5.6 Production planning

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

- explain the difference between just-in-case (JIC) and just-in-time (JIT) stock control
- recognize the need for optimum stock levels; prepare and analyse appropriate graphs
- explain different stock control methods and analyse the appropriateness of each method in a given situation
- explain outsourcing and subcontracting, compared with provision by the firm itself
- make appropriate calculations to support a decision to make or buy

Stock control

Controlling inventory levels is very important for a business. The business has to get the balance between not holding a certain level of stock because of emergencies (just in case, or JIC) and holding minimal levels and only ordering stock (just in time, or JIT). There are arguments in favour of each method but the trend at the moment is in favour of JIT methods.

JIT		JIC
Stock is only brought in from suppliers as and when it is required. The aim is to hold low (even zero) levels of stock.		Stock is brought in and stored with a reserve (the buffer stock) kept back from daily use just in case of need.
JIT: improves the cycle of money that the business needs for its day-to-day activities, which is known as working capital		JIC: reduces pressure on the cash flow
reduces costs (storage and wastage)		reduces costs (by buying in bulk)
reduces the chance of holding obsolescent or unsellable stock	?	means that you can meet sudden changes in demand
means less chance of damage or ruined stock		provides spare parts should the need be to cannibalize
creates more space for alternative production plans		means that all stock is stored–ready to use. There are no delivery issues.
creates a closer relationship with suppliers–they need to run JIT too!		has the advantage that suppliers don't charge a premium price for the outsourcing of stock holding.

Table 5.17 Comparison of JIT and JIC

Data response exercise

Read the text below and answer the questions that follow.

Case study

Building a Boeing 747

The manufacturing of a Boeing 747 is done in seven stages, which take on average six months to complete in total. The engines are bought from a supplier (Rolls Royce) in time for the sixth stage as buying them and storing inventories for five months would be expensive. The engines cost approx $10 million each.

Generally, Boeing can sell a 747 for $200 million.

Examination questions

1 Define inventories. [*2 marks*]
2 Explain how delaying the purchase of the engines might affect Boeing's cash flow. [*4 marks*]
3 Evaluate the effectiveness to Boeing of using this system of stock control. [*8 marks*]

HL

As the debate over whether to use JIT or JIC goes on, many businesses continue to use the more traditional methods of stock control. While a lot of stock control is now computerized there is still a need to understand the process—and anyone who has worked in a warehouse will know that what it says on a computer screen may not be what they will find on the shelves.

As we've seen, there are two sides to the question of holding stock. On the one hand, there is the cost of not having stock when required—the cost of lost orders and emergency deliveries. And on the other hand, there is the cost of holding too much stock—the cost of storage and damage.

We can combine these two sets of costs in Figure 5.18.

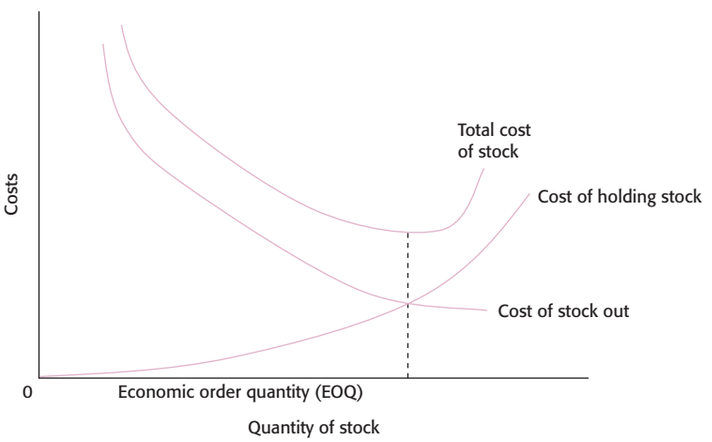


Figure 5.18 Costs of holding stock and of stock out

- *Cost of holding stock.* If we do not have any stock there is no cost but then the cost rises as we store more and more units.
- *Cost of stock out.* If we have a small amount of stock then the cost of having a sudden surge in demand can be huge but this will go down the more stock we buy in.
- *Total cost.* By combining the two sets of costs we can see that the minimum point of the total cost is what we call the **economic order quantity** (EOQ) and this is the amount that should be ordered for a given time period. Usually the calculations are made on an annual basis.

Traditional stock control diagram

Together with the EOQ the process of controlling stock is shown by using the following terms.

- The initial order: the first amount of stock delivered, say at the start of the year.

- Usage pattern: how much stock is used over a given time period. Usually the pattern is considered to be regular or at least to have predictable highs and lows (Christmas, Chinese New Year, school holidays, etc). In general, the stock is depleted over time and so is shown by a line with a negative slope.
- The maximum stock level: the maximum amount of stock held at any one time.
- The minimum stock level: the amount of stock that is kept back as a reserve, sometimes called the buffer stock. The amount of stock never goes lower than this level.
- The reorder level: when the stocks are depleted to a set level which is then the signal to order a new amount of stock
- The reorder quantity: the amount of stock that is ordered each time.
- Lead time: how long the stock takes to be delivered.

A typical stock control diagram may look like Figure 5.19.

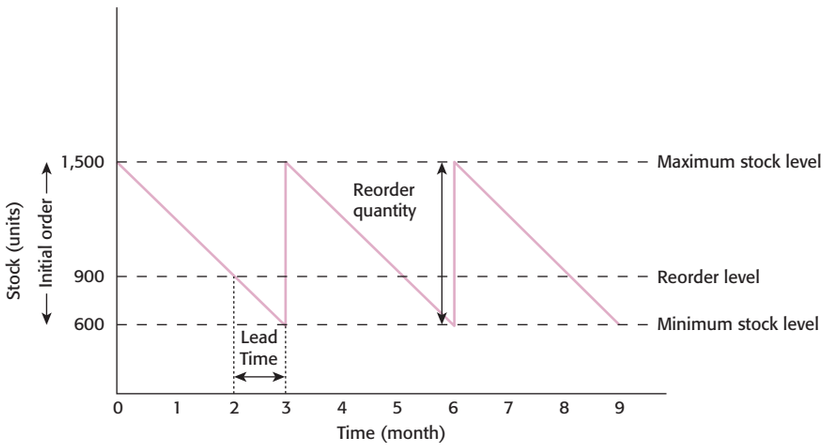


Figure 5.19 Stock control diagram

In the example shown in Figure 5.19—let's say it's a company making phones for Nokia—the factory staff may order an initial delivery of 1,500 hand phones and they want always to keep a reserve of 600 phones just in case. The factory's production manager has calculated that, barring unforeseen changes in usage patterns, he will run through 900 phones over a three-month period.

After two months he knows that stock will run down to 900 phones and that is when he arranges for a new delivery of phones to be made from their suppliers. It takes one month for that reorder quantity of 900 phones to arrive and when they do the whole cycle is continued.

Of course this is a simple example, but we can alter the usage patterns to take account of seasonal differences and odd surges in demand. Indeed, many businesses will also have the software to do this but the basic diagram remains as shown in Figure 5.19. And it is a very useful tool for production managers to see where the stress points are likely to be and how to resolve them.

Optimal stock levels

In order for a business to calculate the optimal level of stock, there are a number of factors that need to be taken into account.

- *The market.* Is it growing? Is the business increasing sales? Are there any new organizations coming in to the market?
- *The final product.* What type of product is it? Is it a cheap, single-use, fast-moving, high-volume product or is it the opposite? Is it a complex product requiring many individual components?
- *The stock.* Is it perishable? Is it likely to be out of date? Is it big—will it take up much storage space?
- *The infrastructure.* Is it reliable or is there a need to stockpile? Will, for example, the weather have a bearing on the ability of suppliers to meet demand?
- *The finance.* Does the business have the required money at the right time? What possibilities for credit do the suppliers allow? Are there going to be significant savings from buying in bulk?
- *The human resources.* What are the implications for resourcing changes in stock holdings?

Using the EOQ and stock control diagrams, businesses may get some idea of the correct amount of stock to order and when, but overall it is difficult to judge precisely. They should be aware that many factors can change and this creates more pressure depending on the system that they are using. It is for this reason that the JIT system requires greater coordination and cooperation with the suppliers than the JIC system which, although it may tie up a lot of funds, can be safer.

Capacity utilization

Production managers often want to know: How efficient is the facility? Is it being used to its maximum capacity? For example, a hotel may want to know what the occupancy rate of its rooms is, a factory may want to know how often a machine breakdown affects the work done, or a school principal may want to know whether there is a chance to use the school's facilities more at weekends and holidays by renting the site out.

Of course, it would be theoretically possible for a hotel to be full all year round, or a factory to work at full capacity—that is 24 hours a day, 365 days a year, or in fact a school to house a day school and a night school in the same buildings. But the reality is that even then (using one of our examples) there will be times of year when it is impossible to fill all the hotel rooms, and in fact the hotel may use some slack time to update or otherwise overhaul the facilities. Similarly, slack time will be used in factories if machines need to be "rejigged" or the site needs to be cleaned and maintenance done. The same is true of cleaning and maintenance in schools—and even teachers will need to sleep sometimes. So in practice it is often not possible to achieve 100% capacity utilization but many businesses would still aim to get as close as is possible to this figure.

There is a simple formula to calculate capacity utilization:

$$\text{Capacity utilization} = \frac{\text{Actual production}}{\text{Productive capacity}} \times 100 \quad (14)$$

Improving your supply chain—the Australian way

1. Check your inventory levels—produce to order, rather than for stock.
2. Consider smaller production runs with greater customization.
3. Conduct a survey of customers and suppliers.
4. Use the available advice from governments and professional associations.
5. Look for ways to expand your customer base.
6. Examine the available logistics technology to see what is most suitable for you.
7. Review your payments procedures to ensure stable cash flow.

Source: www.theaustralian.news.com.au

For example, if a hotel has 100 beds and on average 80 are filled then the capacity utilization is 80%. Similarly, a factory might be able to make 100,000 pairs of shoes in a year, but it only has orders for 40,000. Its capacity utilization is 40%. Finally, a school with sufficient space for 3,000 students which has 2,900 students on the register has a 96.6% capacity utilization.

Businesses that should aim for a high capacity utilization will be ones where profit margins are low, for example budget airlines or fast food outlets. These businesses cannot afford to lose any opportunity to sell the product and so will need to market their product accordingly. At the other end of the range, business class travel or Michelin five-star restaurants will not need and may not wish to aim for high-volume sales.

Outsourcing and subcontracting

A business can cut costs and so lower prices in order to earn a competitive advantage using **outsourcing** (also known as sub-contracting or contracting out work); which is where a business cuts back on its operations to focus on its core activities. There is an extension of outsourcing known as **offshoring** whereby a business can outsource outside the home country. With improved global communication this has been a growth area in the modern business environment. India, for example, has seen a huge growth in IT offshore contracts such as call centres and help desks signed up with Western businesses.

Traditionally, a business may have had a number of activities happening on a day-to-day basis, many of which may not have been part of the core business skill sets, so they become transferable and thus a saving for the business. By buying in these peripheral services from producers who can achieve economies of scale because they are specialists in that particular service, the main business can reduce costs.

Imagine that the costs of a business can be represented by circles and comprise the two different elements—core and periphery. The change can be clearly seen in Figure 5.20.

Let's return to an example used on p. 98—when we looked at what functions a school could contract out. For example, the school might have as its core activity the teaching but it can then outsource such services as:

- catering
- transport
- duties and invigilation
- coaching
- expeditions
- staff training
- recruitment
- security
- maintenance
- cleaning.

All of these could probably be provided at a lower cost and with a better result than if the school tried to complete all the tasks itself.

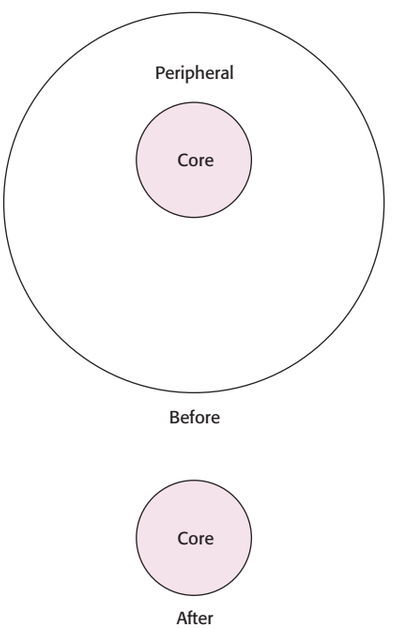


Figure 5.20 Core and peripheral elements

In the wider business environment typical, activities that are outsourced are:

- marketing—for example using an advertising agency
- production—for example licensing a producer to make your product
- HR—for example employing an agency to "headhunt" potential staff
- finance—for example hiring accountants to run an external audit.

Outsourcing can bring many advantages.

- It can reduce costs by losing employees and other assets.
- Costs can be restructured by reducing the fixed asset element.
- It can allow the business to focus on its core activities.
- The quality of the product that is produced should improve.
- It can lead to improved capacity utilization.
- Delivery time can be reduced.
- It can lead to transfer of expertise.

However, there are some very real risks involved by outsourcing and these problems can especially be made worse if the business offshores some of its production.

- There will be a different corporate (and national) culture, but for outsourcing to work there has to be "**synergy**".
- The business becomes more dependent on the supplier (reliability, for example for deliveries, can be an issue).
- The business has less control of the final product (there may be issues of quality and ethics, for example use of sweatshops).
- Communication can be difficult (especially when people are having to deal with different languages and time zones).
- Dilution of the brand can be a problem—if the consumer realizes that product "x" is not produced by company "y".

There are many reasons why businesses still prefer to produce at source rather than by outsourcing and especially by offshoring. In fact, there is also a new idea beginning to gain ground in the business environment—**insourcing**, that is, reversing the trend by taking back jobs lost to offshoring overseas by focusing on the quality end of the market. Particularly with service-based products, there is a lot to be said for local knowledge.

Make or buy decisions

Very often the decision about whether to outsource or not hinges on costs and at the root of this is the idea that it can be cheaper for a business to buy a product made elsewhere than to make it themselves. The decision can be shown very clearly by using the costs and revenues formulae in the section on costs and revenue (p. 234–235) to create cost to buy (CTB) and cost to make (CTM) equations:

$$CTB = P \times Q \quad (15)$$
$$CTM = FC + (VC \times Q) \quad (16)$$

For example, imagine that a small international school in South East Asia has to decide whether to subcontract the bussing in of students

or to provide the service themselves. What if the school requires 20 buses and a company called School Run charges $10,000 a bus for the year? Then according to the formula

$$CTB = P \times Q$$

this service would cost the school:

$$\$20 \times \$10{,}000 = \$200{,}000$$

On the other hand, if the school could buy the 20 buses from Dodgy Dealers Inc. for $100,000 but faced variable costs of $10,000 a bus for fuel and the driver's wages over the year then the cost to make the service using the other equation

$$CTM = FC + (VC \times Q)$$

would be:

$$\$100{,}000 + (\$10{,}000 \times 20) = \$300{,}000$$

In this case CTB < CTM so the school should outsource.

Of course, this example ignores many of the factors that may have a bearing on the supply chain. For example, how reliable are the buses bought from Dodgy Dealers? What are the implications of the school employing drivers as opposed to someone else doing so? When deciding on what action to take, a business would take qualitative factors such as these into account as well.

Data response exercise

Read the text below and answer the questions that follow.

Case study

Supply chains should be kept on a short leash

Simon Caulkin, the *Observer*, 27 April 2008

The big business idea of the last 20 years is going rancid. Last week, Boeing's embarrassed chief executive announced the third major delay to its much-hyped 787 Dreamliner project.

Unbelievably, although nearly 900 of the aircraft have been sold, its profitability is in question as the firm's global **supply chain** cracks up. At the heart of the problem is the "Dell model" (after the computer manufacturer), applied to the project's funding and management. Industry researchers say that Boeing's attempt to minimise financial risks by maximising the number of development partners has had the opposite effect: outsourcing on this scale (80 per cent, including large and complicated components) has actually increased the risk of project and management failure.

Boeing should have paid heed to the experience of Dell, which posted a powerful warning on the dangers of paying more attention to the supply than the demand chain: being good at giving customers what they get is not the same thing as being good at giving them what they want.

But it's not only computer and aerospace companies that are learning these lessons. One automotive component maker was shocked to discover that parts arriving for final assembly in the US had spent up to two years shuttling between 21 plants on four continents—when it had only actually taken 200 minutes to make them. Much of the work was done in China to benefit from lower labour costs, but any advantage was more than offset by the costs of managing and scheduling inventory in the tortuous supply line. With hindsight, the China move was rated "a disaster".

Yet undeterred, service industries are now making exactly the same mistakes. In theory, since there is nothing physical to make or transport, services are ideal candidates for disembodied processing and reassembly by low-cost labour in foreign parts. But state-of-the-art call centres and distant graduates are quite often the wrong answer to the wrong question. A friend [in the UK] trying to get to Norwich [from the north of England] over Christmas spent ages on the phone to India working out how to do it without taking 24 hours [because of delays and cancellations]. When he got to Liverpool Street the man on the spot told him: "Go to King's Cross, mate: trains to Cambridge aren't affected, then change for Norwich." Similarly, when your cable broadband is down, you don't need someone thousands of miles away reading from a script, but a spotty youth around the corner who will sort it out for £60 and a supply of cola or coffee.

Why do companies—and public-sector organisations—continue to get this so wrong, pursuing the will-o'-the-wisp of cost reduction with measures that end up increasing them? Aided and abetted by consultants and computer firms that should know better, they are prey to three management myths.

- One is **economies of scale**. Manufacturers and service outfits alike think they can cut costs by mass producing processes in vast specialist factories. They can't, because of all the unanticipated costs noted earlier: carrying and transport costs (for physical inventory) ramifying the possibility and consequences of mistakes, re-work (mopping up complaints about things not being done or being done wrongly), knock-on costs up and downstream, and finally the management costs of sorting it all out.
- The second myth is that there's no alternative because **quality costs more**. Yet quality—in the sense of giving customers what they want, no more, no less—costs less, not more. This is because if you do just that, a) you don't incur the cost of giving them what they don't want, and b) indirect costs fall too, since there are fewer mistakes to rectify.
- Third, companies habitually overestimate the coordinating power of markets (and thus the attractiveness of short-term outsourcing to India and China) and underestimate the role of organisation. But while the internet can undeniably cut the cost of some market coordination, for any complex task a good organisation can still out-compete what can be supplied unaided by the market—which is why we still have organisations in the first place.

For both products and services, the principles are the same. Supply chains should be as short as possible in both time and distance; small and local, from police stations and GPs' surgeries to banks and computer firms' call centres, almost always beats large and remote. Expertise should be upfront, whether on the production line or the phone, where it can respond immediately to the customer. The title of a report from the Cambridge Institute for Manufacturing, "Making the Right Things in the Right Places", says it all: in a globalised, virtual world, location and supply-chain decisions are more critical, not less.

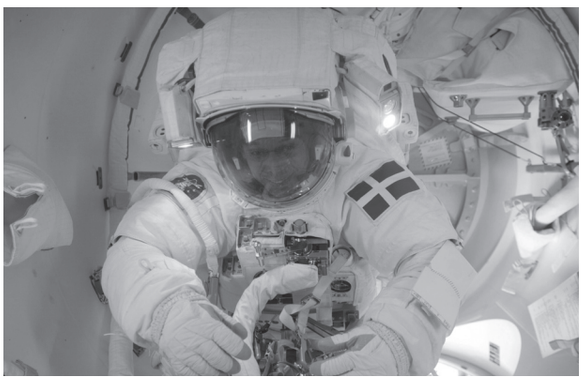
Examination questions

1 Define the terms in bold. [*6 marks*]

2 Explain how Boeing can "minimise their risk by maximising their development partners". [*4 marks*]

3 Discuss the costs and benefits to Boeing of outsourcing the 787 plane. [*10 marks*]

Case study



Christer Fuglesang will do two spacewalks on the mission

Swede prepares for critical mission

by Irene Klotz, Kennedy Space Center, Florida

With the arrival this week of space shuttle Discovery at its launch pad, NASA has begun the final round of preparations for a critical space station assembly mission that promises to test the mettle of the seven-member crew.

In the thick of a complicated series of tasks to rewire the station—hopefully without serious interruption to the resident crew aboard—will be Sweden's first astronaut, Christer Fuglesang. He is a 49-year-old particle physicist who joined the European Space Agency (Esa) astronaut corps 14 years ago.

Though this will be Fuglesang's debut space flight, he will have his hands full. Fuglesang is paired with veteran Nasa astronaut Robert Curbeam for the first two spacewalks of the mission.

During the first outing, the pair will install a new external truss segment onto the station's structural backbone. Two days later, another spacewalk is planned to begin critical work to hook up the station's permanent electrical and cooling systems.

The work scheduled for the Discovery crew must be finished before any more station assembly missions can be flown. Nasa is under a strict deadline to complete construction before the shuttle fleet is retired in 2010. There are no other spaceships designed to carry and install the station components.