the necessary help.
  - d Examine the grid you have constructed and identify the following:
    - issues requiring help that current customers provide;
    - issues requiring help that only potential customers provide;
    - issues requiring help that no one provides;
    - customers (current or potential) that provide a great deal of help;
    - customers (current or potential) that provide little or no help.

- e Use these five criteria as the basis for identifying companies that should be valuable in ensuring your company's long-term success. These companies are the ones that should be considered as likely partners.
- f Having identified the likely partners, identify the difficulties in establishing partnerships and the problems in maintaining them.
- g Conclude with the actions that you would undertake to overcome the problems associated with partnerships in order to gain their advantages.

		Companies that help suppliers			
		Company A	Company B	Company C	Company D
Improvement help required	ISO 9000				
	Process improvement				
	Communication systems				
	Environmental legislation				

Key



**Figure 9.10** A supplier development grid

- 2 'Supply chain relationships don't mean anything. At the end of the day, it depends entirely on who has the most power. It's the big boys in the supply chain who decide just how much of a relationship there's going to be.'

Discuss the implications of this statement.

## References

- Aitken, J. (1998) 'Integration of the supply chain: the effect of inter-organisational interactions between purchasing-sales-logistics'. PhD thesis, Cranfield School of Management.
- Becattini, G. (2002) 'Industrial sectors and industrial districts: tools for industrial analysis', *European Planning Studies*, Vol. 10, No. 4, pp. 483–93.
- Cooper, M. and Gardner, J. (1993) 'Building good business relationships – more than just partnering or strategic alliances?', *International Journal of Physical Distribution and Logistics Management*, Vol. 23, No. 6, pp. 14–26.
- Harrison A.S. (2000) 'Perestroika in automotive inbound', *Supply Chain Practice*, Vol. 2, No. 3, 28–39.

- Harrison, A.S. (2004) 'Outsourcing in the automotive industry: the elusive goal of tier 0.5', *Manufacturing Engineer*, February/March, pp. 42–5.
- Harrison, A. (2005) in Slack, N. (ed), *Blackwell Encyclopedic Dictionary of Operations Management* 2nd edn. Oxford: Blackwell.
- Hunter, L., Beaumont, P. and Sinclair, D. (1996) 'A "partnership" route to human resource management?', *Journal of Management Studies*, Vol. 33, No. 2, pp 235–57.
- Koulikoff-Souviron, M. and Harrison, A. (2007) 'The pervasive human resource picture in interdependent supply relationships', *International Journal of Operations and Production Management*, Vol. 27, No. 1, pp 8–27.
- Lewis, A. and Wright, C. (2004) 'Tier 0.5 manufacturers, where are you?' – management briefing, Just-Auto, Bromsgrove, UK, pp. 1–3.
- Pagell, M. (2004) 'Understanding the factors that enable and inhibit the integration of operations, purchasing and logistics', *Journal of Operations Management*, Vol. 22, pp. 459–87.
- Porter, M. (1990) *The Competitive Advantage of Nations*. London and Basingstoke: The McMillan Press Ltd.
- Rubery, J., Carroll, M., Cooke F., Grugulis, I. and Earnshaw, J. (2004) 'Human resource management and the permeable organization: the case of the multi-client call center', *Journal of Management Studies*, Vol. 41, No. 7, pp. 1199–222.
- Sako, M. (1992) *Prices, Quality and Trust: Inter-firm relations in Britain and Japan*. Cambridge: Cambridge University Press.
- Smart, A. and Harrison, A. (2003) 'On-line reverse auctions and their role in buyer–supplier relationships', *Journal of Purchasing and Supply Management*, Vol. 9, pp. 257–68.
- Speckman, R.E., Kamauff, J.W. and Myhr, N. (1998) 'An empirical investigation into supply chain management', *International Journal of Physical Distribution and Logistics Management*, Vol. 28, No. 8, pp. 630–50.
- Syson, R. (1992) *Improving Purchase Performance*. London: Pitman.
- van Hoek, R. and Weken, H.A.M. (1998) 'The impact of modular production on the dynamics of supply chains', *International Journal of Logistics Management*, Vol. 9, No. 2, pp. 25–50.

### Suggested further reading

- Cousins, P., Handfield, R., Lawson, B. and Petersen, K. (2006) 'Creating supply chain relational capital: the impact of formal and informal socialisation processes', *Journal of Operations Management*, Vol. 24, No. 6., pp. 851–63.
- Das, T.K. and Teng, B.S. (1998) 'Between trust and control: developing confidence in partner co-operation in alliances', *Academy of Management Review*, Vol. 23, pp. 491–513.
- Li, S., Ragu-Nathan, B., Ragu-Nathan, T. and Subba Rao, S. (2006) 'The impact of supply chain management practices on competitive advantage and organisational performance', *Omega*, Vol. 43, No. 2, pp. 107–24.
- Ploetner, O. and Ehret, M. (2006) 'From relationships to partnerships – new forms of cooperation between buyer and seller', *Industrial Marketing Management*, Vol. 335, No. 1, pp. 4–9.
- Scarborough, H. (2000) 'The HR implications of supply chain relationships', *Human Resource Management Journal*, Vol. 10, pp. 5–17.

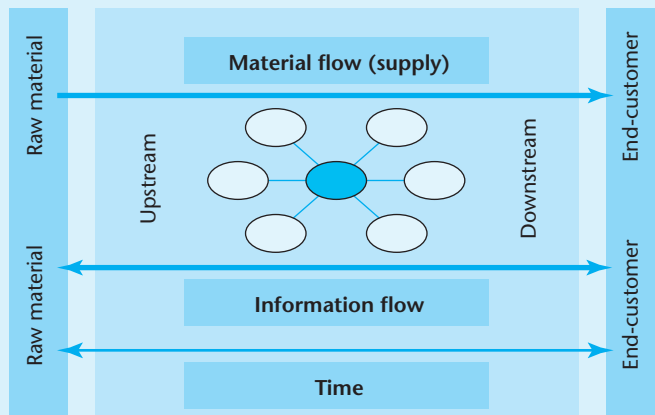




# Part Four

## CHANGING THE FUTURE

The final part of this book takes a somewhat different approach. It takes the lessons learned in the previous nine chapters and considers how future changes can be expected. The rationale for these changes is based on earlier lessons combined with current leading-edge thinking on logistics. Chapter 10 assesses current approaches to the supply network, and their impact on logistics in several areas such as internal alignment, spotting opportunities for collaborative developments, managing cost-to-serve for company growth and the creation of supply chain managers of the future. We hope that this will provide input to the process of taking the lessons learned in this book off the page and putting them into practice to create improvements in tomorrow's supply chains.





## CHAPTER 10

# Logistics future challenges and opportunities

### Objectives

*The intended objectives of this chapter are to:*

- collect together four major changes that are impacting on supply chain strategies;
- identify how management of the supply chains of the future will be affected by the advance of new structures and approaches to aligning the organisation, external partners and management development;
- list key issues in managing the transition towards future state supply chains.

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

- understand key issues in four key areas that will affect the way supply chains of the future will be structured;
- understand improved ways in which supply chains may compete in the marketplace;
- understand ways of approaching implementation in four major change areas.

### Introduction

We are looking at an exciting future for logistics in general and logistics managers in particular. Everything you have learned in the book so far offers you crucial basics to travel on the journey towards supply chain management becoming a key enabler of a firm's competitive position. So the question becomes, what is it that we will be working on in the next few years as we strive to deliver on the promise of supply chain management? There is not one single answer to this question. If one thing should be clear from the cases and examples offered in this book so far, it is that there are multiple answers depending upon markets, company maturity and strategy. No two supply chains are alike, and companies often participate in multiple supply chains. Furthermore, there are multiple scenarios and initiative areas on which both practice and research focus.

We decided to develop this chapter for the third edition from scratch, and to take a fresh look at logistics today and where it is going. In our view there are four areas that will be particularly fruitful to pursue – and where a lot of progress can be made. These form the key issues of the chapter.

## Key issues

This chapter addresses four key issues:

- 1 **Internal alignment:** improving internal alignment before further integrating externally.
- 2 **External improvement priorities:** picking upstream and downstream collaborative opportunities.
- 3 **Cost-to-serve:** how do we manage full service costs for healthy, profitable growth?
- 4 **Supply chain managers:** the major influences on creating supply chain managers of the future.

## 10.1 Internal alignment

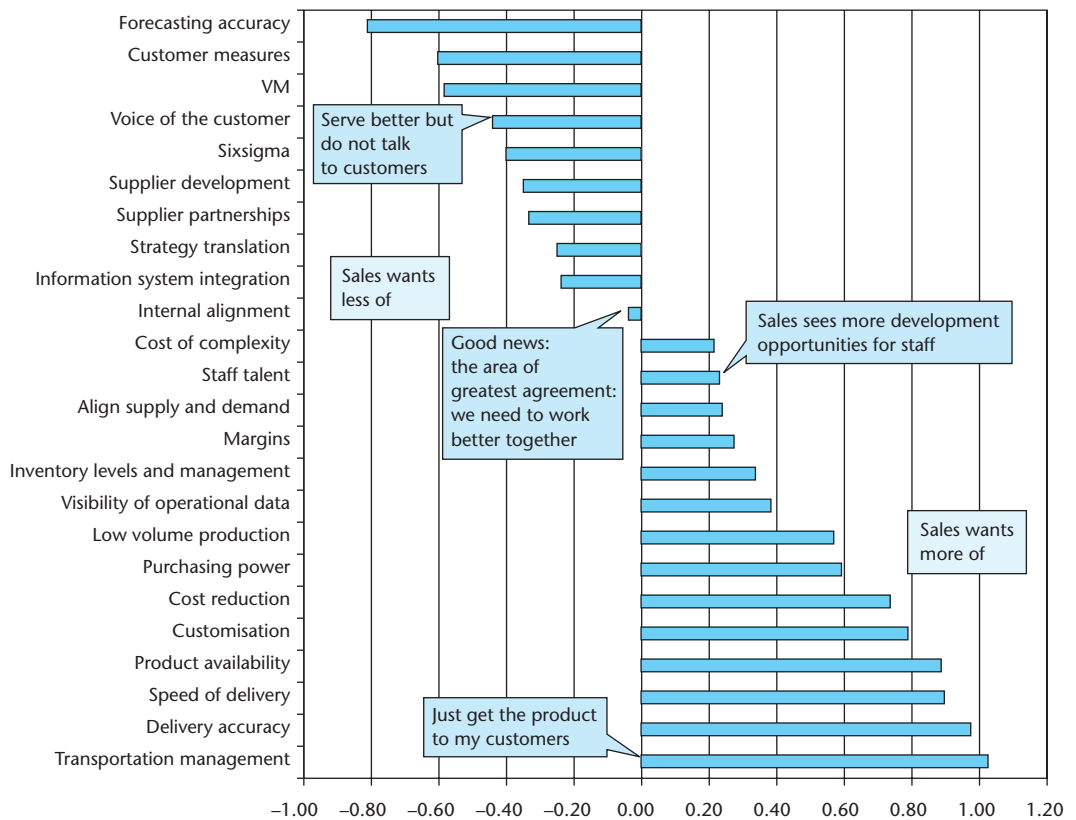
**Key issue:** How do we align the internal organisation around supply chain opportunities, priorities and efforts?

External integration between partners in a supply network is an important destination. But internal integration is the essential precursor to external integration, the research case for which we outlined in section 8.1.1. Key functional domains that form parts of the supply chain or impact supply chain performance need to align around priorities, opportunities and approaches. The fact that this is often not the case impedes supply chain efforts and might be what stands between ‘great plan’ and ‘great success’. Put simply, if a company cannot even speak with one voice, how can it align with other companies in the supply chain?

Figure 10.1 offers a chart from van Hoek and Mitchell (2006) that demonstrates the challenge of internal alignment. This chart captures findings from an internal survey of a globally operating manufacturing company (and repeated in many other companies with similar results). The survey included existing supply chain priorities and initiatives. In a way it lists supply chain targets and supply chain efforts already under way, that is, the existing plan that the supply chain is operating against – and that is Board-approved. The supply chain team and peers in other functions – in particular sales – were surveyed. They were asked for their opinion about the importance of these priorities and the current performance on them. The difference between importance and performance is considered to be an indication of the opportunity for improvement.

Figure 10.1 shows that, when contrasting opportunity scores of respondents from sales with respondents from the supply chain, important differences in opinion are found. When bars point to the right, sales sees a greater priority, when bars point to the left, supply chain sees a greater priority. Taken together, the chart tells a shocking story of misalignment. Not least, when looking at the smallest bar in the centre of the graph, it appears that there is one and only one area where supply chain and sales more or less agree – the area of internal alignment. An interpretation of this is that the only thing we agree upon is that we do not agree on anything, and that we need to align better. Another obvious area of misalignment is that sales is asking for improved transportation management and delivery services. But sales is asking for less focus on the enablers of improved

delivery service, such as forecasting accuracy. The chart reveals the painful challenge many supply chain managers face on a day-to-day basis: complaints about shipments and little support for its efforts at improvement that are critically dependent on support from other functions.



**Figure 10.1** Misalignment between supply chain and sales

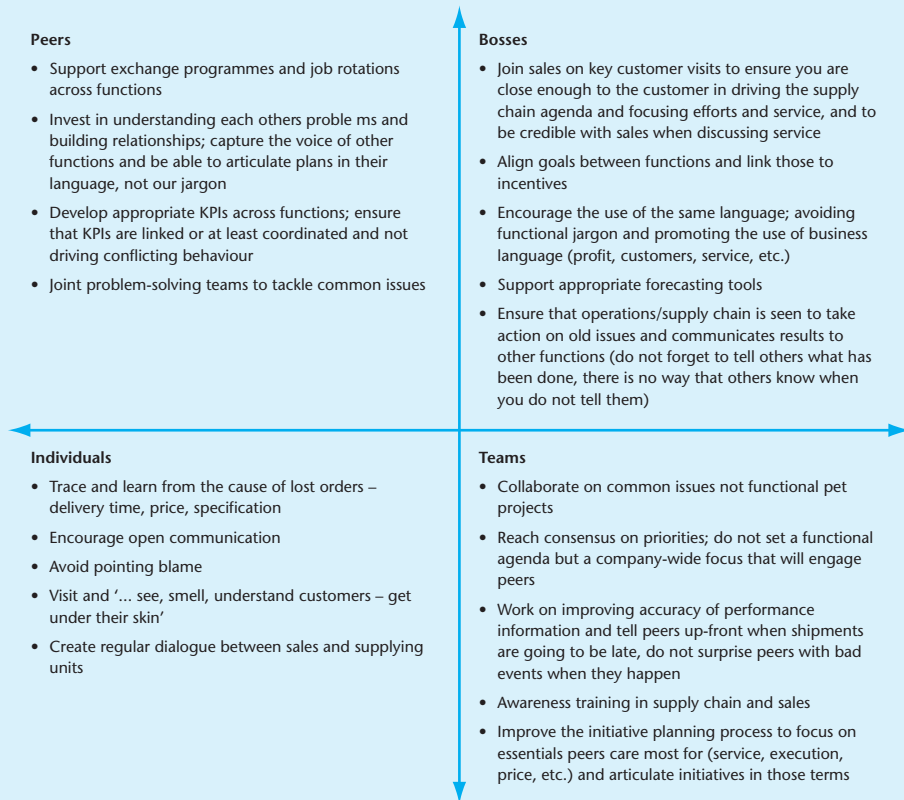
(Source: van Hoek and Mitchell, 2006)

## CASE STUDY 10.1

### Alfa Laval

When the senior supply chain executive team from Alfa Laval conducted an alignment analysis throughout the company, as exemplified in Figure 10.1, it realised there were a lot of basics to be improved. The team identified four areas where alignment improvement efforts could be focused: in interactions with peers from other functions; in interactions with their bosses and the Board; in interactions with their teams; and in their own day-to-day behaviour. Some of the mechanisms and actions defined by the team are captured in Figure 10.2, which they termed their 'Alignment Compass'.

In this effort, two key areas received a lot of attention – improving communication and training in supply chain and operations, and improving the initiative planning process. Starting with the latter, it was surprising for the executive team to see that there was no appreciation from peers in other functions for some of the strategic initiatives under way in the supply chain. The team realised that this is going to make the



**Figure 10.2** Alfa Laval's alignment compass

journey through those efforts harder at least and impossible at worst. It was decided that improvements can be made in the initiative planning process by expanding pilots in cross-functional efforts in the supply chain already under way and that the planning process could be improved to capture the voice of the organisation up-front. Areas earmarked as valuable included initial discussions with key peers to ensure engagement, time and resource commitment, and the effective focusing of initiatives.

In the communication area it was realised that the case for supply chain initiatives was not clearly communicated to begin with, and that peers were not committed to the implementation journey. Specific communication tactics for improving this situation included:

- using training in other functions as a channel for communication;
- moving away from jargon and technical language;
- moving towards using shared business language that puts initiatives in terms of shared output objectives and in terms of benefits to priorities in other functions;
- communicating the case for initiatives from the start, and frequently updating peers on progress and, more importantly, results against shared output objectives.

It is important to note that these communication improvements are also intended to be personal in nature. These communication issues should not be left to an internal communications department. They need to be incorporated into the personal toolkit of

supply chain managers in order to increase the likelihood of initiative success, effective cross-functional management, and, most importantly, their personal effectiveness. It was found that driving success in these areas will require some training, coaching and possible 'tag teaming' with peers – or even job rotation.

(Source: After van Hoek and Mitchell, 2006)

### Questions

- 1 Can you provide examples of how functional agendas might clash, leading to challenges in supply chain initiatives?
- 2 Can you suggest additional integrative mechanisms along the axes of the alignment compass?

It is often pointed out that the impact of the supply chain on new product development (NPD) and new product introduction is important in areas such as:

- shipping products to market fast enough (before product launch dates);
- ensuring sufficient inventory at the launch date; and
- ensuring a flow of parts and components for new product manufacturing.

Examples of how this presents itself in practice are provided by Nike and Reckitt Benckiser (van Hoek and Chapman, 2006). At Nike (see Case study 4.3) – as in fashion companies – it is important to ensure that all key accounts have sufficient stock available at the start of each of the four seasons in a year when a rush for products begins. That means ensuring supply of several thousand skus from multiple suppliers globally, through the distribution channel to all customers on time simultaneously. Missing the launch date disappoints customers and affects overall product revenue. Equally, when a new blockbuster videogame is introduced in the market one-third or more of the entire sales take place within the first 24 hours of the product becoming available, with people lining up in front of stores before a midnight release. Obviously in this example it is also crucial to ensure sufficient supply to stores in order to avoid lost sales and disappointed customers and accounts. In conclusion new product development and the supply chain is another key area where internal alignment must be targeted.

Like many companies, Reckitt Benckiser, a consumer products company, found forecasts for new products to be one area where misalignment between supply chain and NPD was particularly costly and challenging. A major challenge with new products is that there is less historical reference data to use as a base number for forecasting and there are more uncertainties to contend with around such important issues as an exact launch date, and supply volumes. Misalignment was found to be costly because poor forecasts led to limited product availability, disappointed customers and lots of fire fighting and last-minute fixes. Several reasons were found for the underperformance of the forecasting process. These included tendencies to average out forecasts when functions do not agree, delayed response due to lack of group consensus, and even forecasts that become available late as a result of forecasting being given a low priority for too long.



In order to address these shortcomings and contribute to supply chain readiness, Reckitt Benckiser created a new role in the supply chain team – a new product introduction forecasting manager. This manager is dedicated to working with functions involved in the NPD process specifically to drive alignment around the forecast. The manager flags forecasting differences between functions and spots possible challenges in assumptions and works across functions to arrive at a more accurate forecast. Next, the forecasting manager supports the translation of the forecast into a supply chain capacity plan, and forms a natural spotlight in the organisation for avoiding bottlenecks.

With supply chain readiness for NPD improved and with fewer execution issues and fire fighting the supply chain team has manoeuvred itself into a better position. It is less likely to be distracted by last-minute crises and more likely to be considered a useful member of the NPD team that can make valuable contributions based upon the capability it has to offer.

### Activity 10.1

Assume for a moment that you are a supply chain manager invited into a new product development team meeting, what questions would you ask of the team to ensure you can prepare your supply chain for effective product launch?

## 10.2 Selecting collaborative opportunities upstream and downstream

**Key issue: Where and how to place bets on collaborative opportunities upstream and downstream in the supply chain.**

Once a company has its internal organisation more aligned around supply chain opportunities, priorities and initiatives, it is in a better position to select external collaborative opportunities. In some respects, this is like placing bets – but not like playing roulette, if managed carefully! There are new developments pertaining to selecting opportunities downstream (with customers) and upstream (with suppliers and partners). Specifically, the notion of being selective is key. Some argue that the term ‘partnership’ is one of the most inflated terms in modern business and it is well known that you can only truly partner with a few. So where should we focus upstream and downstream in the supply chain for maximum benefit?

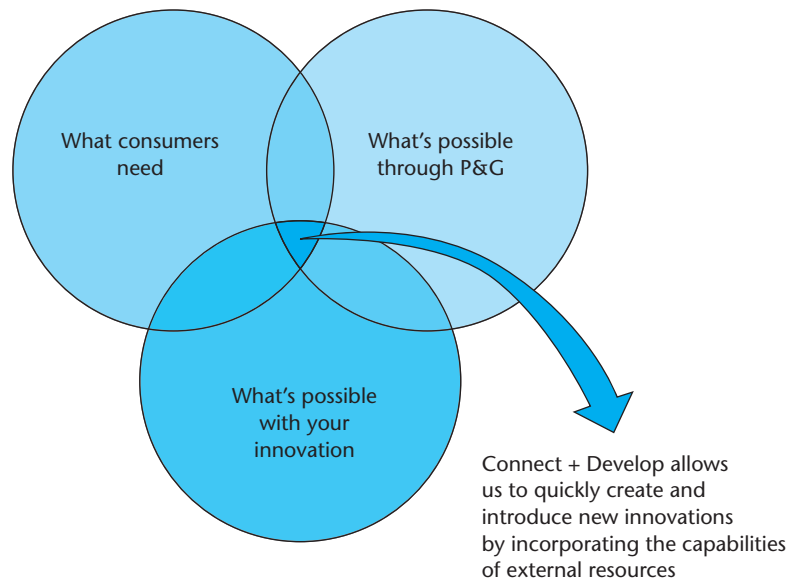
### *Selecting upstream collaboration opportunities*

Beyond sourcing parts and services needed to make and deliver products and service for customers, firms are increasingly looking at collaboration opportunities in new product development and R&D. Of course companies can only do this really effectively when they are aligned internally first (see section 10.1 above). Procter & Gamble has a stated objective to move towards having 50 per

cent or more of its innovation from external partners, and has launched a programme called 'Connect + Develop' to enable this (see Figures 10.3 and 10.4). The company has tackled this diligently:

- They have established a dedicated organisation with senior leadership, programme management, deal makers, business developers and engineers.
- They have developed a 'needs list' containing technologies in which the company is interested. This helps to focus the search for innovation, and serves as a screening tool for assessing collaborative opportunities.
- Account managers will steward partner innovations into the organisation and throughout a structured and well-defined process.
- P&G can structure partnerships in multiple forms depending on the type of innovation and application.

Figure 10.3 shows the P&G 'Connect + Develop' philosophy, and Figure 10.4 illustrates examples of 'Connect + Develop' efforts.



**Figure 10.3** The P&G 'Connect + Develop' philosophy

(Source: Procter and Gamble Connect + Develop program)

### *Selecting downstream opportunities: which customers to give the keys to our car?*

Partnering with customers can be a much scarier notion than partnering upstream. It implies sharing a lot of inside information with customers and talking openly about what a company *cannot* do. Traditionally, this is not how companies (and sales staff) sell. When making the mind-shift, however, there is a lot of potential on the table. Specifically, some companies are initiating customer collaboration efforts that involve working to resolve supply chain problems jointly with customers to serve the end-consumer better. Among the areas

**Connect + Develop successes**

Consumers around the world have already realised the benefits of P&G's Connect + Develop strategy. The following products and technologies are examples of the mutually beneficial collaborations we have established through external connections.

**Ready-to-go technologies**

P&G introduced Bounce, the world's first dryer-added softener, after acquiring the product technology from the independent inventor who developed the innovative fabric-care solution.

**Ready-to-go products**

By acquiring the newly introduced SpinBrush, P&G was able to bring a superior oral care brand to market quickly, without undertaking the time and expense of developing an entirely new product.

**Ready-to-go packaging**

Several of our Olay Skin Care products now utilise new consumer-preferred pump dispenser originally developed by a European packaging products company. P&G led a collaborative improvement process to make the original pumps more effective prior to their launch in Olay's North American markets.

**Commercial partnerships**

P&G found the perfect complement to the Swiffer brand in a hand-held duster developed by a Japanese competitor. After purchasing the product, P&G leveraged elements of existing manufacturing processes and advertising components to launch Swiffer Duster within 18 months.



**Figure 10.4** Examples of 'Connect + Develop'

(Source: Procter and Gamble Connect + Develop program)

where fruitful collaboration opportunities have been found are several process integration areas, including:

- linking supplier delivery to customer warehousing and materials handling processes;
- linking supplier to customer forecasting;
- linking customer ordering to supplier delivery planning systems.

Additionally, a focus on serving the end-consumer better implies collaborative opportunities such as:

- supplier suggestions for campaigns and merchandising;
- joint product and packaging design;
- joint product mix development to improve inventory turns on the retailer's shelf.

An example of the latter would be for a consumer product company to suggest replacing certain of its own products on a retailer's shelf with others, and suggesting improved store and shelf planograms. Essentially, these collaborations centre around a supplier actively (re-)designing part of the customer's operation and adjusting its own systems accordingly. These efforts can come at an investment premium and involve market risks. Hence it is important to select wisely which customer relationships to engage with in these collaborative efforts. One global manufacturer uses a set of screens to evaluate customer relations in terms of collaboration opportunities. Counter to common wisdom, they do not look so much at the size of the customer account but rather at the nature of the customer's business and their relationship. The company may select smaller customers for investment in collaboration for reasons such as: it could be one of the rising stars in the industry worth investing in now, or it might be a particularly innovative customer investment which could have a much broader spin-off. The characteristics the company uses to evaluate customer relationships are not so much financial or sales-oriented, but focus on 'soft' factors (see section 1.3.3) such as openness to innovative suggestions and willingness to experiment. The company found that its efforts to evaluate customer relationships before offering up collaborative options helped in prioritising projects for greater returns and greater opportunities for success.

### Activity 10.2

- 1 What are the main risks involved in collaborating with customers of a focal firm? Consider industrial as well as consumer sectors by referring to Table 2.2.
- 2 Why is internal stewardship and process ownership necessary for collaborations?

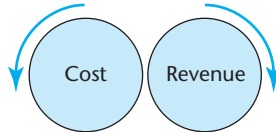
## 10.3 Managing with cost-to-serve to support growth and profitability

**Key issue:** How do we leverage full service costs management for growth and profit?

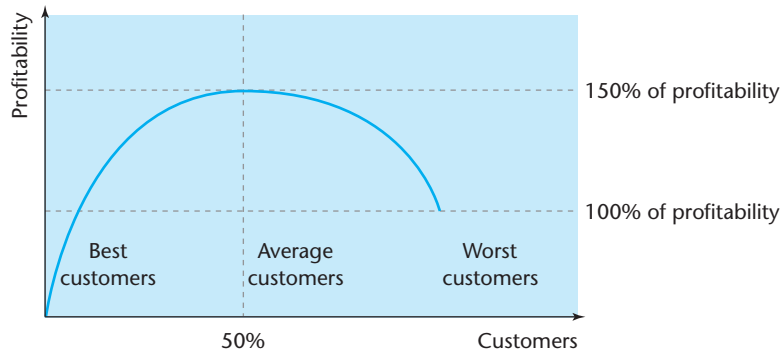
We discussed activity-based costing (ABC) in section 3.3. Assessing the *cost-to-serve* uses ABC methodology to quantify the actual costs involved in fulfilling customer orders. Despite all the progress in the last few years on moving from functional organisations to process and supply chain organisations, most firms today are still focused on managing efficient supply of products against customer demand. Cost rationalisation efforts centre on using global sourcing and purchasing to reduce material costs. As a result, supply chain cost reduction has been executed in isolation of customer value and revenue generation. The undesirable outcome is to rationalise service to the most valuable customers. This has been brought about by lack of a clear sense of customer relationship investment opportunities, and by the inability to have a constructive discussion with sales and customer service about what services are valuable for which customers, and

what services do not contribute. Figure 10.5 shows how costs and revenue have been moving in opposing directions. Customer profitability analysis helps dispose of that shortcoming, as it assesses an organisation's ability to profitably fulfill individual customer orders, and to serve individual customer accounts and distribution channels with current supply chain design and customer service systems. Essentially, this analysis changes the economic starting point from internal costs to working from customer orders upstream.

Cost and revenue spinning in opposite directions



... lead to an unfavourable profit distribution



**Figure 10.5** The dynamics of customer profitability

Figure 10.5 also shows how customer profitability analysis can reveal how 150 per cent of profits are generated by 50 per cent of the customer base, and how 50 per cent of customers are currently unprofitable. This finding assumes that most traditional accounting systems are very accurate in tracking cost of goods sold (*source* and *make* costs) but underperform in tracking logistics costs to individual customers (*deliver* costs). Once shipment, service and customisation costs are added on a 'per customer' basis, a different profitability curve emerges.

This analysis has several implications, including:

- service terms and conditions for unprofitable accounts need to be changed, and converted into profitable alternatives;
- the most important customers need more attention, by focusing more customer service efforts on these customers;
- prices should be increased for unprofitable customers, or they should be gradually removed from the focal firm's sales portfolio altogether.

Most importantly, customer profitability analysis enables focal firms to link supply chain efforts to customer value and market opportunity in a way that improves customer relations and revenues in a profitable manner.

The concept of cost-to-serve shows that the supply chain contributes significantly to profitability. Cost-to-serve also enables a local firm to home in on the best growth opportunities, which would otherwise be difficult to identify.

Rationalising a product mix is a good area of application, as shown in Case study 10.2 below.

## CASE STUDY 10.2

### Clorox supports growth by cutting SKUs

Companies want to grow, and one of their commonest strategies is to create new products. These may increase revenues, but of course they do not guarantee profits. In fact, product proliferation often reduces margins. One company we studied found that the bottom 40 per cent of its products generated less than 3 per cent of revenue, and the bottom 25 per cent of its products were highly unprofitable.

Several years ago, Clorox, a \$4 billion consumer products company, realised it needed to address the problem of underperforming products. At the time, 30 per cent of the company's stock keeping units (skus) were falling short of sales volume and profit targets. Clorox responded by developing a formal process for evaluating sku performance and making decisions about which products to cut.

As part of the annual business planning process, annual reduction goals are established for underperforming skus, as well as a 'glidepath' (specific goals by month) and specific action items for reaching the reduction goal. Specific action items may include discontinuance, substitution, or increasing distribution. A cross-functional sku management process team, sponsored by the CFO and led by the director of supply chain planning, meets monthly to track progress, spotlight businesses that are off-target, discuss process improvements, and resolve policy issues. The team includes director- or VP-level representatives from sales, marketing, finance and product supply.

This team uses a 'dashboard' (selected key measures of performance) to evaluate the performance of skus against annual sales volume and profit goals (or hurdles). The dashboard also rates the performance of each business according to the proportion of skus that meet hurdles. Business are graded 'green' if they are exceeding goals; yellow if they are within 5 per cent of target and red if they are more than 5 per cent from target. 'Red' businesses are required to specify tactics to bring their proportion of products meeting hurdle rates in line with goals. The executive teams of 'red' businesses typically must identify underperforming skus that will be eliminated, and specify the strategy for eliminating them.

Like any business tactic, product rationalisation must be used cautiously. Many companies have tried to tackle this issue by ruthlessly cutting the product portfolio. The risk, though, is that a company cuts too deeply into its revenue streams and finds it has discontinued products that key customers care for, damaging important customer relationships. Clorox frequently reviews product lines with customers to optimise the product mix on the shelf.

Today, more than 90 per cent of Clorox's skus meet volume and profit hurdles, up from 70 per cent four years ago. Retail sales per sku have grown by more than 25 per cent, the return on products has increased and retail customer service levels have improved. Clorox now leads its peers in retail sales per sku in the majority of its categories.

(Source: Based on van Hoek and Pegels, 2006)

**Questions**

- 1 What reasons for and against product proliferations might different functions use?
- 2 What reasons need to be considered for discontinuing and continuing skus?

## 10.4 The supply chain manager of the future

**Key issue:** What are the changing needs and requirements that apply to the most effective supply chain managers?

Ultimately, the purpose of this book is to support the development of effective supply chain managers. This is arguably the most important job to begin with. In that respect it should be noted that today's and tomorrow's supply chain manager looks very different from the supply chain staff of the recent past. There are several key capabilities that will make or break supply chain managers of the near future:

- These managers need to be effective at interfacing with customers. This is new because in the past supply chain staff used to be almost completely internally and operationally focused. Sales monopolised the customer, leaving supply chain managers short of 'supply chain relevant' customer insight.
- Functional knowledge is a base requirement (this used to be a differentiator, now it is a qualifier).
- They need to have strong interpersonal skills (van Hoek *et al.*, 2002) Supply chain staff used to be technical and operational in background and training. They were heavily focused internally, without the ability to align peers around efforts and priorities, and unable to engage business people in their efforts.
- They need to have general management and strategic management capabilities and skills. Hence, they should no longer be solely operationally focused and boxed in, which makes them unable to integrate and be seen as contributing to corporate strategic goals.
- They need to be able to develop and foster relationships internally and externally (as opposed to being focused only on running an operation).
- They need to be able to translate supply chain efforts and jargon into business language that their peers can respond to and relate to their own day-to-day efforts
- They need to have a service ethic that does not include always saying 'yes'. Traditionally, supply chain people have either been very good at saying 'no' to special requests, or saying 'yes' all the time. They therefore need to manage trade-offs in operations, while finding creative ways to serve.

This will help supply chain managers avoid traditional pitfalls such as:

- being unable to align the organisation around supply chain opportunities;

- lacking crucial voice of the customer (VoC, section 7.2.1) insights to achieve success with final customers;
- being only operationally focused, with limited insight into strategic business goals;
- taking initiatives in an effort to help peers, but not succeeding due to the points listed above.

### Activity 10.3

- 1 Consider what courses are key for a supply chain student to follow, in addition to supply chain programmes.
- 2 Find an example of a recent supply chain job posting at a management level, review this for competency requirements and propose how this might be modified to fit the future challenges in the area.

Finally, we have a few pointers for the supply chain managers of the future:

- Traditional operations people are often seen as being best at saying 'no'. Avoid saying 'no' for technical reasons, but ask about the business need that a request serves.
- Do not rely on technology as a 'be all and end all'. Most difficult supply chain challenges can at best be supported by technology, but they mostly involve people- and change-related issues.
- Supply chain people often suffer from initiative overload. Avoid taking in all business requests and saying 'yes' too often.
- Avoid being caught out by taking initiatives without clear business and cross-functional involvement, ownership, sponsorship and goal sharing.
- Traditional supply chain people often spend a lot of time taking calls about problems, fighting fires and being the hero of the day. But this can distract from working on structural solutions that will prevent those problem calls from happening to begin with. So stop fixing things, and start solving problems.
- Traditional supply chain people were born and raised in areas of functional expertise and have built their careers around that. This leads to communication and business alignment issues. Supply chain management is a cross-functional job. So stop being a functional expert, and start being a business general manager.
- Think growth, not just cost containment. The supply chain is often called upon to deliver savings and operational synergies – most often in tough times and during mergers, the supply chain is called upon first. While the supply chain has a key role to play here, an emphasis on cost containment underestimates the possible contribution of the supply chain to growth, and keeps it in a negative box – insulated from the happy times during periods of growth!
- Start with the voice of the customer as an ally and ultimate judge.



## Summary

### *What does 'leading edge' logistics envisage in terms of the supply chain of the future?*

- The ability to align the organisation internally around supply chain opportunities, priorities and efforts in order to avoid partial, ineffective or failed supply chain improvement efforts.
- The capability to spot and select the limited number of collaborative opportunities upstream with partners and suppliers, and downstream with customers.
- The capability to map true and complete cost to fulfil customer orders and to manage services and costs for increased profitable growth
- The development of a 'new breed' of supply chain managers that will help realise all of the above.

We hope the readers of this book will have picked up insights and lessons that they can use on their journey to create supply chains of the future.

## Discussion questions

- 1 We started out in Chapter 1 by defining supply chain management as 'Planning and controlling all of the business processes that link together partners in a supply chain in order to serve the needs of the end-customer'. How will leading-edge developments covered in this chapter contribute to this vision?
- 2 Suggest how the four change areas discussed in this chapter apply to our model of the supply network (Figure 1.2) and to the integration of demand and supply shown in Figure 1.7.

## References

- van Hoek, R. and Chapman, P. (2006) 'From tinkering around the edge to enhancing revenue growth: supply chain – new product development alignment', *Supply Chain Management, An International Journal*, Vol. 11, No. 5, pp. 385–89.
- van Hoek, R.I., Chatham, R. and Wilding, R.D. (2002), 'People in supply chains: the critical dimension', *Supply Chain Management, An International Journal*, Vol. 7, No. 3, pp. 119–25
- van Hoek, R. and Mitchell, A. (2006) 'Why supply chain efforts fail; the crisis of misalignment', *International Journal of Logistics, Research and Applications*, Vol. 9, No. 3, pp. 269–81
- van Hoek, R. and Pegels, K. (2006) 'Growing by cutting sku's at Clorox', *Harvard Business Review*, April, p. 23.

### *Suggested further reading*

- 2016: *The future value chain*, Global Commerce Initiative, Capgemini, Intel.
- Harrison, A. and White, A. (2006) *Intelligent distribution and logistics*, *IEE Proceedings of Intelligent Transportation Systems*, Vol. 153, No. 2, pp. 167–80.

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