Nigel Slack
Alistair Brandon-Jones
Robert Johnston

Seventh Edition

# OPERATIONS MANAGEMENT

PEARSON

# 6

# Supply network design

## Key questions

> Why should an organization take a total supply network perspective?

> What is involved in configuring a supply network?

> Where should an operation be located?

> How much capacity should an operation plan to have?

## INTRODUCTION

No operation exists in isolation. Every operation is part of a larger and interconnected network of other operations. This *supply network* will include suppliers and customers. It will also include suppliers' suppliers and customers' customers, and so on. At a strategic level, operations managers are involved in 'designing' the shape and form of their network. Network design starts with setting the network's strategic objectives. This helps the operation to decide how it wants to influence the overall shape of its network, the location of each operation, and how it should manage its overall capacity within the network. Here we treat all these strategic design decisions in the context of supply networks (*see* Fig. 6.1).
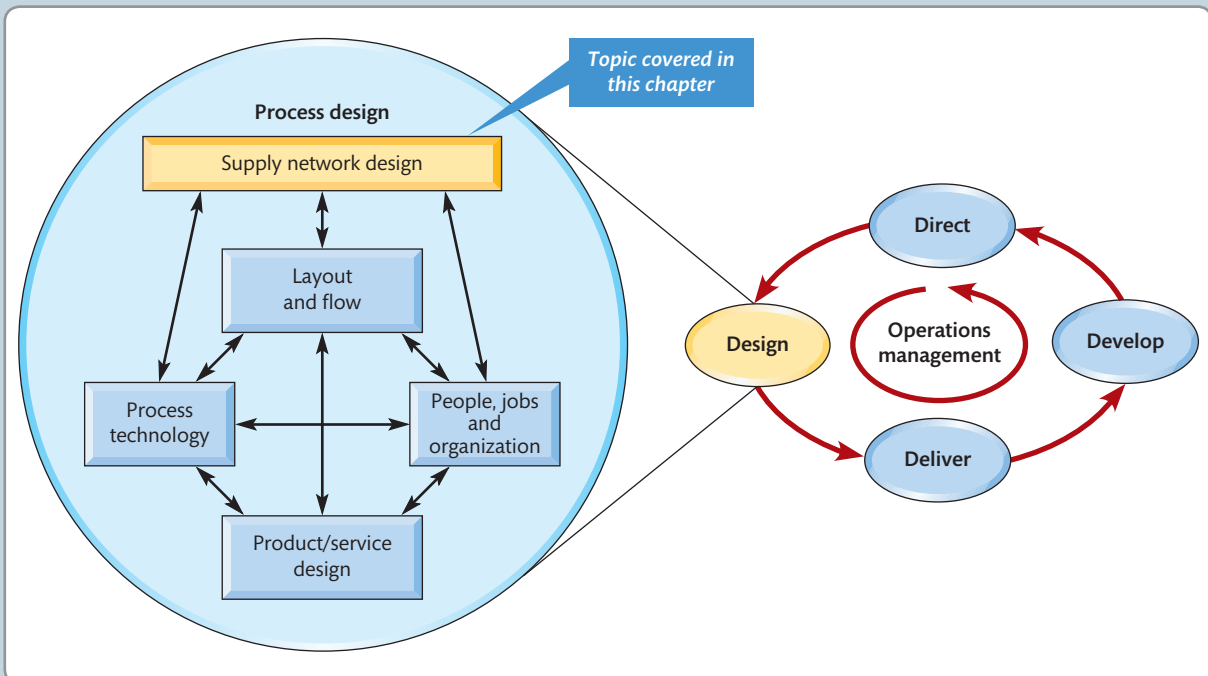


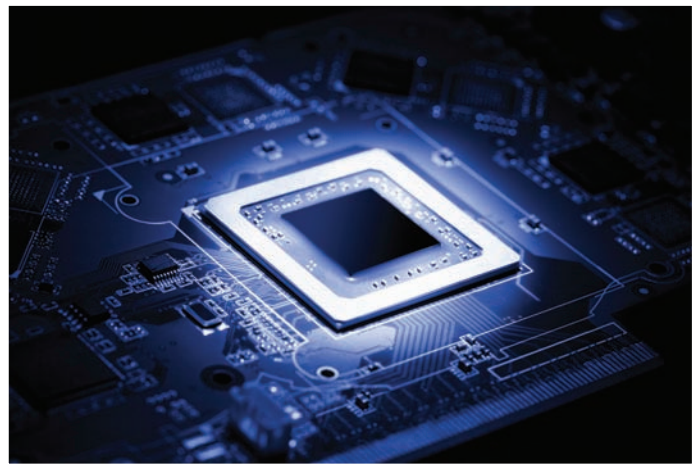**Figure 6.1**  **This chapter covers supply network design**

MyOMLab

*Check and improve your understanding of this chapter using self-assessment questions and a personalized study plan, a video case study, and an eText – all at* **www.myomlab.com***.*

# Dell: the customer is still king of the supply network[1]

Michael Dell, the founder of Dell, has always stressed that his customers are the driving force behind how he shapes the company's supply networks. As a student in Texas he realized that he could add value by modifying PCs bought from local dealers so that they represented better value for local businesses. He quit university and founded the computer company which was to revolutionize the industry. But his fledgling company was just too small to make their own components. Better, he figured, to learn how to outsource to a network of specialist component manufacturers. Dell says that his commitment to outsourcing was always done for the most positive of reasons. *'We focus on how we can coordinate our activities to create the most value for customers.'* To save costs further, Dell still decided to sell its computers directly to its customers, allowing them to cut out the retailer's (often considerable) margin, which in turn allowed Dell to offer lower prices. Also, dealing directly with customers provided them with the opportunity to get to know their customers' needs far more intimately. They could forecast based on the thousands of customer contact calls every hour and could talk with customers about what they really wanted. Most importantly it allowed Dell to learn how to run its supply networks so that products get to end customers fast and efficiently, reducing Dell's level of inventory and giving it a significant cost advantage. However, two decades after its foundation, Dell seems to have forgotten supply network management's golden rule – understand the customer.

Selling computers to individuals (as opposed to the corporate market) was changing. Maybe influenced by Apple, customers increasingly wanted up-to-date computers with a high design value, and most significantly, they wanted to see, touch, and feel the products before buying them. This was clearly a problem for a company like Dell who had spent 20 years investing in its telephone- and later, internet-based sales channels. What the market wanted had changed but Dell's supply network had not. However, Dell did recover. It focused on consumers. *'Let's say you wanted to buy a Dell computer in a store – you'd have searched a long time and not found one. Now we have over 10,000 stores that sell our products.'*

In a recent move, Dell has re-emphasized its commitment to matching its supply networks with what customers want. It has established the 'Social Media Listening Command Center' which monitors more than 25,000 posts and Twitter messages every day that in some way relate to Dell. Using an analytics tool, this allows the monitoring team to gather and sort conversations, evaluate trends and problems and, if necessary, react rapidly to customers. Dell says it has a 'resolution rate' of 99 per cent customer satisfaction and succeeds in converting more than a third of its online critics to fans. *'Today a single customer complaint from someone with influence can have more impact on your company's reputation than your best marketing'*, said Jason Duty, head of Dell's global social outreach service.

Source: Shutterstock.com/Filipchuk Oleg

## THE SUPPLY NETWORK PERSPECTIVE

A supply network perspective means setting an operation in the context of all the other operations with which it interacts, some of which are its suppliers and its customers. Materials, parts, other information, ideas and sometimes people all flow through the network of customer–supplier relationships formed by all these operations. On its supply side, an operation has its suppliers of parts, or information, or services. These suppliers themselves have their own suppliers who in turn could also have suppliers, and so on. On the demand side,

the operation has customers. These customers might not be the final consumers of the operation's products or services; they might have their own set of customers. On the supply side, is a group of operations that directly supply the operation; these are often called first-tier suppliers. They are supplied by second-tier suppliers. However, some second-tier suppliers may also supply an operation directly, thus missing out a link in the network. Similarly, on the demand side of the network, 'first-tier' customers are the main customer group for the operation. These in turn supply 'second-tier' customers, although again the operation may at times supply second-tier customers directly. The suppliers and customers who have direct contact with an operation are called its immediate supply network, whereas all the operations which form the network of suppliers' suppliers and customers' customers, etc., are called the total supply network.

Figure 6.2 illustrates the total supply network for two operations. First is a plastic homeware (kitchen bowls, etc.) manufacturer. On the demand side it supplies products to wholesalers who supply retail outlets. However, it also supplies some retailers directly, bypassing a stage in the network – not an uncommon situation. As products flow from suppliers to customers, orders and information flow the other way from customers to suppliers. It is a two-way process with goods flowing one way and information flowing the other. But do not think that only manufacturers can be part of supply networks. The second illustration in Figure 6.2 shows a supply network centred on a shopping mall. It also has suppliers and customers who themselves have their own suppliers and customers.
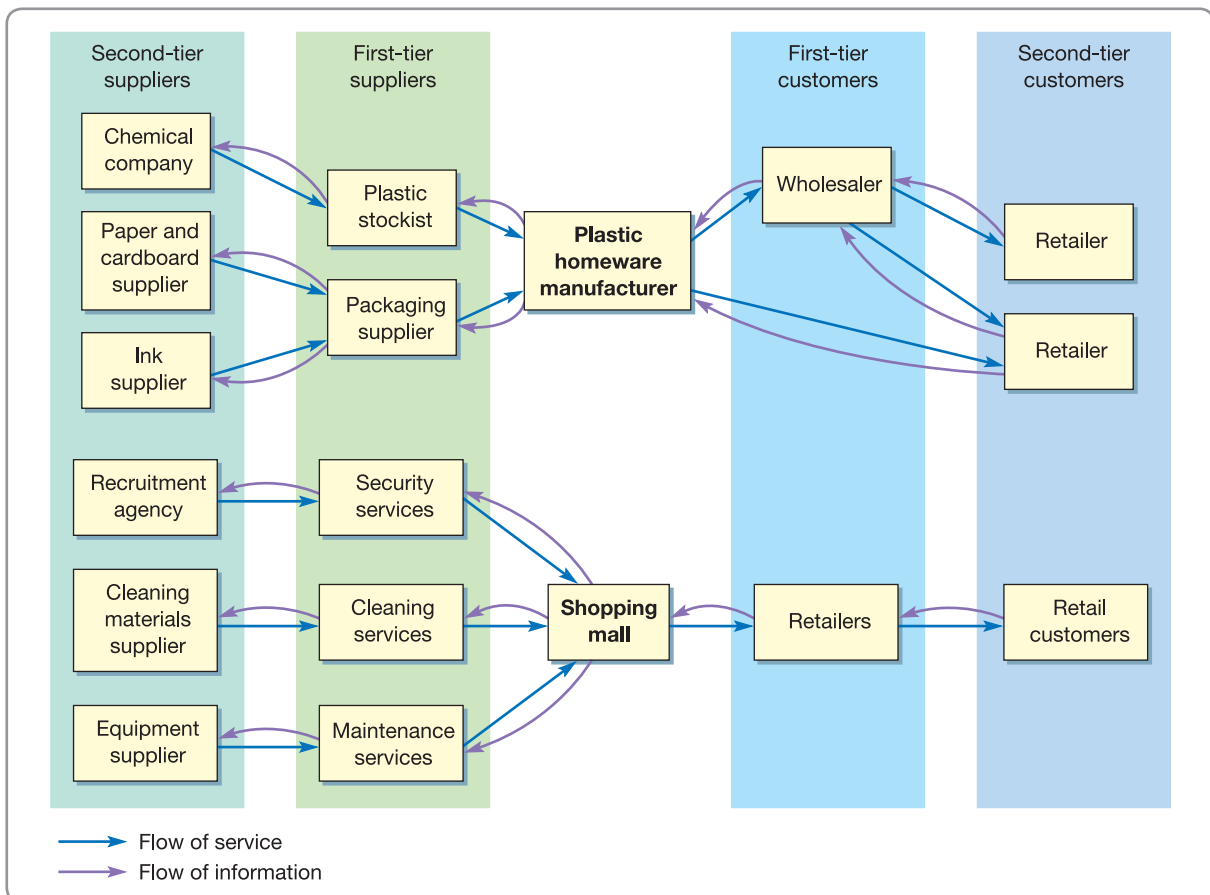


**Figure 6.2** **Operations network for a plastic homeware company and a shopping mall**

## Why consider the whole supply network?

So why is it important to stand back and look at the whole (or a large part of) a supply network rather than an individual operation? There are three reasons:

**It helps an understanding of competitiveness**  Immediate customers and immediate suppliers, quite understandably, are the main concern for companies. Yet sometimes they need to look beyond these immediate contacts to understand *why* customers and suppliers act as they do. Any operation has only two options if it wants to understand its ultimate customers' needs at the end of the network. It can rely on all the intermediate customers and customers' customers, etc., which form the links in the network between the company and its end customers. Alternatively, it can look beyond its immediate customers and suppliers. Relying on one's immediate network is seen as putting too much faith in someone else's judgement of things which are central to an organization's own competitive health.

**It helps identify significant links in the network**  Not everyone in a supply network has the same degree of influence over the performance of the network as a whole. Some operations contribute more to the performance objectives that are valued by end customers. So an analysis of networks needs to understand the downstream and the upstream operations which contribute most to end customer service. For example, the important end customers for domestic plumbing parts and appliances are the installers and service companies who deal directly with consumers. They are supplied by 'stock holders' who must have all parts in stock and deliver them fast. Suppliers of parts to the stock holders can best contribute to their end customers' competitiveness partly by offering a short delivery lead time but mainly through dependable delivery. The key players in this example are the stock holders. The best way of winning end customer business in this case is to give the stock holder prompt delivery, which helps keep costs down while providing high availability of parts.

**It helps focus on long-term issues**  There are times when circumstances render parts of a supply network weaker than its adjacent links. High street music stores, for example, have been largely displaced by music streaming and downloading services. A long-term supply network view would involve constantly examining technology and market changes to see how each operation in the supply networks might be affected.

> **✳ Operations principle**
>
> A supply network perspective helps to make sense of competitive, relationship, and longer-term operations issues.

### Design decisions in supply networks

The supply network view is useful because it prompts three particularly important design decisions. These are the most strategic of all the design decisions treated in this part of the book. It is necessary to understand them at this point, however, because, as well as having a particularly significant impact on the strategy of the organization, they set the context in which all other process design decisions are made. The three decisions are:

1 How should the network be configured?
2 Where should each part of the network be located? The location decision.
3 What physical capacity should each part of the network have? The long-term capacity management decision.

In this chapter we deal with these three related strategic decisions. Note, however, that all three of these decisions rely on forecasts of future demand which the supplement to this chapter explores in more detail. Also, in Chapter 13 we will cover the more operational day-to-day issues of managing operations networks.

## CONFIGURING THE SUPPLY NETWORK

'Configuring' a supply network means determining its overall pattern. This includes two main sets of decisions. First, what should be the pattern, shape or arrangement of the various operations that make up the supply network? Second, how much of the network should a specific operation own? This may be called the outsourcing, vertical integration, or the do-or-buy decision.

# Changing the shape of the supply network

Even when an operation does not directly own, or even control, other operations in its network, it may still wish to change the shape of the network. This involves attempting to manage network behaviour by reconfiguring the network so as to change the scope of the activities performed in each operation and the nature of the relationships between them. Reconfiguring a supply network sometimes involves parts of the operation being merged – not necessarily in the sense of a change of ownership of any parts of an operation, but rather in the way responsibility is allocated for carrying out activities. The most common example of network reconfiguration has come through the many companies that have recently reduced the number of direct suppliers. The complexity of dealing with many hundreds of suppliers may both be expensive for an operation and (sometimes more important) prevent the operation from developing a close relationship with a supplier. It is not easy to be close to hundreds of different suppliers.

## Disintermediation

Another trend in some supply networks is that of companies within a network bypassing customers or suppliers to make contact directly with customers' customers or suppliers' suppliers. 'Cutting out the middle men' in this way is called disintermediation. An obvious example of this is the way the internet has allowed some suppliers to 'disintermediate' traditional retailers in supplying goods and services to consumers. So, for example, many services in the travel industry that used to be sold through retail outlets (travel agents) are now also available direct from the suppliers. The option of purchasing the individual components of a vacation through the websites of the airline, hotel, car-hire operation, etc., is now easier for consumers. Of course, they may still wish to purchase an 'assembled' product from retail travel agents which can have the advantage of convenience. Nevertheless the process of disintermediation has developed new linkages in the supply network.

## Co-opetition

One approach to thinking about supply networks sees any business as being surrounded by four types of players: suppliers, customers, competitors and complementors. Complementors enable one's products or services to be valued more by customers because they can also have the complementor's products or services, as opposed to having yours alone. Competitors are the opposite: they make customers value your product or service less when they can have their product or service, rather than yours alone. Competitors can also be complementors and vice versa. For example, adjacent restaurants may see themselves as competitors for customers' business. A customer standing outside and wanting a meal will choose between the two of them. Yet in another way they are complementors. Would that customer have come to this part of town unless there was more than one restaurant to choose from? Restaurants, theatres, art galleries, and tourist attractions generally, all cluster together in a form of co-operation to increase the total size of their joint market. It is important to distinguish between the way companies co-operate in increasing the total size of a market and the way in which they then compete for a share of that market. Customers and suppliers, it is argued, should have 'symmetric' roles. Harnessing the value of suppliers is just as important as listening to the needs of customers. Destroying value in a supplier in order to create it in a customer does not increase the value of the network as a whole. So, pressurizing suppliers will not necessarily add value. In the long term it creates value for the total network to find ways of increasing value for suppliers and well as customers. All the players in the network, whether they are customers, suppliers, competitors or complementors, can be both friends and enemies at different times. The term used to capture this idea is 'co-opetition'.

## Outsourcing

No single business does everything that is required to produce its products and services. Bakers do not grow wheat or even mill it into flour. Banks do not usually do their own credit checking – they retain the services of specialist credit checking agencies that have the specialized information

systems and expertise to do it better. This process is called outsourcing (also known as the do-or-buy, or the vertical integration decision) and it has become an important issue for most businesses. This is because, although most companies have always outsourced some of their activities, a larger proportion of direct activities are now being bought from suppliers. Also many indirect processes are now being outsourced. This is often referred to as business process outsourcing (BPO). Financial service companies in particular are outsourcing some of their more routine back-office processes. In a similar way, many processes within the human resource function, from simple payroll services through to more complex training and development processes, are being outsourced to specialist companies. The processes may still be physically located where they were before, but the staff and technology are managed by the outsourcing service provider. The reason for doing this is often primarily to reduce cost. However, there can sometimes also be significant gains in the quality and flexibility of service offered. *'People talk a lot about looking beyond cost cutting when it comes to outsourcing companies' human resource functions'*, says Jim Madden, CEO of Exult, the California-based specialist outsourcing company. *'I don't believe any company will sign up for this [outsourcing] without cost reduction being part of it, but for the clients whose human resource functions we manage, such as BP, and Bank of America, it is not just about saving money.'*

The outsourcing debate is just part of a far larger issue which will shape the fundamental nature of any business. Namely, what should the scope of the business be? In other words, what should it do itself and what should it buy in? This is often referred to as the 'do-or-buy decision' when individual components or activities are being considered, or 'vertical integration' when it is the ownership of whole operations that are being decided. Vertical integration is the extent to which an organization owns the network of which it is a part. It usually involves an organization assessing the wisdom of acquiring suppliers or customers. And different companies, even in the same industry, can make very different decisions over how much and where in the network they want to be. Figure 6.3 illustrates the (simplified) supply network for the wind turbine power generation industry. Original equipment
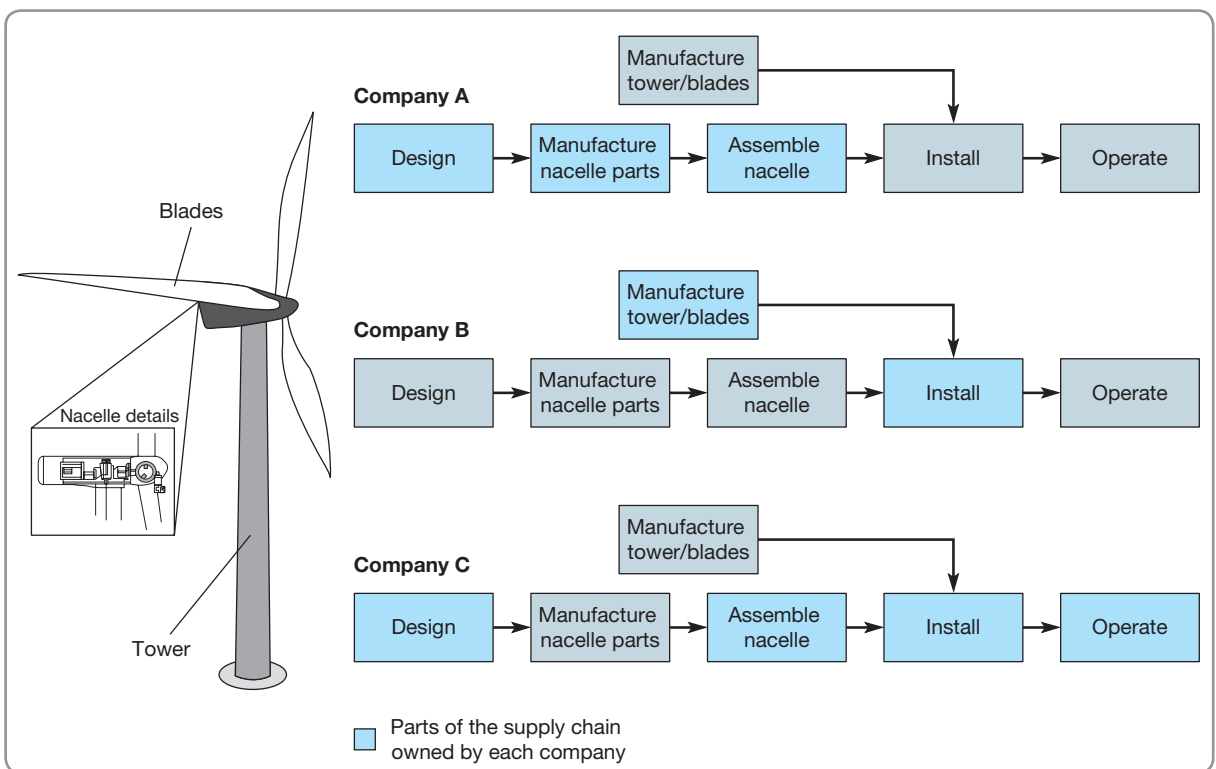


**Figure 6.3** Three companies operating in the wind power generation industry with different vertical integration positions

manufacturers (OEMs) assemble the wind turbine nacelle (the nacelle houses the generator and gearbox). Towers and blades are often built to the OEM's specifications, either in-house or by outside suppliers. Installing wind turbines involves assembling the nacelle, tower and blades on site, erecting the tower and connecting to the electricity network. The extent of vertical integration varies by company and component. The three companies illustrated in Figure 6.3 have all chosen different vertical integration strategies. Company A is primarily a nacelle designer and manufacturer that also makes the parts. Company B is primarily an installer that also makes the tower and blades (but buys in the nacelle itself). Company C is primarily an operator that generates electricity and also designs and assembles the nacelles as well as installing the whole tower (but it outsources the manufacture of the nacelle parts, tower and blades).

### Making the outsourcing or vertical integration decision

Whether it is referred to as do-or-buy, vertical integration or no vertical integration, in-house or outsourced supply, the choice facing operations is rarely simple. Organizations in different circumstances with different objectives are likely to take different decisions. Yet the question itself is relatively simple, even if the decision itself is not: 'Does in-house or outsourced supply in a particular set of circumstances give the appropriate performance objectives that it requires to compete more effectively in its markets?' For example, if the main performance objectives for an operation are dependable delivery and meeting short-term changes in customers' delivery requirements, the key question should be: 'How does in-house or outsourcing give better dependability and delivery flexibility performance?' This means judging two sets of opposing factors – those which give the potential to improve performance, and those which work against this potential being realized. Table 6.1 summarizes some arguments for in-house supply and outsourcing in terms of each performance objective.

> ✳ **Operations principle**
>
> Assessing the advisability of outsourcing should include how it impacts on relevant performance objectives.

## Outsourcing as a strategic decision

Although the effect of outsourcing on the operation's performance objective is important, there are other factors that companies take into account when deciding if outsourcing an activity is a sensible option. For example, if an activity has long-term strategic importance to a company, it is unlikely to outsource it. For instance, a retailer might choose to keep the design and development of its website in-house even though specialists could perform the activity at less cost because it plans to move into web-based retailing at some point in the future. Nor would a company usually outsource an activity where it had specialized skills or knowledge. For example, a company making laser printers may have built up specialized knowledge in the production of sophisticated laser drives. This capability may allow it to introduce product or process innovations in the future. It would be foolish to 'give away' such capability. After these two more strategic factors have been considered, the company's operations performance can be taken into account. Obviously if its operation's performance is already superior to any potential supplier, it would unlikely to outsource the activity. But also even if its performance was currently below that of potential suppliers, it may not outsource the activity if it feels that it could significantly improve its performance. Figure 6.4 illustrates this decision logic.

> ✳ **Operations principle**
>
> Assessing the advisability of outsourcing should include consideration of the strategic importance of the activity and the operation's relative performance.

## Outsourcing and offshoring

Two supply network strategies that are often confused are those of outsourcing and offshoring. Outsourcing means deciding to buy in products or services rather than perform the activities in-house. Offshoring means obtaining products and services from operations that are based outside one's own country. Of course, one may both outsource and offshore as illustrated in

**Table 6.1** How in-house and outsourced supply may affect an operation's performance objectives

| Performance objective | 'Do it yourself' in-house supply | 'Buy it in' outsourced supply |
|---|---|---|
| **Quality** | The origins of any quality problems usually easier to trace in-house and improvement can be more immediate but can be some risk of complacency. | Supplier may have specialized knowledge and more experience, also may be motivated through market pressures, but communication more difficult. |
| **Speed** | Can mean synchronized schedules which speed throughput of materials and information, but if the operation has external customers, internal customers may be low priority. | Speed of response can be built into the supply contract where commercial pressures will encourage good performance, but there may be significant transport/ delivery delays. |
| **Dependability** | Easier communications can help dependability, but, if the operation also has external customers, internal customers may receive low priority. | Late delivery penalties in the supply contract can encourage good delivery performance, but organizational barriers may inhibit in communication. |
| **Flexibility** | Closeness to the real needs of a business can alert the in-house operation to required changes, but the ability to respond may be limited by the scale and scope of internal operations. | Outsource suppliers may be larger with wider capabilities than in-house suppliers and more ability to respond to changes, but may have to balance conflicting needs of different customers. |
| **Cost** | In-house operations do not have to make the margin required by outside suppliers so the business can capture the profits which would otherwise be given to the supplier, but relatively low volumes may mean that it is difficult to gain economies of scale or the benefits of process innovation. | Probably the main reason why outsourcing is so popular. Outsourced companies can achieve economies of scale and they are motivated to reduce their own costs because it directly impacts on their profits, but costs of communication and coordination with supplier need to be taken into account. |
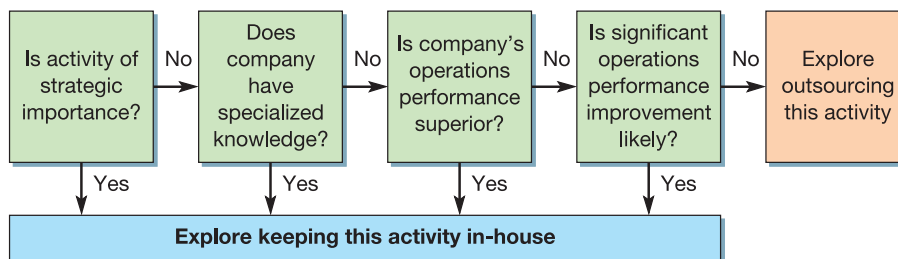


**Figure 6.4** The decision logic of outsourcing

---

**SHORT CASE** **HTC moves downstream**[2]

A few years ago, even mobile communication enthusiasts might not have heard of Taiwan's HTC. Yet the firm has long been one of the most important suppliers to better-known brands. HTC was an 'original design manufacturer', or ODM, developing and building high-end 'smart' phones for better-known Western mobile operators, including Verizon and Orange. And it's a good business. HTC had built an enviable reputation as an innovative and reliable supplier of sophisticated hand-held computers and mobile phones. However, Peter Chou, the Chief

Executive Officer of HTC, believed that the industry was changing. Regarded by many as a pioneer and visionary in the mobile industry, Chou could see the market becoming more difficult. Although still a profitable business, the margins from supplying other brands were shrinking. Chinese suppliers, with their lower labour costs, were providing stiff competition and customers had started to look for rival suppliers (which would increase their bargaining power). *'We needed to establish a new competency before we got into trouble',* explained Mr Chou. The way ahead, the company decided, was to move forward in the supply network and start developing their own brand. This new supply network strategy meant HTC had to develop new capabilities. More talent was recruited to strengthen its in-house design and software skills so that HTC products would have a unique look and feel. But the strategy was not without its risks. It meant investing in the marketing and sales operations that had, up till then, been the province of their customers. HTC also lost of much of its existing business, because some customers were reluctant to do business with a budding rival. Just as significant, the culture and objectives of the company had to move from

*'efficiently implementing what had been decided by one's customers'* to that of *'constantly developing radical and innovative new ideas'.*

Figure 6.5. Offshoring is very closely related to outsourcing and the motives for each may be similar. Offshoring to a lower cost region of the world is usually done to reduce an operation's overall costs, as is outsourcing to a supplier who has greater expertise or scale or both.[3]

## Critical commentary

In many instances there has been fierce opposition to companies outsourcing some of their processes. Trade unions often point out that the only reason that outsourcing companies can do the job at lower cost is that they either reduce salaries, reduce working conditions, or both. Furthermore, they say, flexibility is only achieved by reducing job security. Employees who were once part of a large and secure corporation could find themselves as far less secure employees of a less benevolent employer with a philosophy of permanent cost-cutting. Even some proponents of outsourcing are quick to point out the problems. There can be significant obstacles, including understandable resistance from staff who find themselves 'outsourced'. Some companies have also been guilty of 'outsourcing a problem'. In other words, having failed to manage a process well themselves, they ship it out rather than face up to why the process was problematic in the first place. There is also evidence that, although long-term costs can be brought down when a process is outsourced, there may be an initial period when costs rise as both sides learn how to manage the new arrangement.

## WHERE SHOULD AN OPERATION BE LOCATED?

There is an old saying in retail operations management, *'There are three important things in retailing – location, location and location'*, and any retailing operation knows exactly what that means. Get the location wrong and it can have a significant impact on profits, or service. In fact the same is true for all types of operation. For example, mislocating a fire service station