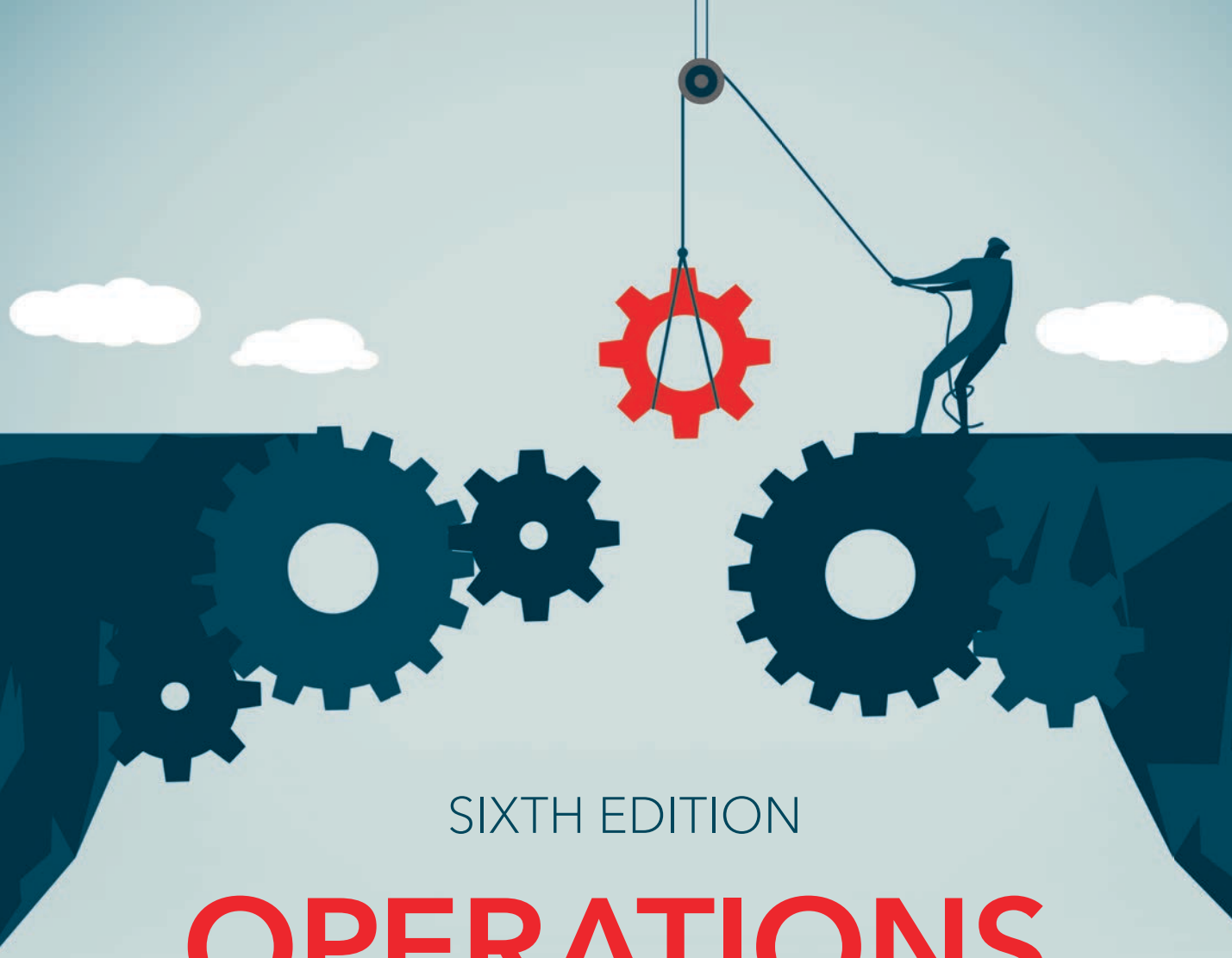


SIXTH EDITION

OPERATIONS STRATEGY

NIGEL SLACK
MICHAEL LEWIS

Pearson

Pearson

At Pearson, we have a simple mission: to help people make more of their lives through learning.

We combine innovative learning technology with trusted content and educational expertise to provide engaging and effective learning experiences that serve people wherever and whenever they are learning.

From classroom to boardroom, our curriculum materials, digital learning tools and testing programmes help to educate millions of people worldwide – more than any other private enterprise.

Every day our work helps learning flourish, and wherever learning flourishes, so do people.

To learn more, please visit us at **www.pearson.com/uk**

Table 4.1 Three levels of capacity decision

Level	*Timescale*	*Decisions concern provision of . . .*	*Span of decisions*	*Starting point of decision*	*Key questions*
Strategic capacity decisions	Years–months	Buildings and facilities Process technology	All parts of the business	Probable markets to be served in the future Current capacity configuration	How much capacity do we need in total? How should the capacity be distributed? Where should the capacity be located?
Medium-term capacity decisions	Months–weeks	Aggregate number of people Degree of subcontracted resources	Business – site	Market forecasts Physical capacity constraints	To what extent do we keep capacity level, or fluctuate capacity levels? Should we change staffing levels as demand changes? Should we subcontract or off-load demand?
Short-term capacity decisions	Weeks–hours–minutes	Individual staff within the operation Loading of individual facilities	Site Department	Current demand Current available capacity	Which resources are to be allocated to what tasks? When should activities be loaded on individual resources?

is forecast to handle 50,000 calls per week and one operator can handle a call every 3 minutes, then it may build a 63-station call centre (operators have 40 × 60 minutes a week, so can receive 2,400/3 = 800 calls a week, so 50,000/800 = 62.5, say 63, operators are needed). But capacity decisions are not always as simple as this. Although a 'single point' forecast of future demand for an operation's products and services will have a major influence on how big its operations will be, other considerations will affect the decision. It is these other factors, acting to modify a simple demand forecast that reveal much about the strategic context of operations decisions.

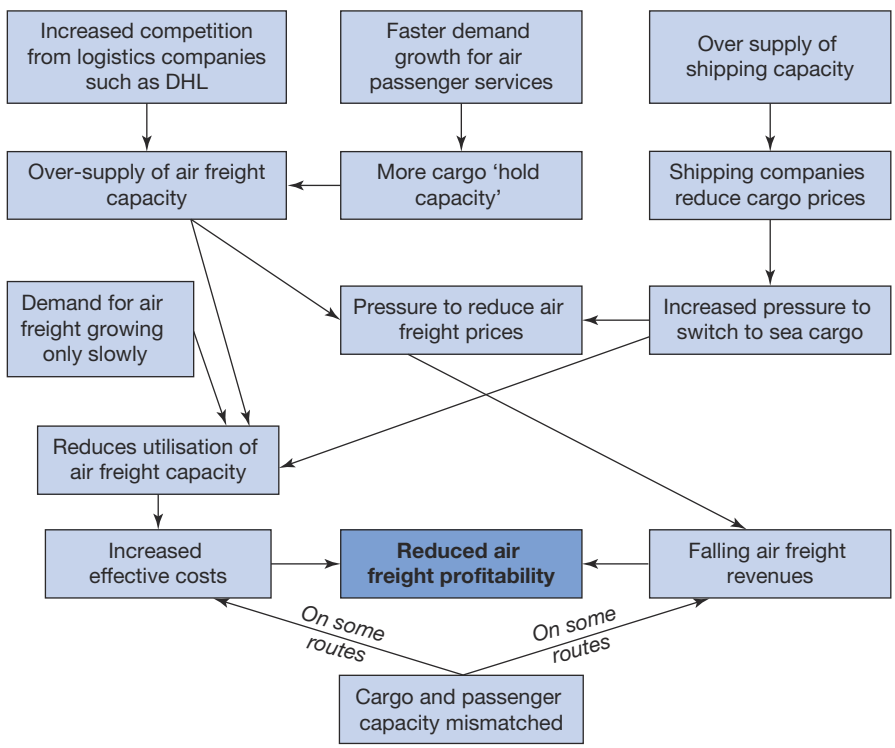
Example **Capacity, demand and price in airfreight[1]**

It was a shock to staff when Midex, which only a few years earlier had been the largest all-cargo airline in the Middle East, closed and its fleet of ten air freightliners was disposed of. It had fallen victim, not to a significant fall in demand but an over-abundance of supply that had cut freight prices and hence revenues. Yet, the international air-cargo business was large. It accounted for more than a third of world trade by value. And when Midex closed, demand had been growing, albeit slowly. What had collapsed was the prices that the air-cargo industry could command. In the five years prior to the closure, airlines' annual cargo revenues fell from a peak of $67 billion to around $50 billion, and in the previous ten years, freight revenues that provided 12 per cent of total airline revenues had fallen to 9 per cent.

What had happened in the industry illustrates that capacity strategy can be particularly challenging. There is often an interconnected, and sometimes complex, nature of capacity, demand, prices, and customers' ability to switch to alternative offerings. One culprit (as far as the airfreight industry was concerned) was the dramatic reduction in sea-freight prices. Overcapacity in that industry had resulted in up to a 75 per cent reduction in cargo rates over some routes. To make matters worse, air passenger volumes over this period were growing fast and airlines had increased their aircraft fleets to cope. This meant that there was increased space available in the holds of passenger flights for cargo, so the utilisation of cargo space fell to its lowest point for years. Not surprisingly, customers demanded (and got) significant price cuts. Yet, not all routes were equally affected. On some routes, airlines abandoned their cargo-only flights and carried all their freight in the belly of their passenger planes. While on other routes where there was more cargo than passenger aircraft could cope with, freight traffic was less affected. Also, on some particularly long routes such as those flying across the Pacific, many passenger aircraft do not have the range to take-off with a hold full of cargo.

If this were not enough for air-cargo companies, emerging distribution services offered by large and powerful logistics businesses such as DHL and FedEx were challenging them. With their integrated networks of planes, trucks and smaller vans, combined with their efficient distribution centres, they could offer a 'total' service that many e-commerce companies found attractive. While airfreight revenues were falling, FedEx and other integrated firms saw an increase in their profitability. Figure 4.3 illustrates these interactions.

Figure 4.3 The interplay between capacity, demand, competition, utilisation, costs and revenues can be complex, as in the airfreight example



Uncertainty of future demand

Even when the demand for an operation's products or services can be reasonably well forecast, the uncertainty inherent in all estimates of future demand may inhibit the operation from investing to meet the most likely level of demand. The economics of the operation may mean that should there be a lower level of demand, the financial consequences would be unacceptable to the company. There are also other consequences of over- and undersupply. For example, the availability of excess capacity may give an operation the flexibility to respond to short-term surges in demand. This could be especially valuable either when demand needs to be satisfied in the short term, or when satisfying short-term demand can have long-term implications; so, immediately after the introduction of a new product or service, especially when there are several competitors, is a bad time not to be able to satisfy demand. Market share lost at this point may never be regained. Paradoxically, though, in some circumstances, undersupplying a market may increase the value (and therefore price) of an operation's goods or services. Such a scarcity based strategy, however, does rely on an appropriate market positioning and a confidence in the lack of competitor activity.

Changes in demand – long-term or short-term demand?

In addition to any uncertainty surrounding future demand, there is also the question of the timescale over which demand is being forecast. For example, short-term expected demand may be higher than expected long-term sustainable demand. In this case, does an organisation plan to provide capacity to meet the short-term peak or, alternatively, plan to satisfy only longer-term sustainable levels of demand? Conversely, short-term demand may be relatively low compared to longer-term demand. Again, there is the same dilemma. Should the operation build capacity for the short or long term? Like many capacity strategy decisions, this is related to the economies of scale of individual operations and the ease with which they can add or subtract increments of capacity. The dynamics of changing capacity levels will be discussed later in the chapter. Here we are concerned with the decision of where initially to pitch capacity levels.

Long-term demand lower than short-term demand

Suppose a confectionery company is launching a new product aimed at the children's market. From previous experience it realises that it must make an initial impact in the market with many sales based on the novelty of the product, in order to reach a lower but sustainable level of demand. It estimates that initial demand for the product will be around 500 tonnes per month. However, longer-term demand is more likely to settle down to a reasonably steady level of 300 tonnes per month.

A key issue here is whether the higher level of demand will sustain for long enough to recoup the extra capital cost of providing capacity to meet that high level. Furthermore, even if this is the case, can an operation with a nominal capacity of 500 tonnes per month operate sufficiently profitably when it is only producing 300 tonnes per month? If the answer to either of these questions is 'No', then a capacity based analysis would tend to discourage investment at the higher level of capacity. The main problem with this approach is that it may prove to be self-fulfilling. Undersupplying the market may depress demand that would otherwise have grown to justify the 500-tonnes-per-month capacity level. It is more likely that competitors will take advantage of the company's inability to supply to increase their own share of the market. Of course, the company may wish to counteract any undersupply by adopting pricing and promotion strategies

that minimise the effects of, or even exploit, product shortage. The lesson here is that setting the initial capacity level cannot be done in isolation from the company's market positioning strategy.

Short-term demand lower than long-term demand

Again, the issues here are partly concerned with economies of scale versus the costs of operating at levels below the operation's capacity. If the economies of scale of providing capacity at the higher level of demand mean that the profits generated in the long term are worth the costs associated with underutilisation of capacity in the short term, then building capacity at the higher level may be justified. Once more, the relationship between capacity provision, costs and market positioning needs to be explored. Initial overcapacity may be exploited by producing at higher volume, and therefore lower costs, and pricing in order to take market share or even stimulate the total market. Indeed, overcapacity may be deliberately provided in order to allow such aggressive market strategies.

The availability of capital

One obvious constraint on whether operations choose to meet demand fully is their ability to afford the capacity with which to do so. For example, a company may have developed a new product or service that they are convinced will be highly attractive in the marketplace. Sales forecasts are extremely bullish, with potential revenues being two or three times higher than the company's present revenue. Competitors will take some time to catch up with the company's technological lead and so they have the market to themselves for at least the next two years. All of this sounds very positive for the company: its products and services are innovative, the market appears to want them, forecasts are as firm as forecasts can be and the company is able to make very healthy profits for at least the next two years. But consider what the company will have to do to its resource base. Irrespective of how novel or technologically difficult the new processing requirements are, there will certainly be a lot more of them. The company will need to increase its operations resources by two or three hundred per cent. The question must arise of whether it can afford to do this or, more accurately, whether it is prepared to face the consequences of doing this? Borrowing enough cash to double or triple the worth of the company may not be possible from conventional sources of lending. The owners may not wish to float the company at this stage. Other sources of finance, such as venture capitalists, may demand an equity stake. Under these circumstances the company may forego the opportunity to meet forecast demand fully. Even though in pure accounting terms the return on any investment in operating capacity may be perfectly acceptable, the consequence in terms of ownership or vulnerability of the company to being taken over may not be worth risking. An alternative for the company may be to increase capacity only as fast as their currently feasible borrowing capability will allow. The risk is that competitor companies will have the time to enter the market and reduce its longer-term potential for the company.

The cost structure of capacity increments – break-even points

One of the most basic, and yet most important, issues in capacity strategy is concerned with the relationship between the capacity of an operation, the volume of output that it is processing and its profitability. Simple break-even analysis can illustrate the basics

of this. Each additional unit of capacity results in a fixed-cost break. The fixed costs of a unit of capacity are those expenditures that must be incurred irrespective of how much the capacity is actually being used. The variable costs of operating the capacity are those expenditures that rise proportionally to output. As volume increases for one operation, the additional capacity required can move an operation through its 'break-even' point from profitability to loss. Further additions to the capacity of the operation will be needed to cope with increased demand. Each addition brings a new set of fixed costs. Fixed-cost breaks may mean that there are levels of output within which a company might not wish to operate. This issue is particularly important when the fixed costs of operation are high compared with the variable costs.

Figure 4.4 shows how this might be in one operation. Each unit of capacity can process 4,000 units of output per month. The fixed costs of operating this capacity are $2,000 per month and the variable costs $0.25 per unit. The revenue from each unit processed to the operation is $0.9 per unit. Demand is forecast to be steady at around 9,000 units per month. To meet this demand fully, three units of capacity would be needed, though the third unit would be much underutilised. As Figure 4.3 shows, when meeting demand fully the company's total costs are higher than its total revenue. It would therefore be operating at a loss. Under these circumstances, the company might very well choose to process only 8,000 units per month – not meeting demand but operating more profitably than if they were meeting demand.

Economies of scale

If the total cost of the output from an operation is its fixed costs plus its output multiplied by its variable costs per unit, then we can calculate the average cost per unit of output simply by dividing total costs by the output level. So, for example, Figure 4.5(a) shows the unit cost for an increment of capacity of the operation described earlier. However, the real average cost curve may be different from that shown in Figure 4.5(a) for a number of reasons.

Figure 4.4 Cost, volume, profit illustration