

Essential Operations Management Lecturer resources

Guideline answers to study activities (discussion questions and assignments)

This document contains teaching suggestions, tips and sample answers for the study activities (discussions questions and assignments) within each chapter. Discussion questions will help students to debate and apply what they've learned from the chapter, whilst assignments are more in-depth individual or group exercises that can be set for completion out of class.

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Managing Operations

1

Teaching resources for study activities

Discussion questions

1 What is operations management? What are the key elements of the operations task? Illustrate your answer with examples.

The rationale for setting this task is to encourage students to reflect on the content of Chapter 1, extract the detail relevant to the two-part question and thereby reinforce their understanding of the key role of operations within a business.

a) What is operations management?

Operations management is the function in an organization that is responsible for the resources necessary to deliver services and/or make products.

b) What are the key elements of the operations task?

The key elements of the operations task are listed below. When discussing these with students it is useful to relate them to a couple of real-life companies or organizations that students recognize and can relate to. This is especially helpful given that many students may not yet have worked in an organization. Choose one organization from the service sector, such as a bank branch or fast food chain and one from manufacturing, such as a car/automobile plant or electronics manufacturer. The key elements can be subdivided into day-to-day tasks, strategic role, and the style of management.

Day-to-day tasks

- *Managing a large cost centre* – involves the assets (such as the equipment and buildings) and costs (most staff are involved in operations plus material costs and overhead costs such as maintenance and power)
- *Managing people* (also see the section below entitled 'style') – the bank staff in the front and back office will primarily report in the operations function as would the assembly workers and support staff in a car/automobile plant

- *Managing the short-term* – for example, serving customers and keeping queue lengths to acceptable levels in the bank and scheduling materials, organizing assembly teams on each shift, and ensuring that the scheduled number of vehicles are made each day with no rejects.
- *Managing technology* in terms of meeting the service/product specification. While specialist staff (such as IT and engineering) would typically design and maintain the systems, it is the task of operations to ensure that these systems allow those delivering or making the services or products to meet the design specifications.
- *Using the common denominators of time and money* – calculating the staff required would use time as its base while the performance of the bank branch or car/automobile plant would be measured in financial terms.
- *Linking the thinking and doing ends of the business* – an operations manager would be part of the executive team and yet need to ‘walk the floor’ and communicate with staff at all levels in the organization.
- *Managing complexity* – the size of both examples makes for a most complex management task in terms of the number of staff (see the section below entitled ‘Style – managing people’), number of customers served (the bank), number of products made (the plant), the costs involved, and the need to aim for a target of zero defects.

Strategic role

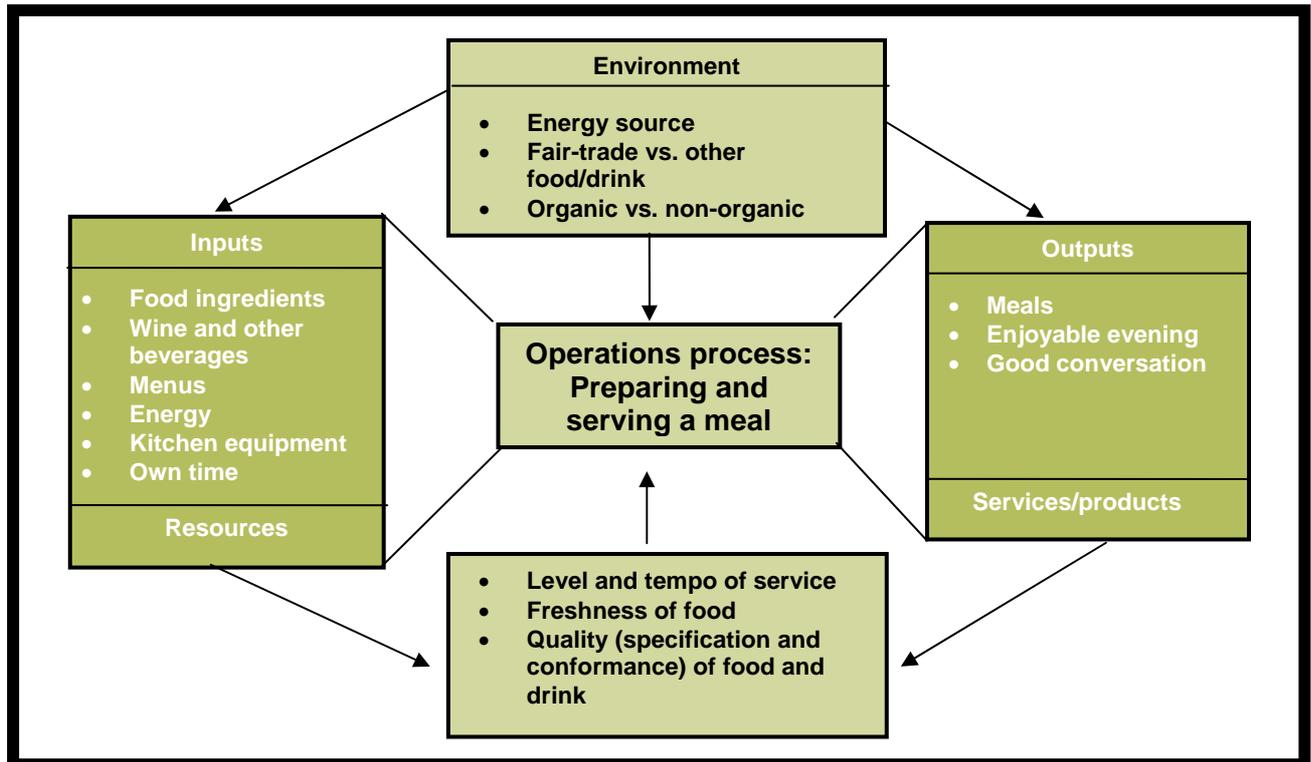
- Meeting the order-winners and qualifiers of a company’s markets for which operations is solely and jointly responsible.
- Because of this, operations has a key role in retaining and growing market share.

Style – managing people

- Internal role – managing people within the operations function itself and those in the functions that interface with operations
- External role - managing people outside the organization at both the supplier and customer ends of the supply chain. In the bank this would include outside cleaning, maintenance and cash delivery services on the one hand and the bank’s own customer on the other. In the car/automobile plant this would include material and parts suppliers and employment agencies on the one hand and the company’s car dealerships on the other.

2 Identify an operations system in your own life. What are the inputs, operations process activities and outputs involved?

The purpose of this exercise is to get students to undertake an operations process review of a task that they understand and have experienced and one that is relatively simple to review. The one provided below is undertaking the task of preparing a meal for friends.



3 Select two service and two manufacturing businesses of your own choice. From an operations perspective, what are the similarities and differences that exist?

The purpose here is to get students to think about a range of businesses from an operations perspective. Again it has been found best to choose businesses that students can visualize as often they have limited experience of organizations. Suggestions are given below.

Services

You could ask students to compare:

- A fast-food restaurant
- A sit-down restaurant

Similarities	Differences
Both organizations serve food	In a sit-down restaurant there tends to be more choice

	A sit-down restaurant is more expensive
	In a fast-food restaurant the customers are more involved in the service delivery system as they go to the counter, select the food and drink, pay for and collect the food, take it to a table and clear away before leaving
	A fast-food restaurant provides a faster service

Manufacturing

You could ask students to compare:

- A car/automobile plant
- A soft drinks bottling plant

Similarities	Differences
Both make high volume products	<ul style="list-style-type: none"> • In a soft drinks bottling plant, the process completes most, if not all, the task with little intervention by staff. • In a car plant, the staff are involved in the assembly of the vehicles.
There is seasonal demand for the items produced by both organizations	<ul style="list-style-type: none"> • In the bottling plant, the process handles 'different' products and will have to be stopped to allow any change to be completed. For example: <ul style="list-style-type: none"> – change of labels and packaging with different language requirements – more than one soft drink is processed by the bottling plant and, therefore, parts of the process would need cleaning between one product and the next • The soft drinks plant having to be stopped and re-set for packaging and/or product changes explained above makes this a linked-batch process.

There is only a small amount of 'manufacturing' that is actually completed by each company, in that:

- a car is assembled from parts made elsewhere
- soft drinks are mixed and bottles are filled and packed by the process

- **In a car/auto plant, staff assemble the cars/automobiles**
- **Even though there are many options (e.g. engine sizes and colours) the process has been designed to cater for these without having to be stopped and re-set. This is a line process in that it doesn't have to be stopped and re-set to accommodate product changes**

4 Select two functions other than operations within a service or manufacturing business. For each, identify three links to operations and explain the key dimensions of the activities involved and how they would assist operations to complete its tasks and responsibilities.

Please note, the example given here is that of a service business, as many students will have had little or no exposure to a manufacturing company. But, if using this question as part of class discussion you could use whatever example is most relevant to your students.

Looking at the example of a call centre in the services industry and taking the two functions of IT and human resources, you could identify the following links to operations:

IT department

- Improving/simplifying existing IT systems will reduce costs and speed up the process of dealing with customers' requirements.
- Developing existing/introducing new systems to speed up the process of dealing with customers or increasing the range of services on offer.
- Training staff how to use the IT systems – increases staff competence and makes operations staff move flexible in terms of the range of tasks that they can undertake.
- Maintaining the IT equipment to ensure that the equipment is working as it should will assist in operations in its day-to-day tasks.

Human resources

- Recruiting staff with the required levels of skills or potential to undertake the tasks involved will ensure operations runs as well as it can.
- Non-IT training also ensures that staff are able to do their jobs.
- Handling personal problems: ensure adequate time is given to these needs and that a consistent response is provided throughout the organization.

Assignments

1 Analyse the operations function in the university or college department in which you are registered or in the company in which you work in terms of:

- **The key operations responsibilities**
- **The size of the operations task**
- **The operations function in the context of the rest of the university/college department or organization**
- **Four factors that illustrate the complexity of the operations task. Give reasons for your choice**

To provide a common base for analysis, here are some aspects of the operations tasks within a college or university department:

Key operations responsibilities:

- Lecturers' timetables
- Class timetables and lecture hall / room allocations
- Handling student queries
- Ensuring information is given to students
- Recording the marks for assessments and examinations
- Organizing examination timetables
- Organizing degree ceremonies
- Arranging examination boards and external examiners
- Arranging student placements where these are part of the course.

The size of the operations task:

The number of students (remember there will be several degree courses comprising 3 or 4 year programmes) and the number of faculty and the timetabling tasks point to a sizeable operations task.

The operations function will need meet the needs of rest of the university departments, where relevant:

- Departments providing courses that can be taken by students from other departments.
- Lecture halls and rooms shared by all departments.
- Other shared resources across the university or college.

Four factors that illustrate the complexity of the operations task:

- Timetabling
- Ensuring the correct room allocations are made (in terms of size) depending on the number of students selecting a course, particularly where options are involved.
- Handling the wide range of queries, problems and concerns from all the students in the department.
- Organizing the examinations, marking and examination boards within the time constraints between the end of the examination programme and the degree ceremony.

2 Consider the following processes that you frequently encounter:

- **Enrolling on a course**
- **Buying lunch**
- **Buying a ticket for a concert or the cinema.**

Identify the inputs, operations process and outputs involved.

The purpose of the question is to reinforce students' understanding of the operations process as a central part of the operations management task. Students should follow the approach used in both Figure 1.4 and the answer to Question 2 of the 'Discussion Questions' for this chapter.

Operations Strategy

2

Teaching resources for study activities

Discussion questions

1 Why should all functions within a company, including operations, participate in business-level strategic planning?

It is useful here to refer back to the section of the chapter on levels of strategy, which deals with business unit and functional strategy. This section can be used to reinforce a class discussion and as a starting point for any issues raised.

- Companies/organizations tend to split their total business activity into 'functions' in order to handle the complexity that comes with size. It is particularly crucial that all these parts are brought back together at the level of strategy and work as a 'whole' business.
- Identifying the current and future markets in which to compete is an essential strategic task in which all relevant functions need to be involved. The contributions of both marketing and operations in Case 2.1 were vital to providing a variety of viewpoints which would strengthen the overall strategy.
- Reinforce discussion by referring to Cases 2.1, 2.2 and 2.3.
- The strategy making processes depicted in Figure 2.3 and Figure 2.4 can be compared with each other.
- Figure 2.6 can be used to visualize how markets should be at the centre of strategy developments and how major functions should link their strategies together and to markets.

2 In the early 1970s, when the Japanese entered the European colour television market, they took market share partly on the basis of providing higher levels of quality conformance. Explain how the improvement of this factor worked in terms of gaining sales. In the period of the early 1970s, was quality conformance an order-winner or a qualifier in the European colour television market? And which is it in today's market? Explain your reasoning.

In the early 1970s (and as with most markets), quality conformance would have been a qualifier in the European colour TV market in that competitors would have provided much the same level of conformance to the design specifications of their colour TV sets.

When the Japanese companies entered this market (as they also did in the car/automobile and other markets) they raised the bar on the dimension of quality by offering a much higher level of conformance (for example, fewer problems, less faults and so on) to the extent that they changed quality conformance from a qualifier (where existing companies provided a similar level) to an order-winner (where Japanese companies' level of conformance was markedly higher). As a result, customers started to choose Japanese-made colour TVs because they became seen as more reliable with fewer problems.

In today's market, non-Japanese manufacturers have been forced to improve their own levels of quality conformance to match that of their Japanese competitors such that this factor has reverted back to a qualifier. When customers wish to buy a colour TV today, a fault-free product is the expectation rather than being a selling point that differentiates a certain type of TV from its competitors.

3 Why would delivery reliability typically be designated an order-losing sensitive qualifier (QQ) for a carton company supplying packaging to a food company?

A food packaging company would invariably use a high volume process such as line to package its products. As you can imagine, it would be very costly for the food company to stop mid-way through a production run as a result of not having cartons. Additionally, changing its schedule would not always be feasible or may result in supply problems to its own customers.

For these reasons, reliable delivery would be designated as a QQ to highlight the fact that failing to deliver on time would quickly lead to a loss of repeat orders from a customer.

4 Why are operations-related considerations becoming more important in formulating business strategy? Describe one example from both the manufacturing and the service sector (other than those given in this chapter) that illustrate how they have gained competitive advantage from operations.

The increasingly competitive nature of today's markets brings additional pressures from customers. These pressures show themselves in a range of factors (many of which are provided by operations) as the examples below illustrate:

Order-winner or qualifier		Function with prime responsibility for provision
Price		Operations
Delivery	Reliability	Operations
	Speed	Operations
Service or product range	Design	Services = Marketing Products = Research and Development
	Provision	Operations
Customer relationship		Marketing
Quality conformance		Operations
New services or products	Design	Services = Marketing Products = Research & Development
	Provision	Marketing or Research & Development and Operations

Students will obviously think of their own examples for this question but here are a couple of examples you could discuss in class to get them thinking about the topic:

- Services – a good example here is McDonalds' dominance of the fast food sector with its low-priced products provided with short lead times (customers queue only for a short time) and high levels of quality conformance (products are made to the same specification and offering the same taste and consistency no matter which outlet you visit).
- Manufacturing – a good example here is in the car/automobile sector, where Japanese companies have entered established regions throughout the world (such as North America and Europe) and are now major players. For example in 2009 General Motors lost its position as the world's number-one automobile company to Toyota.

5 Many companies fail to appreciate the fact that the most critical orders are the ones to which a company says 'no'. Explain.

In many organizations, the importance placed on sales revenue growth coupled with declarations in the past that 'the customer is always right' or that 'the customer is king' has resulted in companies accepting orders no matter what. Sales revenue growth was (and often still is) the predominant (or even the only) measure of a business's success.

What the phrase 'the most critical orders are the ones to which a company says no' seeks to highlight is the reality that not all business contacts are as good as others. This is illustrated well by Case 2.2, where a large energy distribution company discovered that profit margins for its large business customers were, on average, more than 40 per cent lower than for its SME customers.

As a result, it is essential that companies analyse customers and/or markets in terms of factors such as profit margins and the demands customers make (for example, schedule changes and short leads times) to provide a fuller assessment of which customers/markets it is in their best interests to grow.

The decision to say 'no', therefore, can only be made where a company knows which customers it wishes to grow (i.e. to which to say 'yes'). The significance of saying 'no' means that a company understands where it wishes to grow and where it wishes not to grow (i.e. that it has formulated a coherent business strategy).

Assignments

1 Identify the order-winners and qualifiers for the following enterprises:

- **A private hospital company**
- **A company hiring cars for business or leisure**
- **A pharmaceutical company**
- **A furniture removal company**

The list in the table below can be supplemented, but the purpose here is to provide an example of how you might ask students to structure their answers, and what the end result would look like.

You may also wish to get the students to weight the order-winners and so provide detail similar to that in Figure 2.13.

Enterprise		Order-winners and qualifiers				
		Price	Delivery		Quality conformance	Expertise – product or staff
			reliability	speed		
Private hospital company		Q	Q	OW	QQ	OW
Hire car company	Business	Q	QQ	OW	QQ	--
	Leisure	OW	Q	--	Q	--
Pharmaceutical company	Generic	OW	Q	--	QQ	--
	Patented	Q	Q	--	QQ	OW
Furniture removal company		OW	QQ	--	Q	Q

Notes

1. Remind students that 'long lists' signal poor strategy. Therefore, it is essential to keep the list of order-winners and qualifiers short.
2. Product expertise for a pharmaceutical company refers to patented products that yield very high margins.
3. OW = order-winner; Q = qualifier; QQ = order-losing sensitive qualifier.

What would constitute the operations strategy for the four organizations reviewed?

Private hospital company

Patients (or customers) would typically select a private hospital on several counts – the lead time between request and appointment, the known expertise of the medical staff, the location of the hospital and the quality of the environment in terms of patient care, space, privacy and cleanliness. In this market, price would be a qualifier, matching the price for treatment or consultation elsewhere but resulting in high margins. The success/failure of surgery or treatment would be order-losing in nature, as would the standard of the environment and the level of patient care. The operations task here is to maintain a high level of expert staff, providing sufficient capacity throughout to meet patients' needs. With price as a qualifier, keeping costs within the budget rather than cutting costs would be the task.

Hire-car company

The two different segments of this market are reflected in the mix of order-winners and qualifiers:

- Business sector – having appropriate cars available in line with the short lead times that are often required would typically be the order-winner. Price is a qualifier while failure to have the car required there (delivery reliability) or meeting all aspects of the service from speed of the pre-hire processing to the cleanliness of the car would be the order-losing sensitive.
- Leisure sector – car reservations would typically be arranged well before the holiday break. The key factor here would be price.

The operations task in this case is to meet these different sets of needs. Often this is accomplished by having 'preferred customer' status for business hire, where queues are shorter and the paperwork processing often completed ahead of time.

Pharmaceutical company

When a pharmaceutical company first markets a drug, it is usually under a patent that allows only the company that developed the drug to make and sell it. At the end of the patent period, the drug can be made by any company and is then classed as a generic product. The principal result, as you will see from the earlier table, is the change in the role of price from a qualifier to an order-winner.

The much higher margins of patented products generates the cash necessary to fund the large R and D budget required to develop and trial new products – which are the life blood of most pharmaceutical companies. Typically, generic products are made by a company in different manufacturing facilities from those used to make its patented drugs.

With generic products the role of operation is to reduce costs in order to improve margins.

Furniture-removal company

Families moving house would typically search out the lowest price for the service (removals paid for by a person's employer would probably differ in this respect). The fixed nature of moving home would allow long lead times but the need for the removal company to be there at the appointed time would be critical in terms of repeat business or would lead to a reputation of failing to meet delivery promises that would harm future business.

2 Search the Internet to find a European company with operations in China. What is the stated rationale for this decision? Do you think any other factors are involved?

Students should be encouraged to provide a range of insights into why the chosen company decided to establish an operations unit in China. The issue of price would typically be at the forefront of a company's rationale but similarly high on the list might be the need for companies to establish themselves in this vast market.

Some useful background material for a discussion on this assignment can be found in the sections entitled 'Strategic Partnering' and 'Supply clusters' in the 'Make or Buy' and 'Managing the Supply Chain' chapters respectively of Hill and Hill, *Manufacturing Operations Strategy*, 3rd edition, Palgrave Macmillan, 2009, pages 281-5 also provide some useful background to a discussion on this assignment.

Designing Services and Products

3

Teaching resources for study activities

Discussion questions

1 Select a service and a product that are at different points in their life cycles. Explain their progress to date, where they are now and what you expect will happen in the future.

The purpose of this question is to highlight the need for companies to assess where their services/products are on their relative life cycles and to be aware of the need to anticipate the future changes/developments ahead of time. This allows companies to think through ways of moving on or delaying the forward movement of a service or product to the next stage in their respective life cycles.

A service – business class flights

An example that provides a basis for discussion is that of business class air travel. Now in the mature phase of its life cycle, airlines are looking for ways to differentiate what is after all a seat on a flight from one city to another. You could structure a discussion around examples of how two airlines have introduced ways to get ahead of their competitors:

Examples of in-flight changes:

- British Airways flatbeds were soon matched by its rival Virgin Atlantic
- Virgin Atlantic's introduction of a bar and eating area to allow customers to move around and an emphasis on accommodating customers who wish to relax during the flight.

Examples of changes to the non-flight phases:

- Virgin Atlantic introduced a limousine service to/from airport
- British Airways introduced arrivals lounges in some airports.
- Terminal 5 at Heathrow is now considered a significant plus for British Airways.
- In March 2011 British Airways announced it would be upgrading its New York JFK lounges to the same specification provided in Heathrow's Terminal 5.

A product – Apple and McDonald's

Apple's approach to product development serves as a good illustration here. For example, take the iPad, introduced in June 2010. As the product quickly went through several stages of its life cycle, Apple introduced the next version in March 2011 and immediately ceased manufacturing the previous model irrespective of continuing demand. The new iPad includes several additional features:

- A camera to allow for video recording and i-chat.
- Faster processing.

McDonald's could be classed as a mix of service and products. But a focus on the product element provides an example of a series of products now in the mature phase of their life cycles. As with British Airways and Apple, McDonalds has adopted a classic proliferation approach to differentiate its offering from that of its competitors, now selling a range of deli style rolls and salads.

2 The section 'The service/product mix' explained that a service or product can be expressed as a combination of dimensions (that is, 'a service within which there is a facilitating good', 'the explicit and implicit dimensions of the offering' and 'the supporting structural facilities'). Analyze the following businesses in line with these dimensions:

- **A supermarket**
- **A high-street post office**
- **An upmarket restaurant**

The purpose of this question is to encourage students to analyze a service offering in more detail using the structures and approaches described in the chapter. The outcome will illustrate the in-depth nature of such reviews and the insight that these can provide. Again, those reviews and discussions form part of the learning objectives for this chapter, as they enable students to gain a more extensive understanding of the operations management task.

A discussion of the three examples listed in this question is a useful way of exploring the mix of services and products that make up a range of business offerings. These examples typically generate different, often conflicting, opinions from students and help the class to more thoroughly examine the complex issue of what constitutes a business's service offering.

It can prove rewarding to start the discussion by asking the group to decide whether each of the three examples is either:

- A service with a facilitating product, or
- A product with a facilitating service

Once you've taken an account of students' answers, you could record the relative mix of services and products for each of the three examples on a matrix similar to that in Figure 1.8 on page 21 of the book. Sometimes it's not easy to get agreement across the group so be prepared to record more than one version of the matrix.

With this task complete go back to each example in turn and discuss in more detail. You could cover some of the key issues that are listed below. You will typically find that as the discussion unfolds, greater clarity results. However, the objective here is not to draw out the right or wrong answer, but to engage students with the important step of determining the mix of services and products involved in the delivery of a service.

Explicit and implicit benefits

Often the explicit and implicit benefits begin to emerge during the discussion of the points above. It can be more effective to include both of these in an initial discussion and then summarize each point into a list of explicit and implicit benefits at the end.

A supermarket

Service/product mix

A supermarket is an example of a product within which there is a facilitating service. In what is predominantly a self-service business, customers typically select a supermarket for their 'big weekly shop' on the basis of the range, specification, freshness and price of the food and other goods on offer. (Although the criteria for this decision may differ between customers - for example the needs of a student and a well-paid professional might be quite different.) However there are several factors other than the food and goods on offer that do influence selection. For example:

- Location
- Knowledge of the store (for example, where goods are to be found).
- Checkout provision – typical length of queues and optional formats (including self checkout) provided.
- Friendliness and helpfulness of the staff.

As discussion progresses it is useful to recognize that the criteria above affect a person's 'big weekly shop' whereas shopping for a few items or for a 'one-off event' (e.g. a dinner party or Christmas dinner) may involve different criteria.

Explicit and implicit benefits

- Explicit benefits include the purchase of the food and other goods and the choice (range and different brands with a range) on offer.

- Implicit benefits include queue lengths and staff advice/helpfulness.

Structural facilities

Aspects here include level of cleanliness, width of aisles, lighting and décor.

A high street post office

Service/product mix

People go to a post office predominantly to purchase a mix of services and products that cannot be bought elsewhere. Products include postage stamps and various licenses (including TV and car tax) while services include letter/parcel postage and monetary transactions.

Explicit and implicit benefits

A high-street post office provides a range of explicit services including providing road fund/car tax certificates, processing letters, parcel deliveries to domestic and overseas destinations, and secure mail services. The implicit benefits include privacy of transactions and advice on the alternative ways to secure and/or guarantee of delivery of the letters and parcels.

Structural facilities

Aspects include cleanliness, lighting and adequate space to accommodate people queuing.

An upmarket restaurant

Service/product mix

As illustrated in Figure 1.8 (p.21), the mix of services and products for an upmarket restaurant tends to be split around 50/50. The food, wine and other beverages would have to be of the right specification (the different meats, fish, vegetables and other ingredients would need to be a high specification; the range of starters, mains, puddings, wine and coffee on offer need to be extensive; and the food needs to be well prepared and presented). However, when it comes to fine dining, the level of attention directed towards customers by the front of house staff needs to be of a high level from start to finish. Staff need to recognize regular customers on entering the restaurant, and table preferences need to be accommodated for customers who are frequent diners. The product/service mix work in combination to attract repeat business and serve as the basis for recommendations to others.

Explicit and implicit benefits

The meal and the service form the core of the explicit benefits that need to be provided. While the implicit benefits include table settings and level of space around the tables.

Structural facilities

Aspects include the décor and restroom facilities.

3 Give one example of the use of standardization and modular design for both a service and a product of your choice.

Illustrations of the use of standardization and modularization students might identify with include:

Fast-food chains

Fast-food chains illustrate the use of standardization in both the products offered and the service delivery system used. For example, at McDonald's they use:

- Standard products – the food (burgers, French fries, bread buns etc.) is all purchased centrally to an agreed specification. In the 'back office' of the restaurant, the burgers and fries are then cooked using standard procedures and equipment, with specific instructions for the temperature settings and cooking times. In this way, McDonald's is able to serve food that tastes the same no matter which outlet it is bought from.
- A standard delivery system – all staff are trained to undertake their various roles (serving customers, front office cleaning and so on) in a predetermined manner.

Airlines

Commercial airlines use a modular approach to serve their customers throughout the range of seat types (first, business and economy). Handling customers involves a similar set of stages but the modules involved (from ticket purchase to collection of luggage) vary in their provision depending on the class of seat involved.

4 A major German shoe company launched a new range of tennis shoes. There were two styles, one for men and one for women. Within each of these two styles there were six colour combinations, and the shoe sizes ranged from size 7 to 14 for men and 4 to 9 for women. (Note: the sizes available do not include half sizes.) How many shoes would a store have to stock to have one pair of each shoe within both ranges?

The purpose of this question is to draw students' attention to the impact of design decisions on variety. In such circumstances as these, a retailer would sell a selection of different types of shoes (including here, tennis shoes) and a range within each type of shoe. In such circumstances retailers would not be willing to keep pairs of every single type of shoe (in terms of the entire range of sizes for each style) in stock. This is because that would involve tying up a lot of money in inventory and also take up a lot of space in a store.

The maths involved is simple. It's the resulting numbers that are significant:

- Men's shoes: 8 sizes x 6 colours = 48
- Women's shoes – 6 sizes x 6 colours = 36

In total a retail store would need to hold 84 pairs of tennis shoes to cover this single item in its range. At this point it can prove interesting to discuss with students how a retailer handle this issue, bearing in mind that this tennis shoe would be one item in a whole range of items.

- a. The store would probably keep an example of all 6 colours in stock but only hold the more popular sizes as inventory.
- b. As a result of (a), the German shoe manufacturer would need to hold finished goods in inventory of all 84 items so as to provide a fast back-up service to retailers.

Assignments

1 Apply the value analysis principles to a service or product and see if you can identify the opportunities for cost reduction without reducing value.

The purpose of this arrangement is to give students a hands-on experience of applying the value analysis approach to a real-life example. This method is a really effective way of engaging students with the subject. Here are some useful tips on selecting a service or product for the purpose of this assignment:

- If choosing a product try to select items with an abundance of packaging.
- Buy several items at one time once you know they work well as an illustration. You'll need enough to give each small group one to analyze and it's always worthwhile to have a few to spare!
- Provide a list of all the parts of the product together with the estimated costs of each part. This gives students the opportunity to assess the cost savings their suggestions would yield.

2 Complete a review of two fast-food restaurants of your choice using the quality function deployment approach. In this task, use the outline in Figure 3.5 but check, where possible, the detail for:

- **Customers' needs and wants and weight the resulting percentages, as in Figure 3.5**
- **Technical requirements**
- **Customers' rating for each restaurant.**

This assignment allows students to use the quality function deployment approach on two similar businesses and make comparisons. By specifying which fast-food restaurants to review you can ensure that you have the knowledge of the two examples under review and this also allows cross comparisons where two or more groups are involved.

The key here is to go through Figure 3.5 (p.88) and the accompanying text (on p.86-9) in some detail to ensure that the students understand the approach that the assignment calls for. It is advisable to set the task some time before the results are discussed as this provides the opportunity to address queries that arise as the groups are going about their analysis and review.

3 In what types of organization might new ideas have:

- **A low mortality rate (that is, they last for a long time)?**
- **A high mortality rate (that is, they last for a short time)?**

Explain your choice with supporting arguments and details.

It is often best here to offer examples of low and high mortality organizations and then get students to discuss if these are high or low mortality organizations and why.

Low mortality examples include:

- Building material companies (for example, cement, bricks and timber).
- More standard bank services (for example, personal banking, mortgage-lending and house insurance).
- Insurance products in general (for example, life cover, personal injury and healthcare).

High mortality examples include:

- IT products.
- Fashion industry where changing design is at the heart of the provision.

4 Give two examples (with supporting details) of the impact of technology on:

- **A service**
- **A product design.**

As with the previous assignment, using real-life examples is a good way to stimulate discussion. The objective here is to provide the opportunity for students to talk through the examples in order to gain a deeper understanding of the issues involved.

- A good example for services is the internet's impact on personal banking services.
- Product examples include the digital impact on:
 - Photography
 - Music
 - Publishing.

5 Since markets for services typically have lower entry barriers than product markets, why do companies not start with services when they first begin to compete in overseas markets?

This assignment provides an opportunity for students to reflect on the factors that make it easier or more difficult to export services or products. At the heart of the question is the 'sheltered' or 'traded' nature of markets (see p.24 for definitions of these terms) and the key issues to discuss here include:

- Many service markets are inherently sheltered by nature even though developments in the last decade or so have altered the nature of some markets from sheltered to traded.
- Product markets, on the other hand, are largely traded by nature as the product itself constitutes the business offering and is relatively easy to transport and customers are typically not involved in its provision.
- The development of an export market for products can begin with just the sale of one or a few items and use an overseas agent or business to handle the commercial activities and transactions and which can then be expanded as demand is developed and increased. Many services, on the other hand, would typically need a larger business set-up from the outset and usually including a local presence thus making the initial steps in export markets far more significant in terms of commitment.
- It is easier for customers to evaluate the fit of a product to their needs. The less tangible nature of services often creates additional concerns and uncertainties in the initial stages of gaining acceptance in overseas markets.

Delivering Services

4

Teaching resources for study activities

Discussion questions

1 Choose a service company that uses at least two of the delivery systems detailed in this chapter. Explain why a company would have made such choices.

If you wish to use this question as the basis for class/tutorial discussion then you may wish to limit the choice of service companies to keep the discussion contained and everyone involved. The example discussed below is one such option.

A restaurant with a take-away service uses a single-step and multi-step service as follows:

Service	Steps	
	Single	Multi
Take-away	✓	
In-house		✓

Take-away

- Customers enter and order
- Wait
- Collect food, pay and leave

In-house

- Customers enter and are seated
- Menus distributed and pre-dinner drinks are ordered
- Pre-dinner drinks provided
- Meals ordered
- Meals served
- Pay and leave

A take-away service is designed to increase sales by extending the use of the back office (the kitchen) capacity while minimising the disruption in the front office. One way of further reducing the impact of the additional take-away customers is to have them pre-order and arrive at an appointed time so minimising their presence in the front office part of the delivery system. A discounted price is often offered to reflect the nature of the service and encourage its use. The in-house delivery system, on the other hand, is designed to keep pace with a customer's preference for the time it takes thereby creating an enjoyable service while attempting to maximise sales.

2 Based on Figure 4.2 identify an organization that illustrates one of the examples given for each of the four types (customers, customer surrogates, products and information). Then provide an overview (two or three lines) to show what is processed (for example, customer and information).

As with Question 1, if you wish to contain the discussion you may wish to limit the options with a list similar to the one below.

Type	Examples
Customer	Hairdresser, chiropractor and doctor's surgery
Customer surrogate	Car body repair, dry cleaning and dog kennels
Product	Restaurant, bakery and ice-cream parlour
Information	Tax return, passport application and preparing a will

Customer

- Hairdresser – a customer often selects the same hairdresser on each visit and requests from a range of styling choices. The service usually includes a hot drink provision and a choice of magazines and newspapers.
- Chiropractor – options include regular and specific treatments involving reception and pre-appointments.
- Doctor – options include regular and specific treatments. Some treatments may be provided by nursing staff. Computer-based records now form the basis of each consultation.

Customer surrogate

- Car body repair – typically involves pre-examination and quotation. Repair scheduled and completed. Visual, external checks completed by customers.
- Dry cleaning– clothes handed-in, requirements discussed, priced and clothes collected on or after the agreed delivery date.
- Dog kennels– dog housed over an agreed period.

Products

- Restaurant – food and wine prepared and served.
- Bakery – bread, pastries and other items made on-site (in the back office) and sold in the front office.
- Ice-cream parlour – varieties of ice-cream prepared (in the back office) and sold in the front office.

Information

- Tax return – payroll details completed in line with the questions on the return.
- Passport application – forms completed including a verified personal photograph and sent to the passport office for processing.

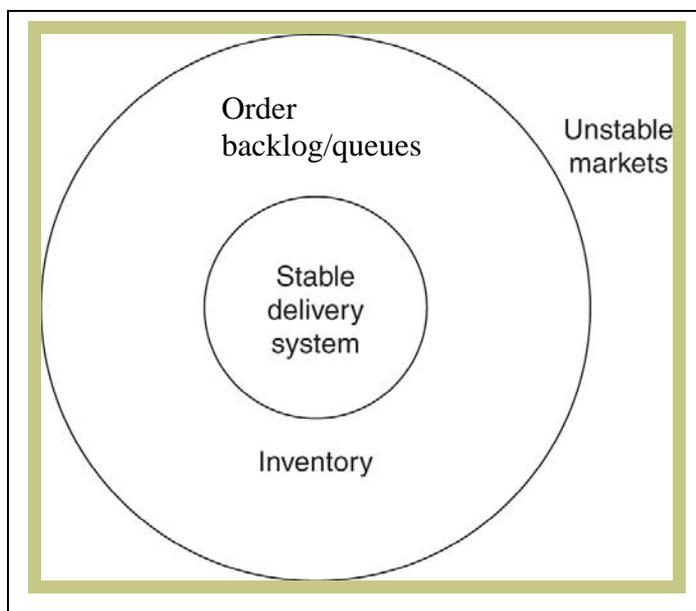
3 Why is queuing often an integral part of a service system design?

It is useful to begin by listing the aspects of service delivery that require the use of queues before asking students to think about the logic behind using this mechanism in the front office phase of delivery systems or in the back office phase where information is processed.

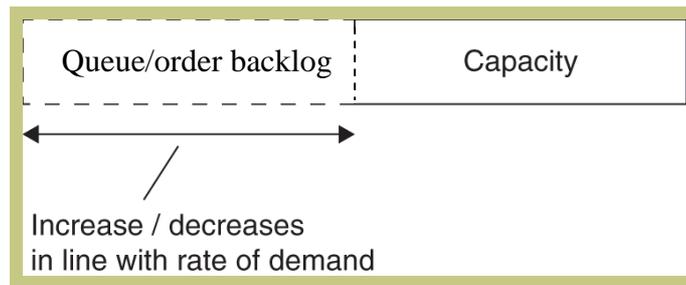
- a) Service companies cannot provide services ahead of demand (that is, on a make-to-stock basis). Because of this they either:
- Make-to-order: serve customers as they enter the front office or process information on receipt in the back office.
 - Assemble-to-order: where companies pre-make part of the product element of the offering (as in a fast-food restaurant) and then assemble the parts of a meal in line with the customer's specific order.
- b) As with any organisation, service companies set capacity levels in line with anticipated demand reflecting hourly, daily and weekly patterns. But, as demand (customers entering the service delivery system) varies around the average, similarly the type of demand also varies around the average, and as a result queues form. In addition, where information is processed, the number of requests and requirements also vary above and below the forecast.

The consequence is that service companies cushion the service delivery system from this instability of demand by using customer queues or a backlog of requests. Here it has been found useful to introduce a simplified version of Figure 8.1 to show the basic mechanisms

of inventory or order backlog, similar to that below:



Alternatively, you can base the discussion on the figure below:



4 For a service company of your choice explain:

- **The service delivery system design**
- **How the company reduces queues within the system.**

An analysis similar to that provided for Question 1 above would be complete in response to this question.

5 Review the data in Figures 4.5 and 4.11. Why do the results seem to make sense?

Figure 4.5 Repurchase interactions of dissatisfied customers

A useful approach here is to ask students to think about whether or not they would repurchase against the three levels of recovery shown below. Interestingly, although the percentages may not match those in Figure 4.5, the change in the level of intention typically matches that given in the table (see below).

Level of service recovery	Percentage buying again	
	Major	Minor
Not resolved	100	100
Resolved	284	152
Resolved quickly	432	207

Using indexing (see above) is a good way to demonstrate the level of recovery between the data in figure 4.5 and the student's scores.

Figure 4.11 Trends in annual profit per customer

Regarding the data in Figure 4.11, it can be useful to have a class discussion about the opportunity to reduce costs with repetition and the extent of the initial costs when setting up customer information and profiles.

Assignments

1 Envisage going to the emergency unit of your local hospital with a suspected broken wrist. List the key steps in the delivery system in which you would be involved. What type of system is used at each step?

An illustration of this delivery system is provided later in the book in Figure 6.7 and you may decide to draw your students' attention to this as the basis for completing the assignment. It is in fact the second half of the question that is the most important.

Overall, this is a multi-stage delivery system with the customer going from to step and being "processed" at each stage. Issues to raise here include:

- A multi-step system allows many patients to be "processed" using the combination of steps that are necessary to meet that requirements.
- Breaking the hospital system down into its parts allows:
 - Specialist skills to be developed
 - Ensures that the costs (level of staff salaries) better match the skills required to deliver each element of the total service
- Queues form between one step and another with the part-processed patients (the equivalent of inventory in a manufactory process) decoupling one step from the next. This increases the utilization of the skilled staff as the patient waits for the process and not the reverse.

2 Select a company (other than the examples provided in the chapter) to illustrate

a:

- **Non-repeat business**
- **Repeat business – low volume**
- **Repeat business – high volume.**

For each, outline the service delivery used.

Again you may want to provide the students with one or more illustrations of the 3 types and ask them to explain the rationale for the categorisation as well as the outcome of using each type of the delivery system. Another alternative is to select the business which all three systems are illustrated as figure in below:

Service company	Non-repeat	Repeat	
		low volume	high volume
Bank	Large industrial loan	Arranging a personal loan	ATMs
Solicitor	A take-over	Preparing a will	House conveyance

Such an approach also allows you to reinforce the difference between

- Categories or types of service (see Figure 4.3)
- Different delivery systems, the task here.

Making Products

5

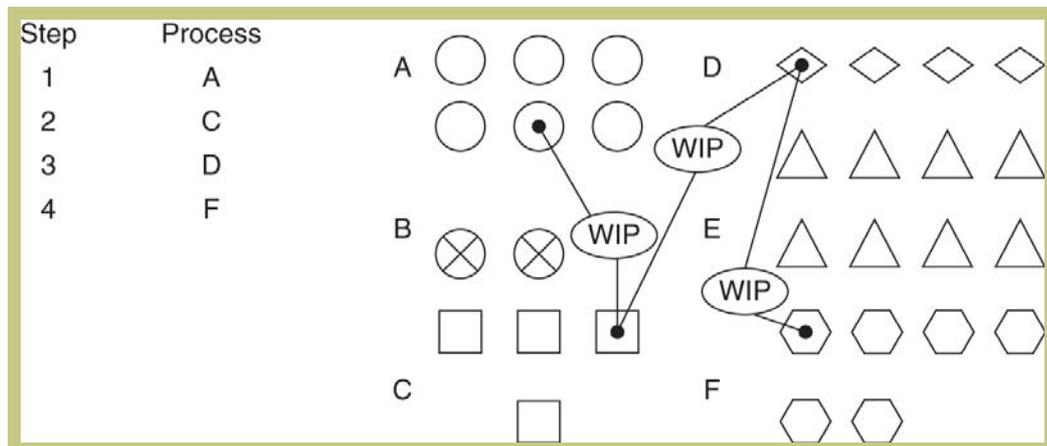
Teaching resources for study activities

Discussion questions

1 Select one simple (involving one or two steps) and one more complicated (three or more steps) batch process in manufacturing companies of your choice. Explain how they work.

The purpose of this question is to get students to more fully understand how products are made using batch processes; why this alternative is selected and used by companies; and some of the business-related consequences that result from using this process.

Below is an example of a typical batch process. Product 172 involves 4 steps to be completed, as shown below:



Notes

- 1 WIP = Work-in-progress inventory.
- 2 The symbols used above (for example, ○ for process A) shown that for A there are 6 similar processes that can complete step 1 for Product 172.

The reasons why a batch process is used to make Product 172

The main factor affecting the choice of process is volume. As with many products, Product 172 (in our example) is a standard product (that is, it is typically made several if not many times) and hence the steps to complete are the same for each time the product is made, as shown above. However, there is insufficient demand (and hence volume) for Product 172 to justify dedicating processes (as would be in line) and hence a batch process is appropriate. However, batch processes are designed to be used and reused by several different products with the result that:

- Processes are shared across a number of products.
- Typically, the task of scheduling products through shared processes requires prioritising and hence products wait for processes and work-in-progress inventory results.
- To complete a step in a process for any product requires that process to be reset each time. This
 - takes time and cost.
 - raises issues about how many to make at any one time (the length of set-up time in relation to the length of the subsequent production run).

The consequences that result include:

- Work-in-progress inventory is created.
- Queues form and products wait for processes.
- The scheduling task is more difficult than it is for either a jobbing or line process.
- The length of a set-up and the length of a production run need to be kept in some overall balance.

2 What are the essential differences between the following processes:

- **Project and jobbing**
- **Jobbing and batch**
- **Batch and line**
- **Line and continuous processing?**

One approach to answering this question is to select a few factors from those listed in Figure 5.12 on which to base comparisons between project, jobbing, batch, line and continuous processing. You may wish, therefore, when setting this question to supplement it by selecting which dimensions you wish to discuss and include these as part of the question.

Project and jobbing

Factors	Project	Jobbing
Where is the process completed?	On site	In-house
Standard or special products	Both	Special products

Jobbing and batch

Dimensions	Jobbing	Batch
Standard or special products	Special products	Standard products
Scheduling task completed by	Skilled person	System
Set-ups completed by	Skilled person	Specialist

Batch and line

Dimensions	Batch	Line
Standard or special products	Standard	Standard
Volumes	Range from low to high	High
Difficulty of the day-to-day scheduling task	Different	Easy
Set-ups completed by	Specialist	None
Level of work-in-progress inventory	High	Low

Line and continuous processing

Dimensions	Line	Continuous processing
Standard or special products	Standard	Standard
Volumes	High	Very high
Can the process be sensible (in terms of cost) stopped at the end of a period (for example day or week)	Yes	No
Difficulty of the day-to-day scheduling task	Easy	Easy
Number of set-ups	None	None
Level of work-in-progress inventory	Low	Low

3 When assembling a car, there will be five tyres (four plus a spare) for each vehicle. Why is it that tyre-making uses a batch process, whereas the car itself is typically assembled using a line process?

This question is designed to reinforce the fact that volume and quantity are different:

- Volume = quantity (number of items) × time per item
- Quantity = number of items

In car assembly, the volume for assembling 1 car (that is 1 multiplied by the time taken to assemble a single car) is higher than the volume required for making 5 tyres (5 tyres × a relatively short time to mould a tyre). 5 tyres take much less time to make than it takes to

assemble one car and so tyre-making comprises much lower volumes. For that reason, car assembly volumes justify a line process whereas making tyres is more suited to a lower volume process such as batch.

4 Why is waiting time an integral part of a batch process design? Illustrate with two examples

As explained in Question 1 above, batch processes are used to make standard (that is, repeat) products for which:

- a) The volume (quantity \times time) for a product is insufficient to justify a dedicated process such as line.
- b) As a consequence of a), batch process are designed to be shared (used and re-used) by more than one product.
- c) As a result of b), a batch process has to be re-set when changing from one product to another.
- d) As a result of b) and c), as products share the use of a process then scheduling products to use the same process will result in some products waiting their turn (see b) above) and then also waiting for the process to be set-up to undertake the required task (see c) above).

Figure 5.4 illustrate these points.

In addition to the printing example in Figure 5.4 other illustrations include:

- Injection moulding – the mould to produce one product is replaced by the mould to produce another product. Similarly, producing the same product in 2 or more colours will require a 'colour change' that takes time to accomplish.
- Metal/wooden components will typically go through 2 or more batch processes that each perform a part of the total task and, as in Figure 5.4, delays will take place.

Assignments

1 Visit the website of a major petrochemical company. Find information on one of its oil refineries and explain:

- **How it handles the product range that is processed in the particular plant.**
- **How often the plant is shut down and why.**

One way of handling the question is to provide students with the addresses for selected websites of major petrochemical companies. For example:

- Kuwait Petroleum Corporation - www.q8.com
- BP - www.bp.com

2 Select a business/organization (other than the examples given in this chapter) to illustrate the five types of process – project, jobbing, batch, line and continuous processing. For each example, briefly explain how the process works.

We have provided examples below. An alternative way to use this question is to list (say) two examples and ask students to identify which process they think would be used in each case.

Business/organization		Project	Jobbing	Batch	Line	Continuous
Replacing power lines		✓				
Designer kitchen	Make		✓			
	Install	✓				
Machined parts				✓		
Reproduction furniture				✓	✓	
Domestic appliances					✓	
Oil refining						✓
Cast iron production						✓

Location and Layout

6

Teaching resources for study activities

Discussion questions

1 Select a service outlet and identify the good and bad points of its chosen location.

The principal reason for setting such a question is to encourage students to start seeing businesses/organisations (in this instance, a service outlet) through the eyes of operations and, in that way, help them to recognise the pivotal role of the operations function in all aspects of a business. In order to limit their answers, you may wish to providing students with a shortlist of businesses from which they can choose an example on which to base their answer. Either way, the points to look for in the choice of location include:

- Proximity to
 - places to park
 - other retail outlets
 - bus stops/train stations/underground stations.
- Frontage of the site regarding how visible the premises are to passers-by.
- Width of the walkway/pavement in front of the site.
- Level of street lighting for those times of the year when the outlet's opening hours extend after daylight.

2 Lord Sieff, when CEO of Marks & Spencer, the UK-based clothing, homeware and food store, is reputed to have said, ‘There are three important factors in retailing – location, location and location.’ Why would he have made such a comment?

The comment appropriately emphasises the importance of site location, particularly for retail outlets. Moving from one site to another is expensive (removal costs and refurbishing costs plus the potential loss of sales) and being in the right or wrong location can significantly affect sales revenue (both first and repeat sales). Selecting, where possible, a good location can well be fundamental to the success of a business.

3 Review the layout of a service organization of your choice and identify the good and not so good features of the layout design. Explain your choices.

This question is again designed to highlight key aspects of operations and the impact on (in this instance) serving customers.

Issues to be addressed here include

a) Context:

- The need to recognise the different volumes that may have to be managed.
- The back and front office decision and identifying the line of visibility that results.
- The single and/or multi-step nature of the chosen delivery systems.

b) Specific layout features:

- Customer flows.
- Access points.
- Entry/exit provision.
- Initial customer entry into the delivery system and how well the layout design facilitates this.
- Inclusion of safety requirements.

4 Complete a similar exercise to that given in Figures 6.13 and 6.14 on your cafeteria. How well balanced is the cafeteria’s service delivery system? What improvements could you suggest?

This question can be a useful exercise for students to complete in preparation for a weekly tutorial, with the format given in Figures 6.13 and 6.14 providing the structure for both analysis and review.

Assignments

These assignments can prove a useful means of encouraging students to explore location and layout issues.

- Getting students to undertake their own analysis of location and layout choices highlights that operations' two key roles are meeting customer needs (its strategic role) and ensuring the organization's efficiency requirements are met (the day-to-day role). Success in these areas is essential in the ongoing task of meeting cost (and profit) targets and schedules.
- These assignments demonstrate that the essential approach to managing functions is one based on analysis (creating data) rather than opinion. Note that the role of opinion in discussing issues and problems is to highlight different views which then, in turn, direct the focus of an analysis and enable a more informed decision to be made.
- The assignments also facilitate access to businesses and organisations in which to observe, analyse and collect data. Where permission is required this can be easily obtained from local management.

1 In a team of three, select two supermarkets and individually assess them against the criteria listed in the section 'Factors affecting the choice of site'. Then review your individual ratings against each others' and discuss and list the key areas of agreement and disagreement.

Using the material in the section of the textbook entitled 'Factors affecting the choice of site' provides an ideal structure for analysis.

The probable difference in views between students promotes discussion and enables distinctions to be drawn between opinion and data while underscoring the key role of data in evaluating alternatives. Collecting data encourages an objective discussion (it can be useful to encourage students to record the initial positions taken by each member of their

team, the points made during discussion and the eventual outcomes to help highlight the importance of objective examination and decision-making).

2 In a team of three, individually select one of the following facilities to review – a large retail chemist, a large bookstore and a multiplex cinema, following these steps:

- a) Within your team, agree for each location the factors to be used to review each site.**
- b) As individuals, assess one of the three locations using the agreed factors.**
- c) Discuss the three sets of findings and then identify the two most important factors that are facility-specific.**

This assignment builds on Assignment 1 above. Where student numbers are large, you can increase the number in each 'analysis group', while achieving the same learning objectives.

3 Complete a similar exercise to the last assignment, but this time analyse the layout of each location with particular reference to customer flows and the type of layout used. Compare and contrast your results. What were the key determinants of layout design for each outlet?

Before setting this assignment it can be helpful to outline the key points from the answer to Discussion Question 3 above. It is also important to stress the need for students to revisit the relevant text in Chapter 5 of the book.

4 A US-based engineering firm has been awarded a contract to build the assembly and fabricating facilities for a new automobile plant in Mexico. It is critical to complete the project on time, given the proposed vehicle launch, and, as with all such assignments, staying within budget is essential. For these reasons, the project manager needs to be continuously kept up to date. The client has assigned its own on-site staff to handle issues as they arise. The desired relationships for the specialist areas involved in completing the project are given in Figure 1. The space allocated to the project team comprises an office for each of the seven sections (see below), together with an office for the client's own staff.

a) Using a relationship chart, complete a suggested layout.

b) Give reasons for your layout proposal.

c) Why do the reasons given earlier in the chapter differ from the reasons used in the example in Figure 6.11?

a) Using a relationship chart, complete a suggested layout

The purpose of this assignment is to:

- Provide a simple exercise in layout design
- Emphasise that typically there is more than one solution and that the resulting alternatives each have their own set of advantages and disadvantages (see Figures 1 and 2 below that offer two solutions to the task).
- Show that the final layout is rarely perfect and provide an opportunity to discuss ways to improve the outcomes –in this case, these include making all or part of two or more offices into a single, larger office that :
 - makes it more convenient where staff from two or more different disciplines may need to work extensively with one another.
 - allows combinations of staff (for example, designers, electrical and mechanical engineers) to work in small groups where it makes sense.

Figure 1 – one possible layout

Mechanical Engineering	Design	Electrical Engineering	Estimating
Client	Project	Purchasing	Scheduling

Figure 2 – a second possible layout

Estimating	Design	Electrical Engineering	Scheduling
Client	Project	Mechanical Engineering	Purchasing

b) Give reasons for your layout proposal

This part of the assignment gives students the opportunity to explain their decisions. There will no doubt be a range of different solutions and rationales, which provides an opportunity to highlight how important it is to engage in a formal process of review when making layout and location decisions (bearing in mind that is expensive to change) rather than making a choice based on opinion.

c) Why do the reasons above differ from the reasons used in the example given in Figure 6.11?

The point of this question is to highlight the fact that when using a relationship chart the “reasons” behind each layout decision vary from case to case depending on the situation, highlighting the fact that there is no ‘set’ list of reasons.

5 Electronic Controls International (ECI), a US-based technology group, has narrowed its location choices down to four possible sites in Europe. ECI will need to train the relevant staff, and the key factors, their weights and ratings for each location are shown in Figure 2. High scores represent favourable values.

a) Calculate the weighted factor score for each of the four sites.

b) Which site would you choose?

c) Would you reach the same conclusion if the weightings for the operating costs and labour costs were reversed?

This assignment is designed to get students to use the weighted factor method for choosing a site, based on the example in the chapter. Below is a chart similar to that in Figure 6.2.

Factor	Weight	Site A		Site B		Site C		Site D	
Staff availability	15	7	105	8	120	7	105	8	120

Operating costs	25	8	200	6	150	8	200	6	150
Government incentives	15	8	120	8	120	7	120	6	90
Land, Construction and other set-up costs	15	7	105	6	90	7	105	7	105
Labour costs	10	8	80	8	80	6	60	6	60
Local technical infrastructure	10	4	40	7	70	8	80	7	70
Transport	10	4	40	8	80	8	80	7	70
TOTAL	100	–	690	–	710	–	750	–	665

b) Which site would you choose?

Site C is clearly the appropriate site given these calculations.

c) Would you reach the same conclusion if the weightings for the operating costs and labour costs were reversed?

The revised weightings are given below and now site B is the best site.

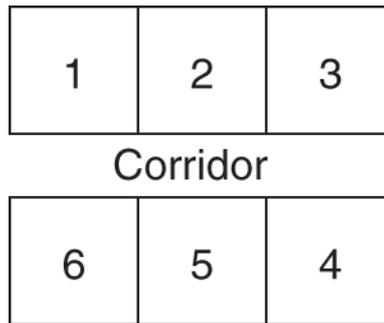
Factor	Weighting	Site A		Site B		Site C		Site D	
Staff availability	15	7	105	8	120	7	105	8	120
Operating costs	10	8	80	6	60	8	80	6	60

Government incentives	15	8	120	8	120	7	105	6	90
Land, construction and other set-up costs	15	7	105	6	90	7	105	7	105
Labour costs	25	8	200	8	200	6	150	6	150
Local technical infrastructure	10	4	40	7	70	8	80	7	70
Transport	10	4	40	8	80	8	80	7	70
TOTAL	100	–	690	–	740	–	705	–	665

6 The accountancy firm Thomas and Mason is made up of six main sections. Owing to the growth of the business over the last five years, the partnership is planning to move into new premises. These comprise six offices of equal size on each side of a corridor, as shown in Figure 3. The distance between the six offices is also shown in Figure 3, as are the number of trips between each sector. From this information, assign each of the six sections to an office in a way that minimizes the total distance travelled.

NOTE

In the first print run of the 2011 edition of Essential Operations Management, the office layout should have had the location of offices 4 and 6 reversed as below. This has been changed in subsequent reprints and editions.



The starting point here is to develop the “step 3” chart that combines the data from the “distance” and “number of trips” between offices similar to that shown in Figure 6.10. Note in the example, the data has been simplified compared to that in Figure 6.10

Total distance travelled (m)

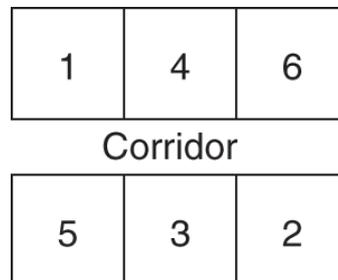
Office	1	2	3	4	5	6	Total
1	–	208	496	1968	1024	112	3808
2		–	360	464	320	1616	2760
3			–	160	624	648	1432
4				–	240	736	976
5					–	448	448
6						–	9424

It is essential to have the offices where the number of trips is the highest closest together, as below

Offices	Number of trips
2–6	101
1–4	82
1–5	64
5–6	56

and so on

On the basis of this table (using IT-based analysis would clearly refine it further) the optimum outcome is:



The impact this rearrangement would have on the total distance travelled is outlined in the table below:

Office	1	2	3	4	5	6	Total
1	–	624	496	656	512	224	2512
2		–	360	464	640	808	2272
3			–	160	312	448	920
4				–	480	368	848
5					–	1344	1344
6						–	7896

This total is already lower by close to 20 percent and can be fine-tuned further but the prime reason for the assignment is to illustrate the usefulness of this approach.

7 Review the layout of a high-street branch of three different banks. List the principal similarities and differences between the layouts. Why do you think these similarities and differences exist?

The purpose of this assignment is to illustrate how businesses in the same sector will make different (often very different) layout decisions. The key issues to address in the class discussions (or if the assignment is set as part of a course evaluation then you may wish to include these as part of the question) include:

- Front office, back office and line of visibility decisions.
- Types of service delivery systems
 - Single step
 - Multi-step
- Volumes – number of customers in a given (for example, two half-hour) periods.
- Use of customers as part of the server capacity.
- Overall layout.
- Traffic flows.

8 One location adage is: ‘Manufacturers locate near their resources while retailers locate near their customers.’ Discuss.

For manufacturing location near resources is vital because:

- It reduces transportation costs of materials (for example, steel plants next to coal fields and the pottery industry in the UK flourished in Stoke-on-Trent due to the abundance of coal and basic clay even though china clay had then to be brought from Cornwall .
- It helps to lower material inventory levels (refer here to the location of suppliers to car assembly plants to facilitate just-in-time (JIT) supply.

For retailers, location near customers is good because:

- It increases the likelihood of their purchasing from these outlets as the cost and time involved in shopping some distance away is somewhat of a deterrent to customers – the principle of a catchment area.

9 Contrast the location of a food distributor with that of one of the supermarkets to which it delivers products. Which important factors are similar and which are dissimilar in their respective choice of location?

Similar factors in choosing a location

The principal factor in choosing a location for both the food distributor and the supermarket is its proximity to customers.

- For the food distributor, its customers are supermarkets and/or outlets.
- For the supermarket, its customers are consumers.

Dissimilar factors

For the most part, however, the criteria for selecting an appropriate location for a food distributor differ from those for a supermarket. This is because the basis of location decisions for a food distributor is to minimise distributor time and costs and to facilitate its own task whereas for a supermarket the basis for location decision is to make it as easy as possible for their customers. The reason is:

- A food distributor goes to its customer to deliver products.
- With a supermarket, customers come to the store to shop for products.

1) Customers

- A supermarket location is influenced by proximity to customers in terms of the distance & customers travel (i.e. the consumers' costs).
- For a food distributor the important issue is to minimise the distances involved in distributing goods to requirements (i.e. the food distributors' costs).

2) Proximity

- Distributor – proximity to good road/motorway systems to help reduce the travel time and costs involved.
- Supermarket – proximity to bus stops or availability of adequate car parking.

3) Site detail

- Distributor – ease of access to the load bays and parking.
- Supermarket – ease of access to the store for customers.

Managing Capacity

7

Teaching resources for study activities

Discussion questions

1 How do the capacity considerations in a hospital, a wine bar and a company making lawnmowers differ?

Measures of capacity are numbers of staff, amount of equipment or a combination of both staff and equipment. In addition decisions about capacity need to reflect:

- Demand levels during different periods of time, from half-hour slots through to annual requirements including seasonal factors.
- Whether capacity can be stored in the form of inventory and transferred to a future time period to be sold.

With these factors in mind, the key considerations for the three organizations listed in the question include:

A hospital

As there are several functions embodied in a hospital service then the capacity considerations will vary by function. Below are some examples to illustrate the range of functions involved and the capacity considerations entailed

Accident and Emergency Unit (A&E)

The number of staff with the relevant mix of expertise will need to be assessed (and will undoubtedly differ) depending on:

- Time of day

- Day of the week
- Week of the year

The equipment specific to an A&E unit will be limited, whereas access to specialist equipment elsewhere in the hospital (for example, X-ray machines and operating theatres) will be on an as-needed basis and in conjunction with the daily schedules of these departments as they handle other patients.

Pharmacy

The number of pharmacists, dispensing assistants and clerical staff will reflect the daily support for in-patients and out-patients with arrangements for an on-call pharmacist support when the department is closed.

Clinical specialists (consultants)

The number of specialist clinics (in terms of their length and frequency) will be arranged to reflect patient demand.

Clinical specialists (operating theatres)

The number of staff within the mix of expertise involved and the equipment required in each theatre will reflect the demand for this type or category of operation.

Maintenance department

As most requirements for these services are not urgent then the number and skill types of maintenance staff will reflect demand for the number and types of day-to-day tasks as they happen and similarly staff numbers would be reassessed depending on any development work arising from upgrading or extending existing facilities.

Nursing staff

The number of nurses will reflect the various tasks and the 24-hour nature of the care required for in-patients. There will be some specific equipment requirements that will reflect the pre- and post-operative tasks completed in each ward.

Wine bar

Compared to hospitals, managing capacity in a wine bar would be a much simpler task and the considerations involved reflect this.

The key capacity consideration is staffing levels. Although some training would be necessary, most, if not all, staff would be multi-skilled and so the principal capacity consideration concerns staffing to forecast/anticipated demand levels. As these would vary markedly during a week, during each day of a week and at different times during a year, then assessing how many staff are required during each hour of each day would be the key factor – having too many staff results in unnecessary costs and having too little staff results in customer queues.

Provision of equipment would not be a major consideration, as little is involved. The only factor might be items such as cooler units.

A company making lawn mowers

As these are seasonal products, the decision on the appropriate combination of products made on a make-to-order and a make-to-stock basis will impact both the staff and equipment capacity decisions.

As with many seasonal products, demand profiles are less certain due to the effect of weather and so companies would undoubtedly plan to a make-to-stock response as the start of the grass-cutting season approaches.

2 In what circumstances would it be best for a business to adopt a lead and when best a follow capacity provision policy? Give two examples for each alternative to illustrate your arguments.

Lead demand capacity provision involves timing the introduction of additional capacity so that there is always sufficient capacity to meet forecast / anticipated demand. Two advantages of this approach are that it ensures customers' orders are met and sales are maximised; and that there is typically a capacity surplus available to meet an unexpected increase in demand. The disadvantages include lower utilization levels, higher risk-taking (forecast sales levels may, in fact, not materialise) and negative cash flow as expenditure in capacity takes place before sales revenue is secured.

Examples to illustrate:

- *Prior to the launch of a new service or product* - If capacity is not in place to meet demand their customers become dissatisfied and competitors have time to respond with other own offerings.
- *Prior to a sales and marketing campaign to boost sales* - The initiatives (often some combination of advertising and price promotions) are intended to increase sales and then retain the improved market share that results. Having capacity in place ahead is clearly an imperative.

Follow demand capacity provision involves timing the introduction of capacity so that it lags (follows) demand and is at best equal to but typically greater than capacity. This less risky approach ensures that available capacity is fully utilized and that expenditure on capacity takes place only when sales revenues are somewhat guaranteed. On the downside, actual sales are typically less than those available and organisations are unable to exploit opportunities to increase sales should they arise

Examples to illustrate:

- Where sales of services or products are uncertain then a capacity-following demand provision typically makes sense.
- Where the level of investment in capacity is high then the risk factor is increased which tends to require a capacity-lagging approach.

3 Which approaches to capacity management would you favour using in an Italian ski resort hotel? Explain your choice.

On the whole the preferred approach here is for a capacity-following demand approach. In a high margin market (with a season that extends for only some months of year), handling demand/capacity provision through pricing and, where demand levels become more firmly identified, increasing capacity incrementally is probably the best option. Ensuring that current capacity is kept to a high specification would also typically be the first priority for annual capital investment allocations.

4 In making reservations for services, a common approach where demand is uncertain is to ‘overbook’ to avoid the cost of no-shows.

a) Using the examples of a passenger airline and a good-quality restaurant, discuss the pros and cons of this approach.

b) How ethical is this practice?

c) How do you think that companies handle those times when more customers show than available capacity can accommodate?

Overbooking capacity is one of the ways that a service business can use to increase the yield (use of capacity) of its operation in order to maximise its revenues. This is particularly relevant where:

- Services are sold in advance
- Services cannot be stored in any way
- Capacity is relatively fixed
- The cost of making a sale is relatively low

This practice is more commonly used where historically the incidence of ‘no shows’ (customers who book, reserve or buy a ticket or slot and then fail to turn up) is common and part of customers’ behaviour due to the nature of the way a particular segment works.

Passenger airlines

The pros and cons of using overbooking here fit all the criteria. Furthermore, the service differentiation (pre-flight, during flight and post-flight) is typically not high, particularly on domestic and other short duration flights.

If an airline overbooks and passengers fail to show it has increased its yield and hence increased its revenues. However, if more passengers show than seats available it has a problem which typically it handles with financial inducements for passengers to take another flight. By analysing past data on flight demand and no-shows, airlines try to balance the risks of over-booking.

Good quality restaurant

Using a policy of over-booking in this situation is quite different from the airline example. Although it fits all the criteria, the opportunity to re-book customers elsewhere is low and the likelihood that customers will accept an alternative is unlikely – the time of the new reservation will be late and the cuisine may not be of their choice. Furthermore, restaurants rely more on repeat business and recommendations than airlines do (competition for restaurant business is local compared to that for airlines) and to using over booking would not make business sense.

b) How ethical is this approach?

Businesses such as passenger airlines are most vulnerable to no-shows. Seat capacity is fixed and perishable. As part of its approach to selling capacity, an airline offers a range of seats prices some of which are flexible in terms of which flight can be taken. As common passenger behaviour includes no-shows then the case for over-booking has some merit. For a high-quality restaurant, few, if any, of these arguments hold true and no-shows are infrequent. As the likelihood of no-shows is small, there is no case for over-booking.

c) How do you think that companies handle those times when more customers show than available capacity can accommodate?

As well as the obvious need to pacify irate customers, handling times of over-booking will often involve financial inducements (such as money vouchers for the next ticket purchase), a later flight and even free flights at other times.

5 Discuss the advantages and disadvantages of the following approaches to meeting demand:

- **The build-up and depletion of the finished goods inventory**
- **Subcontract work**
- **Using part-time staff.**

Build up and depletive of finished foods inventory

Advantages

- Uses only trained staff to make products.
- Avoids the recruitment and training costs of take on other staff.
- Keeps a more stable working environment.

Disadvantages

- Cash tied up in inventory.
- Costs of additional warehousing – space, heating, staffing, insurance and so on.
- Potential product deterioration.

Sub-contract work

Advantages

- Task of recruiting and laying off staff is passed over to the supplier.
- Can respond quickly to lower sales without incurring the costs or problems of finding work for own staff.

Disadvantages

- Typically increases the labour cost of the service or product.
- More difficult to control quality conformance levels.

Using part-time staff

Advantages

- Under a business's own control.
- A good way to seek out future potential full-time staff.
- Able to switch staff onto work that reflects actual sales demand figures.

Disadvantages

- Involves the tasks of recruiting and training the staff.
- Need for additional space to accommodate the additional staff or if the part-time staff work at a different time of day (for example, in the evening hours between (say) 6 pm and 10 pm) then the need for additional heating costs, supervisor costs and so on.

Assignments

1 A fully integrated oil company is involved in the following major steps in the business process:

- **Searching for new oilfields**
- **Drilling for oil**
- **Building a new oil refinery or extending an existing one**
- **Managing an oil refinery**
- **Delivering different fuel grades to petrol stations**
- **Managing the sale of non-fuel goods at a petrol station.**

What are the likely time horizons in capacity planning for each of the above activities? Fit these into the long-, medium- and short-term time frames introduced in this chapter.

The purpose of the question is to get students to recognise the wide-ranging nature of the time horizons that can face a business. When using this assignment as a tutorial task you could ask the students to also have a go at one or two other companies or organisations to ensure a more thorough understanding of the time frames involved in these decisions.

Step	Likely time horizon	Time frame
Searching for new oil fields	10+ years	Long
Drilling for oil	1+ years	Long
New refinery / refinery extension	Up to 1 year	Medium
Managing an oil refinery	3–6 months	Medium
Delivering fuel grades to petrol stations	1–2 weeks	Short
Managing sales of non-fuel foods	1–2 weeks	Short

2 Which approaches (order backlog/queues or work-in-progress/finished goods inventory or a mix of the two) would the following organizations use to help handle the medium-term capacity planning issues discussed in the chapter: Managing Capacity

- **An architect’s office?**
- **A high-quality reproduction furniture manufacturer?**
- **A management consultancy company?**

The purpose here is to give students an opportunity to apply the chapter content to 3 widely different businesses. This helps to introduce them to how these businesses function and the approach to managing medium-term capacity planning issues that best suits their needs.

An architect’s office

As with most, if not all, professional firms, work is on a make-to-order basis and there will typically be a backlog of enquiries, and agreed contracts waiting to begin.

However, much of the work involves a range of staff (for example, architects' assistants and quantity surveyors besides architects themselves) while the contracts are typically completed over weeks and often months. In this way there will always be work-in-progress (contracts at different stages in their completion) that allows staff to maintain a full schedule of work with the decision about which task to do next being determined by the priority of a particular contract.

A high quality reproduction furniture manufacturer

Given the high quality (here this general phrase will refer to product specification) nature of the products, the approach to meeting demand will typically be on a make-to-order basis. However, such a company may use finished goods and work-in-progress inventory in the following ways

- Finished goods inventory may be kept for some of the high volume pieces. Typically, these high volume pieces would also be the smaller sized items. The reason for not keeping much in stock and typically selecting smaller items is:
 - Potential damage - even a scratch will demand much additional work to put right).
 - Space - furniture is bulky and difficult to store.
- Work-in-progress inventory may be kept at the pre-finished stage. As furniture typically goes through 'rough-cut' then 'fine-cut' stages, holding parts at the rough-cut stage will decrease process lead times and yet be easy to store (once assembled, furniture becomes bulky) and not so critical regarding slight damage as the 'fine-cut' stage involves taking off timber to reduce the part to its exact measurement.

A management consultancy company

This professional firm is somewhat similar to the architect's office. The only major difference is that when an assignment is started, clients want it to progress as quickly as possible to reduce its somewhat disruptive nature and to secure the benefits of the work as soon as they can. To accomplish this, consultancy companies typically have a small team

working in each client's organisation that may be (and often is) supplemented by specialist consultants as and when required. For the consultancy company, it will use the range of on-going contracts (which are their work-in-progress) to allow them to do some switching of staff and to ensure that all staff maintain the required level of billable days in a period. In this way it is able to better manage its medium-term capacity issues.

3 Should an organization always attempt to match its capacity to its forecast and known demand patterns? Give two examples to illustrate your views.

This is a good way to get students to think through an organisation's dilemma of how much capacity to plan for. Given the uncertain nature of demand (even for businesses where there is a healthy backlog of orders there will be key capacity decisions about whether or not to lead, follow or not too match future forecasts).

The answer to this question is clearly business-specific but, on the whole, there will be times when companies, by plan or default, decide not to match capacity to forecast and known demand patterns:

- Many professional companies such as dentists and lawyers will typically wait for higher demand patterns to be confirmed before making a decision to increase capacity. Often an increase of one member of staff in a key area would be equal to a relatively high percent uplift in total capacity
- Businesses such as supermarkets on the other hand, may look to match capacity with the level of market share they have set themselves to gain. In such instances they will be likely to match capacity with forecast demand levels.

4 Discuss the major differences between a call centre and a soft drinks company producing own-label products for major retailers with respect to:

- **Capacity provision**
- **Facilities location**

Capacity provision

Call centre

A reasonably high percentage of call centre staff will be part-time and some may even be temporary or agency staff. Such arrangements allow companies to adjust capacity levels more easily as staff skills are typically common across the work involved.

Soft-drinks company

Here a company would use a combination of finished goods inventory and temporary staff in higher sales periods to help manage capacity.

Facilities location

Call centre

The telephone-based nature of the delivery system uncouples the need to site a call centre in any particular location. As a result, many call centres are located in lower pay areas in order to minimise costs. This part of the question then lends itself to a discussion about the pros and cons of overseas call centre provision.

Soft-drinks company

Setting aside companies whose current location is due to past decisions, such companies would select sites that are in relatively low salaried areas, near to motorways and central to large cities or towns.

Scheduling and Executing Operations

8

Teaching resources for study activities

Discussion questions

1 Give an example of a business that would use a push and one that would use a pull operations control system. Explain your choice and briefly describe how the system would work.

The purpose of this discussion question is to get students to think through the way in which a business works and how different approaches are appropriate.

Push system

Many service business/organisations use a push system when dealing with customers who have widely different requirements, resulting in a difficulty in estimating the duration of the service for each customer. Push systems deal better with fluctuations in demand (both predictable and unpredictable) than pull systems. For example, specialist clinics in a hospital are based on an appointments system. Customers then arrive and queue at different points in the delivery system. Such approaches are used in other service businesses including dentists and hairdressers.

Pull system

Using the example of an automobile- or car-assembly plant provides a simple example of how a pull system works in practice and the conditions that need to be in place, as discussed earlier in the chapter.

2 What is the difference between independent and dependent demand? Give two manufacturing and two service examples to illustrate your answer.

This question again provides the opportunity to reinforce some of the main learning points in the chapter while requiring students to identify service and manufacturing organisations where these concepts are applicable.

- Independent demand – describes services and products for which the pattern of demand has to be forecast or based on known orders.
- Dependent demand – describes services and products for which the pattern of demand is directly linked to the use of other items.

Manufacturing examples

Tennis racquet manufacturer

- Independent demand item – tennis racquets.
- Dependent demand items include – racquet frames, stringing material, grips and racquet holders.

Manufacturer of chocolate wafer bars

- Independent demand item – chocolate wafer bars.
- Dependent demand items include – chocolate, wafer fingers, silver foil wrapping, printed paper sleeve, outer cardboard box holding several (say 24 or 48) bars and shrink wrapping material.

Service examples

Fast-food burger outlet

- Independent demand item – burgers.
- Dependent demand items include – beef burgers, buns and boxes.

Ice-cream vendor

- Independent demand item – vanilla ice-cream cornets
- Dependent demand items include – vanilla ice cream, cornets and paper holders.

3 Under what conditions should a company refuse a customer order that it is technically able to provide?

This question helps open up discussion about how a business needs to consider all the factors before making decisions about customer orders. In essence, what the question asks is - when should a business refuse a sale?

Given that repeat business and recommendations are essential ways of maintaining sales into the future the reasons to say 'no' include:

- Being unable to meet the customer's lead times.
- If the price required results in very low margin business.
- The size of the sale will make the customer involved too large a proportion of the company's customer portfolio.

The discussion that takes place will typically lead to a whole range of reasons and where this happens it is important to categorise them to improve the insights a tutorial group will gain.

4 Your local dry cleaner always specifies a two-day lead-time, no matter what items of clothing you take in to be cleaned. Suggest reasons why the outlet is able to do this and how it works.

Setting a lead time of 2 days is acceptable to most, if not all, customers. However, the amount of work waiting to go into the dry cleaning process plus the time required for post-cleaning tasks (such as checking, hanging on a hanger and bagging) is always less than two days.

No doubt in times when the order backlog had grown such that two days was not feasible then customers would be advised at the time of placing their orders.

5 Describe a service application where the principles of the theory of constraints can apply.

There are examples in the service sector where constraints of the past are no longer an issue. These include:

- Paying the bill at a restaurant – whereas in the past all payments were typically dealt with at one payment station within the restaurant, now there are usually two or more wireless credit card machines that enable the waiter/waitress to process the bill at the customer's table.
- Supermarket checkout – in most, if not all, large supermarkets self-checkout facilities provide the opportunity for a customer to avoid long queues.

A final example of demonstrating the principles of the theory of constraints was provided in Chapter 6 of the book in Figures 6.12–6.14 and the accompanying text.

6 In operations, priorities manifest themselves in a conflict between meeting customers' lead-times and due dates, and the productivity and efficiency goals of the operations system staff. Discuss and provide examples to illustrate your points.

The question provides an illustration of dual roles of operations highlighted in Chapter 1 - managing the strategic task (meeting customers' needs) and the day-to-day task (the efficiency targets in operations).

In many ways it is good initially to play the devil's advocate if help is needed to keep the debate alive. Normally, however, no help is required.

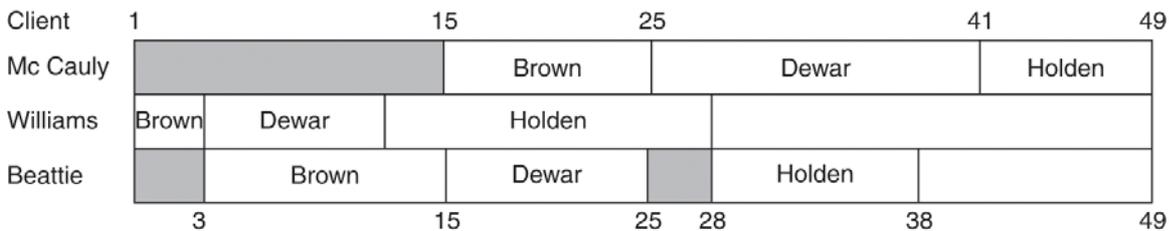
Assignments

1 A small business consultancy company has three specialists in one area of its work. Furthermore, each of these three is further specialized to undertake certain phases of an assignment. Jim Brown handles phase 1, Anne Dewar phase two, and Jean Holden undertakes phase 3. Details of the work to complete each of these assignments, together with agreed completion dates, are given in the table on p.284. In all cases, the phases need to be completed in the order 1, 2 and 3. The three

consultants can also complete other fee-paying work during the period. Using day 1 as the start date, draw a bar chart to schedule the above tasks in order to meet the agreed completion dates and release each consultant as early as possible to take on other fee-paying work when their part of these three jobs has been completed.

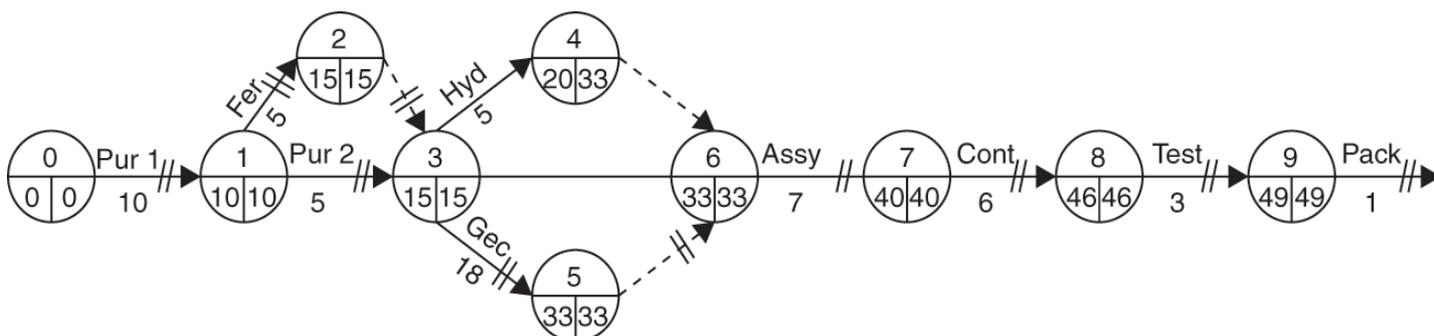
This assignment can be an interesting and fun way to show how a simple scheduling process works and is a simple way to introduce students to the topic. When discussing the assignment, you could ask students:

- 1 How many attempts did each student have at scheduling the tasks before they reached a final version?
- 2 How did they approach the task?



2 A piece of equipment requires the times shown in the table on p.284 for its manufacture. Each of the activities must be completed sequentially (that is, Activity 2 follows Activity 1 and so on), except that fabrication can be started 10 days after purchasing begins, and the hydraulics and electronics steps can be completed in parallel. Draw a bar chart for this job. If the hydraulics and electronics steps could also be started 10 days after purchasing begins, what would the network look like for this job? Also, calculate the critical path.

The network is given below



Regarding the change to when the hydraulics and electronics steps could start then the network for these 2 steps could be as for “fabrication” above, with the critical path reduced to 45 days.

Managing Inventory

9

Teaching resources for study activities

Discussion questions

1 What types of material inventory would you find in the following businesses?
Give an example of each:

- A retail pharmacist
- A petrol station
- A coffee bar
- A stone and gravel extraction company.

Business	Type of inventory		
	Raw materials	Work-in-progress	Finished goods
Retail pharmacist	Where a pharmacy makes up one-off or more low volume products (e.g. skin lotions) would hold the basic ingredients in stock. Drugs for dispensing would also be held as	Made-up prescriptions awaiting collection	Any general items not requiring a prescription.

	inventory.		
Petrol station	None	None	Fuel in holding tanks and any retail items for sale in the petrol station shop.
Coffee bar	Coffee, tea, milk, sugar etc.	Typically none	Snacks, cakes, drinks and sandwiches
Stone and gravel extraction company	None	Unwashed gravel and any materials awaiting further processing before sale.	The range of stone, gravel and other materials ready for sale.

The purpose of the above is to provide students with ways to understand a range of business and the role and type of inventory in use

2 Illustrate the difference between independent and dependent demand with two examples from a pizza restaurant.

When discussing this question you may wish to begin with a definition of items with an independent pattern of demand and items with a dependent pattern of demand, similar to that provided for Question 2 of the discussion questions for Chapter 8.

For the pizza restaurant:

- *Independent demand items* – all types of pizza and any other products sold such as garlic bread.
- *Dependent demand items* – pizza bases (or the ingredients to make these in – house), toppings, synthetic/paper bases, boxes and napkins.

3 List the 10 most valuable items you own, with an estimated unit value for each (if you own more than one of an item, multiply the unit value by the total number of items you own and use the total for this exercise). Now undertake a Pareto analysis.

A fun way to show the use of a Pareto analysis. Towards the end it is often found valuable to ask students to reflect on how much time and analysis they spend/spent when buying the 10 items and whether this analysis would influence future behaviour.

Assignments

1 What difficulties are, in general, forced on service organizations as a result of their inability to inventory their capacity? How do organizations attempt to manage these difficulties? Illustrate your answer using the following businesses:

- **A sandwich bar**
- **A passenger airline**
- **A bank**
- **A call centre.**

Following your analysis, compare and contrast the approaches you identified.

The difficulties include:

- Typically (if not always) services are make-to-order.
- Managing variable demand in a day, week or longer period is a challenge.
- Seasonal businesses typically supplement their core activities with additional ones that often are also seasonal. One consequence is that they may not understand these new sectors as well as their prime sectors.
- There is always the dilemma of having either too much or too little capacity.
- Need for multi-skilled staff to handle support activity tasks.

Sandwich bar

A sandwich bar handles the challenges of managing capacity by:

- Making fillings (work-in-progress), dressings and so on in low demand times for use in higher demand periods.
- Where possible, making finished items (for example, pre-packed sandwiches) in low demand periods.
- Preparing items such as soup ahead of time for use later.

Passenger airline

In order to improve passenger loads airlines use a combination of

- Price discounting – using lower prices as a way of affecting demand
- Varying service types with capacity – many airlines adjust the number of seats in (say) business class on busy schedules and times thereby increasing revenues
- Over-booking capacity in line with historical patterns of no-shows on different flights.

Bank

The advent of self-service (for example, ATMs) and on-line banking are illustrations of how banks have addressed this inherent characteristic, as well as taking out cost. Similarly, call centres bring together capacity by cumulating demand which facilitates handling the problem

Call centre

A combination of part-time staff and agency staff together with multi-skilled staff, allows some staff to move into other work as demand levels change.

2 Textet Computing sells software via the Internet. With each purchase, the company includes a computer manual, and it is currently rethinking whether it should outsource the preparation of these manuals or continue to make them in-house. Below are the cost estimates for the options:

- **Outsourced – total cost of 0.50 per manual**
- **Make in-house – variable cost per manual 0.30 - annual fixed costs of 7,500.00**

- (a) Which alternative has the lower total cost if annual demand is 30,000 copies?**
- (b) At what annual volume do these alternatives have the same cost?**
- (c) Textet Computing estimates that its sales of software next year will increase to 55,000 units. The outside supplier will drop the price per manual to 0.43 for these volumes. At what quantity of manuals are the cost of making in-house and the cost of outsourcing equal at 0.43?**

a) The annual total cost for outsourced is $30,000 \times \text{£}0.50 = \text{£}15,000$.
Annual total cost for make in-house is $30,000 \times \text{£}0.30 + \text{£}7,500.00 = \text{£}9,000 + \text{£}7,500 = \text{£}16,500$

b) At what annual volume do these alternatives have the same cost as made-in-house:

$$\frac{\text{Annual fixed cost in-house}}{\text{Difference between outsourced}} = \frac{7,500}{0.20} = 37,500$$

c) The break even analysis is similar to that for b) above:

$$\frac{7,500}{0.13} = 57,692$$

Managing Quality

10

Teaching resources for study activities

Discussion questions

1 The table on p.358 lists data concerning the errors in an account management function in the financial services sector.

This question serves two purposes:

- 1) It provides a chance for students to have a go at Pareto analysis and discover what it reveals
- 2) It emphasises the importance of undertaking several analyses to get a more informed picture

Pareto list – frequency

Error type	Frequency	Cumulative %
D	56	27
A	40	45
C	33	61
H	28	74
E	22	85
G	16	92
F	12	98

B	4	100
TOTAL	211	100

Pareto list – cost involved

Error type	Costs (£s)	Cumulative %
H	116,000	53
C	36,000	69
G	23,000	80
D	15,500	87
A	12,500	93
E	7,500	96
F	5,750	99
B	2,800	100
TOTAL	219,050	100

Notes

1 A good learning point here is that rounding figures sharpens the analysis but does not detract from the accuracy. The key in providing management data is magnitude and not exactness

2 Both figures illustrate the 80/20 type relationship highlighted in this chapter

2 Discuss the advantages and disadvantages of staff recording their own performance data in the form of a control chart and analysing the outcomes for the delivery system for which they are responsible.

The need to make staff feel responsible for the quality conformance of the delivery system for which they are responsible is essential to ensure that they are proactive in meeting quality conformance targets and fixing the origins of problems. Such a stage as this is essential for organisations to improve standards

3 The evolution in how best to manage quality has been described as follows:

Product reliability → Process reliability → People reliability → Total quality management

Comment on these rankings.

These steps reflect the changing approach to managing quality and this question offers a platform to discuss each step and the changes (include difficulties such a changing management activities) that are required.

Assignments

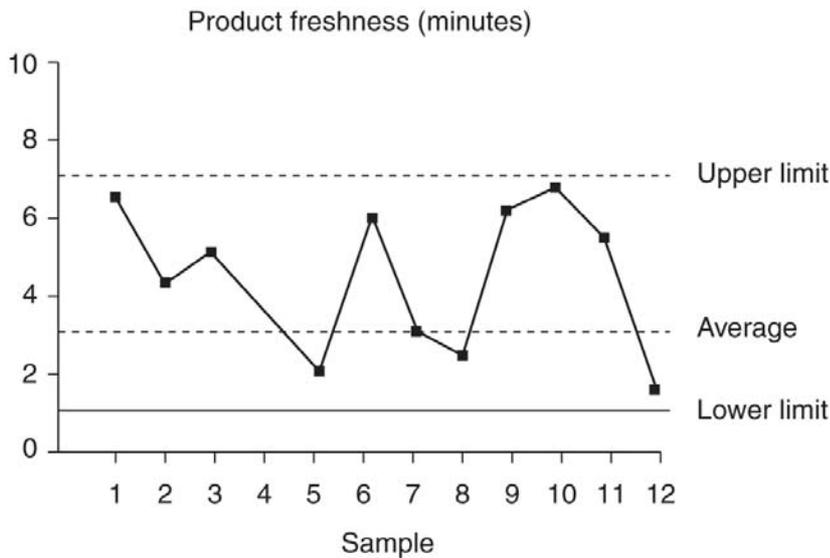
1 Draw a fishbone diagram to represent why your car might be two hours later than the promised completion time at an auto service centre.

This arrangement encourages students to use a fishbone diagram and also (and often this needs to be brought to their attention) to recognise that it helps to identifying possible problems even in situations in which they are unfamiliar.

2 To access part of its service delivery system, a fast-food chain undertakes regular checks on certain elements of the system. One such check at an outlet revealed the control data in the table on p.359.

The best way to approach this assignment is to ask some students to complete a control chart for one element, some for another and so on. In this way students will get the chance to experience using a control chart, and will better understand its use in running a business as a way of checking the targets for aspects in the delivery system.

The one for “products freshness” is provided below and can be used as an illustration.



3 An operations manager records the daily output and number of rejects on a bag-making line that runs for a single eight-hour shift with occasional overtime on a Saturday.

The data for the last 40 days are given in the table on p.360.

- (a) Construct a control chart for these data**
- (b) What does the data analysis tell you?**
- (c) What management action should be taken?**

With a larger group, a good way to handle this question is to split the task into completing control charts based upon:

- a) Output (number of bags)
- b) rejects (number of bags)
- c) rejects as a % of total output. For example Day 1 would be:

$$\frac{24}{2040 + 24} \times 100 = 1.16$$

Note – you should highlight the need for students to determine the upper and lower limits.

4 Casual Elegance is a mail order business in clothes for the younger businessperson. From time to time, customers complained about errors in their orders – wrong style, wrong size, and so on. The company wishes to keep order errors to less than 2 percent. To check how well the system was working, a sample of 50 orders was taken several times over a representative period. The results are shown in the table on p.360.

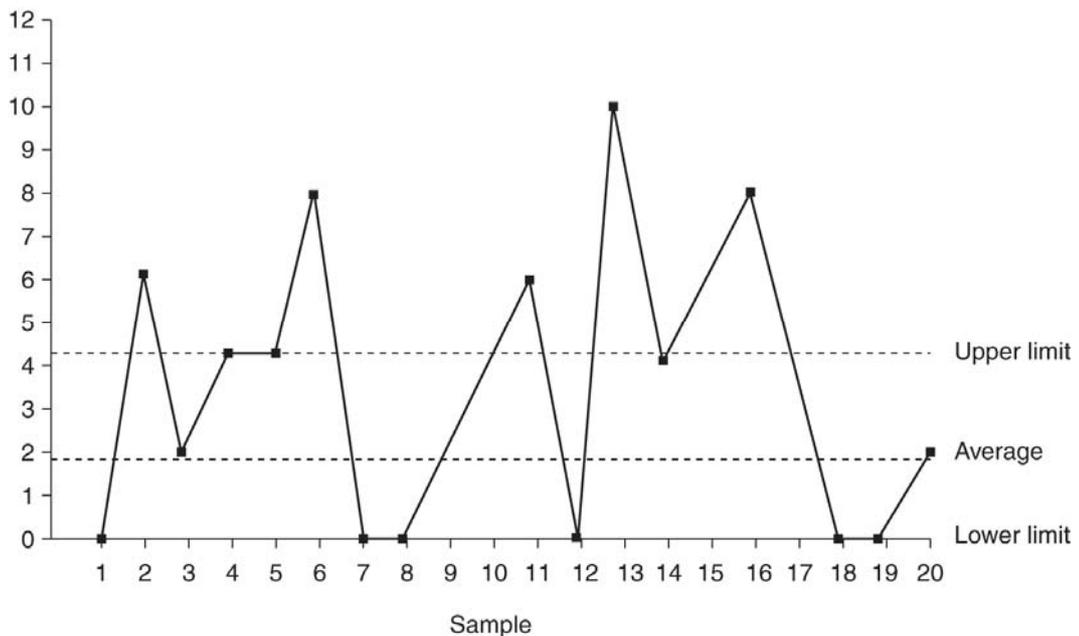
a) What type of control chart is appropriate for checking the process capability of the ordering operation?

Control charts are used to monitor a process and ensure that the process performs consistently over time. In this instance, a control chart for variables would be used, similar to that in Figure 10.9, p 346 of the text.

b) Construct a control chart using these data. What observations can you make about the process?

The first step is to convert the 20 samples of 50 orders into the percentage of problems found, as below:

Sample	% Problems	Sample	% Problems
1	0	11	6
2	6	12	0
3	2	13	10
4	4	14	4
5	4	15	6
6	8	16	8
7	0	17	4
8	0	18	0
9	2	19	0
10	4	20	2



Note here the upper limit and average have been introduced and part of the debate would be around their positions.

Comments

- 1 The average % problems from these data is:

$$\frac{35 \text{ problems}}{1000 \text{ orders}} \times 100 = 3.5\%$$

- 2 Clearly the current operation falls well short of the order error target it desires

Managing the Supply Chain

11

Teaching resources for study activities

Discussion questions

1 What factors should be taken into account when making make-or-buy decisions? Illustrate your answer with examples from a service and a manufacturing organization.

This question is designed to get students to think through the make or buy decision using real-life examples. The chapter covers these points from page 369 onwards. The section lists 7 factors that need to be taken into account, together with the advantages and disadvantages of making-in house or buying from outside/outsourcing.

2 Given the increasing importance of environmental concerns, how would a company incorporate these issues into the make-or-buy process? Give two examples to illustrate your views.

As part of a growing ethical awareness within companies, particularly those that source from overseas, environmental considerations are increasingly affecting the commercial behaviour of suppliers and decisions about where/what to buy.

Examples to illustrate this include

- The percentage of recycle material used by type (e.g. paper, glass and plastic).
- Use of “Fairtrade” material suppliers.

3 How will e-commerce continue to impact the supply chain?

The question is designed to get students to think through how e-commerce will continue to reduce the front end of the process thereby reducing overall lead times and in so doing, will continue to change customer's expectations of delivery speed and the pressure this places on operations and distribution lead times.

4 What benefits do suppliers receive from developing closer ties with major customers?

As many supplier relationships move increasingly towards a collaborative and integrative supply chain, the gains for suppliers include:

- Longer contracts leading to more certainty and reduced risk when investing in the relevant delivery systems and manufacture processes.
- Able to reduce costs and thereby maintain margins where customers look to agree lower, stable prices.
- Access to real-time information.
- Greater harmonisation of supplier's work with customer requirements.
- Increasing control over when and how much to deliver.
- Suppliers' own processes and delivery systems are taken into account when customers design new products and services. In fact eventually suppliers could be more fully integrated into their customer's design team.

5 A major company decides to move to a more collaborative stance with a supplier. What would be the first key changes it would need to make? What possible initial responses might be made by the supplier?

The first changes the customer would need to make include:

- Reducing the number of suppliers for given services and products.
- Agreeing longer contracts.
- Becoming proactive in developing a supplier relationship.

What possible initial responses might be made by a supplier?

- Being uncertain about the form and format of the “more collaborative” relationship, a supplier may be reluctant to commit to its side of the new arrangement – the difference between words and deeds.
- Ascertain the detail / reality of what the new “more collaborative” relationship means on a whole range of key issues including whether agreed volumes and delivery schedules could be changed and the timescales involved to invoice payment agreements.

6 Give two examples (with reasons) for both a service and manufacturing company where outsourcing a service:

- **Makes sense**
- **Does not make sense**

Makes sense to outsource

- Service company example – skilled aspect of work the demand for which is uncertain and insufficient to recruit an experienced, full-time professional
- Manufacturing company example – those processes (such as heat treatment or other specialised processes) which require significant investment and bring additional costs and concerns such as health, handling hazard materials and so on.

Does not make sense to outsource

- Service company example – where the technical know-how is core to the service offering and where the control and development of these capabilities is essential to retaining and growing market share.
- Manufacturing company example – those processes closest to the sale as these provide direct feed-back on future demand and increase the chances of responding to changing customer needs and requirements.

7 What type of call centre service providers lend themselves and do not lend themselves to overseas provision?

- Call centres providing the first line of technical support in which call centre staff lead customers through a number of pre-defined steps to address their problems typically lend themselves to overseas provision.
- Instances where customers are seeking advice and for which there is no clear-cut solution do not lend themselves to overseas provision.

8 What benefits would a company derive from introducing e-procurement? What are the obstacles you would expect to hinder this development?

E-procurement extends electronic applications into the wide range of indirect goods and services that are bought by staff at all levels in an organisation.

a) The benefits to the organisation include

An increase in contract compliance through:

- Increased use of preferred suppliers
- Fewer instances of contract spending
- Reduced processing costs

Leverage of the purchasing spend by:

- Providing greater oversight of the sizeable elements of total purchasing costs
- Recorded details by supplier and service/product category
- Allows full purchasing power to be leveraged when agreeing contracts

Lower processing costs by:

- Faster processing times
- Low number of emails/telephone calls
- Fewer errors

Increased involvement of people:

- Online takes delay out of the purchasing process while involving people in the process
- Customer control is built into the system which ensures that customers can search to get the best fit for their needs.

b) Obstacles hindering this development include:

- Initial uncertainty about how it would work.
- Reluctance by the purchasing function to delegate the task to the user.

Assignments

1 What criteria do you think the owner of each of the following independent outlets would use to evaluate and select key suppliers?

- **A restaurant**
- **A stationer**
- **A coffee shop.**

Now visit an independent outlet for each of these types of company and ask the owners how they evaluate and select key suppliers. Compare the results and explain any significant differences.

A restaurant

- Quality conformance – meeting an owner's food specifications and requirements regarding taste, freshness and so on.
- Delivery speed – the willingness and ability of a supplier to meet short lead time requests.
- Availability – the range of products on offer.
- Price – probably a qualifier, as products must be in the correct price bracket to ensure reasonable profit margins.

A stationer

- Price – as specifications of product alternatives would be similar and large competitors such as supermarket chains would wield greater clout the overall margins would need to be reasonable.
- Delivery reliability – deliver orders on time.
- Range on offer – easier and makes more sense to deal with a single supplier for different categories of product

A coffee shop

- Price – as it would use high volumes (in coffee shop terms) of some products then would seek competitive prices to enhance its own margins.
- Product specification – must have selected brands of coffees and teas and a source of fresh cakes, pastries, breads and fillings.
- Delivery reliability – regular orders delivered on schedule.

2 In what circumstances would you consider that each of the following would be advantageous to a company:

- **Single sourcing**
- **Multisourcing**

Use a service and a manufacturing organization to illustrate your views.

Single sourcing

- Particularly lends itself to high volume, low specification products making switching easy while maximising price discount opportunities.
- Wish to encourage supplier to invest in its processes and capabilities to bring about cost reductions and to enable the suppliers to meet more exacting future technical requirements

Multi-sourcing

- To ensure access to the required skills and technical process capabilities.
- High risk due to the central nature of the purchased service or part.

- Anticipated future growth needing to have sufficient potential supplier capacity in place.

Improving Operations

12

Teaching resources for study activities

Discussion questions

1 A retail outlet offering a range of high-specification women's clothes wishes to develop relevant performance measures. Suggest those that you consider appropriate.

Possible performance measures include:

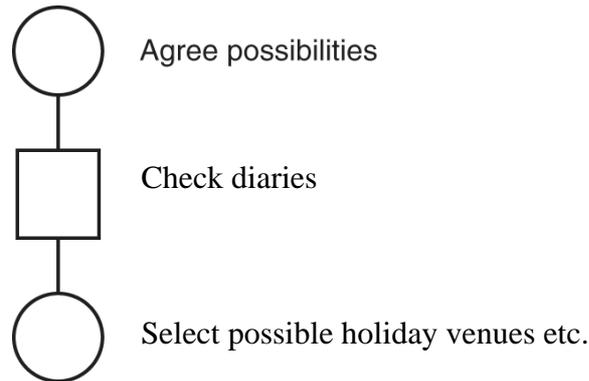
- Revenue per hour/day generated.
- Discounted sales as a percent of total sales.
- Size of discounts in total and by brand name and garment type.
- Sales revenue in terms of first-time buyers and repeat customers.
- Sales revenue by
 - brand name.
 - garment type.
- Number of times when customers are waiting and by time of day
- Number of customers waiting:
 - 1 customer.
 - 2 customers.
 - 3 or more customers.

2 Explain the difference between stepped and incremental change programmes. What are the advantages and disadvantages of each?

This question seeks to get students to analyse the relevant sections in Chapter 12 (p 420 onwards) and provide an overview including the advantages and disadvantages

3 Draw an outline process chart when arranging a holiday for which the hotels and flights are directly booked by you.

The purpose here is to get students to utilize these tools on situations that they either know or can easily envisage. It is always useful to display (or even better program) how the outline process chart would be designed. There is a whole range in *Operations Management*, 2nd Edition (2005) Palgrave Macmillan as Exhibit 16.12 on page 594–5.



4 Why is the use of video gaining widespread application in the field of continuous improvement?

The first step having selected a task or part of a task that needs improving is to record what currently happens.

Videoring what takes place is a simple but accurate method with the following benefits

- Accurate – it provides a complete record of the activities
- Acceptable – as it is equipment and not a person that is completing the recording then those under review find this method more acceptable
- Facilitates analysis – a visual record facilitates analysis and provides the opportunity for all involved to be party to reviews and solutions
- Visual record of events

5 Why is there actual conflict between management and staff over productivity levels? What actions can operations managers take to resolve these differences?

Any conflict that may arise stems from management's desire/belief/knowledge that actual output/hour (for example) could be higher. Such situations were (and may be still are) at the root of conflict and may show themselves in the form of a business's intent/proposal to reduce manning levels.

The operations manager's task is to develop a style of involvement by staff both in terms of recording work, errors and so on while being at the forefront of any proposed developments.

Assignments

1 Develop a cause and effect diagram to explain lengthy service at a restaurant.

This assignment offers an alternative opportunity to get students to use tools within the book. Take a look at Chapter 10 Assignment Question 1 where such an analysis was completed for the possible reasons why your car might be two hours later at the garage than promised.

2 Use the Deming cycle approach to suggest and implement improvements to the library lending delivery system.

Again this assignment provides students with an opportunity to use one of the many tools covered in the book and typically provides a good vehicle for discussion. Involving the college/university library staff (in the analysis and any proposed changes to the tasks in the college/university library) brings the best results.