

Chapter 18

Product costs: materials, labour and overheads

REAL WORLD CASE

This case study shows a typical situation in which management accounting can be helpful. Read the case study now, but only attempt the discussion points after you have finished studying the chapter.

Company buyers across Europe aim to cut the cost of procuring raw materials, goods and services this year by 13%, the highest amount in four years. The aggressive target coincides with the arrival of the purchasing manager – once seen as an administrative function – at the finance director's right hand side. But many of the 225 purchasing heads from financial services and manufacturing companies responding to an annual survey by software company Ariba admitted they had little idea what was being spent by other departments. For instance, 37% said they could account for less than 10% of the amount that their companies spent on services. Instead, to hit their cost saving targets, more buyers than ever said they will rationalise their supplier bases and pressurise those left to deliver more cheaply. They would continue to renegotiate contracts despite admitting that average year-on-year savings from contracted suppliers had fallen from 10% to 7% in the past year, the growing use of non-contracted suppliers based on low-cost countries apparently eroding the previously wide price difference between the two.



Source: *Daily Telegraph*, 24 February 2005, Business2Jobs, p. 1, 'Buyers resolve to slash costs'.

Discussion points

- 1 What is the role of the purchasing manager?
- 2 What are the limitations of forcing cost savings onto suppliers rather than looking to internal improvements in the buying company?

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Learning outcomes

After reading this chapter you should be able to:

- State the main components of total product cost.
- Explain the process of controlling and recording costs of materials.
- Explain the process of controlling and recording costs of labour.
- Explain the traditional approach to allocating and apportioning production overheads to products.
- Explain how cost drivers may be used to allocate overhead costs in activity-based costing.
- Contrast the traditional and activity-based methods of dealing with overhead costs.

18.1 Introduction

Some businesses manufacture goods, while others perform a service. Whatever the nature of the business, all will at some stage use materials, they will employ labour and they will incur overhead costs (the name given to other costs which are necessary to the operation of the manufacturing or service process).

In this chapter we outline traditional procedures for recording the costs of materials, labour and production overheads and indicate some of the problems which are encountered. Many of these procedures remain a cornerstone of present-day management accounting but others, particularly those related to overhead costs, have caused management accountants to look for new procedures.

A statement of the cost of a unit of output provides a useful starting point for this chapter in setting out a list of items to be explained in more detail (see Exhibit 18.1).

This chapter explains how costs are recorded and traced to products. Products may be goods or services. Direct costs are directly traceable to the relevant products. Indirect costs (overheads) must be shared across more than one product. Exhibit 18.2 summarises the way in which costs are traced to products. It relates to a cost centre where the output consists of three different products (goods or services). Materials and labour are part of the **product cost** (where products may be goods or services). The direct materials and direct labour are part of the **prime cost**. The indirect materials and indirect labour are part of the **production overhead costs**.

Definition

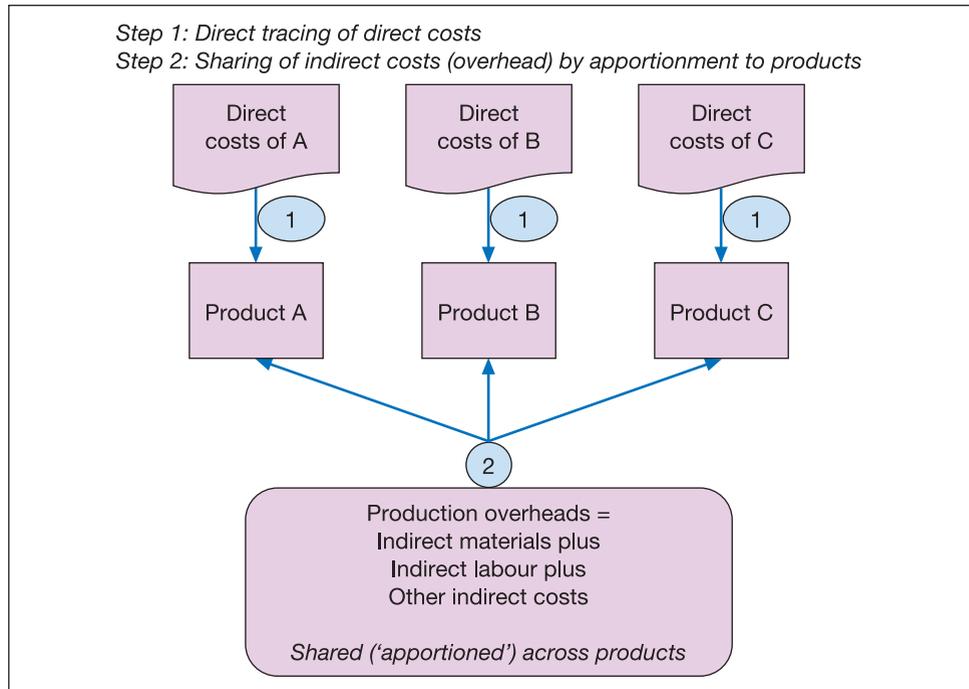
Prime cost is the cost of direct materials, direct labour and other direct costs of production.

The **direct costs** in Exhibit 18.2 consist of direct materials, direct labour and any other costs that are directly identifiable with a product. We know how much material is needed for the product, we know how much labour time is worked on the product and we know about any other costs related only to that product. So the arrows flowing downwards in Exhibit 18.2 show the direct costs of each product flowing directly to that product.

Some materials, some labour and some other costs are classified as **indirect** because they are spread across a range of products. These have to be shared in some way across the products. Exhibit 18.2 shows the overhead costs being **apportioned** ('shared') across products. One debate in management accounting focuses on how to carry out that process of **apportionment**. This chapter presents two approaches in that debate.

Exhibit 18.1
Statement of cost of a production item

	£	£
Direct materials		xxx
Direct labour		xxx
Other direct costs		<u>xxx</u>
Prime cost		xxx
Indirect materials	xxx	
Indirect labour	xxx	
Other indirect costs	<u>xxx</u>	
Production overhead cost		<u>xxx</u>
Total product cost		<u>xxx</u>

Exhibit 18.2**Tracing costs of Products A, B and C in a single cost centre**

Sections 18.2 and 18.3 of this chapter describe methods for recording and controlling the costs of materials and labour. The nature of the materials and labour, and the type of output of the enterprise, will lead to classification of **direct** and **indirect costs** of materials and labour.

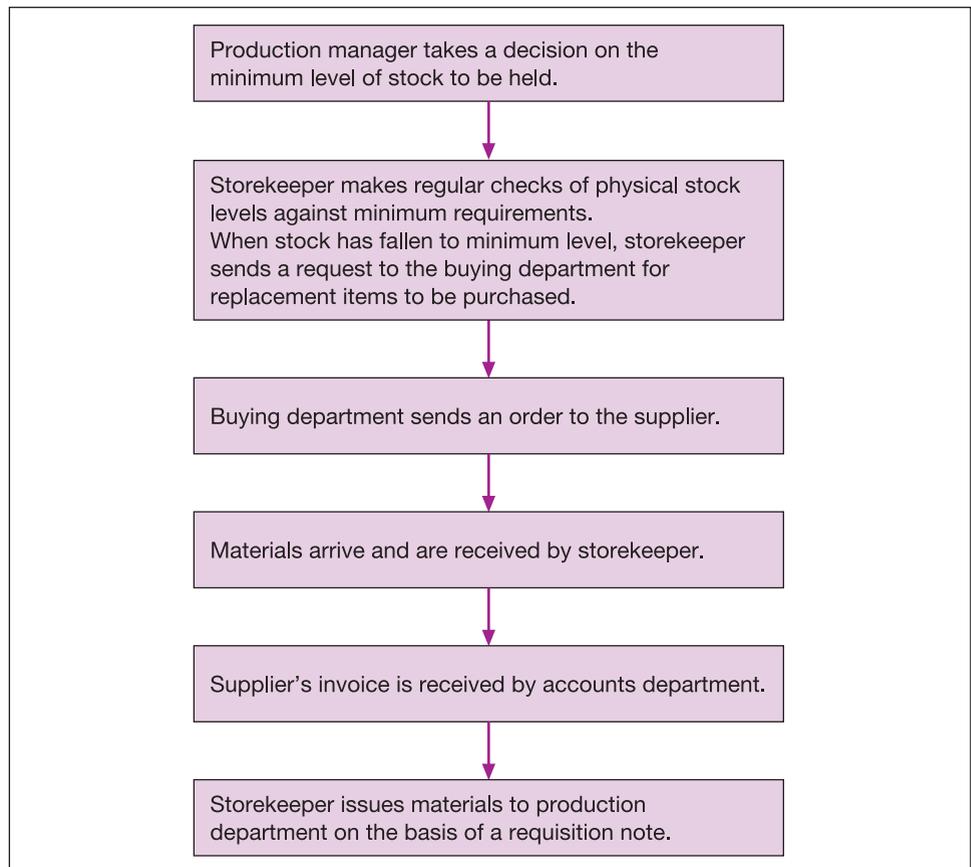
Section 18.4 brings together all the indirect costs of production and groups them under the heading **production overhead cost**. It describes the process of ensuring that overhead costs reach the products, using the **traditional** approach. Section 18.5 sets out an alternative to section 18.4 by sharing out the production overhead costs using an **activity-based costing** (ABC) approach. Section 18.6 compares the traditional and the ABC approaches.

Activity 18.1

Look at some item in the room where you are sitting as you read this chapter (perhaps a table or a desk or a window). What words would you use to **describe** the cost of producing that item (e.g. wood, plastic, work in assembly, running costs of workshop)? How would you start to **measure** the cost of producing that item? Write down your thoughts now, and then look back after you have finished this chapter. That will help you consider what you have learned from the chapter.

18.2 Accounting for materials costs

Exhibit 18.3 shows the sequence of activities which control the ordering, delivery and safekeeping of materials, together with the subsequent payment to suppliers. Information which is useful for accounting purposes will be collected from the documentation that is created during these procedures.

Exhibit 18.3**Materials control procedures**

It is not difficult to see that with so many procedures involved there needs to be careful control over materials moving into, and out of, store. Each stage in the process requires a document as evidence that the transaction or process has been completed correctly. Every business has a different system of documentation which suits its particular needs. The following description is typical of the documents encountered in materials handling and control. *Italics* are used to indicate each document.

18.2.1 Materials handling and control documentation

When the storekeeper notes that the inventory (stock) has fallen to the minimum level, triggering a reorder requirement, a *purchase requisition* will be sent to the buying department. The buying department will have a list of items which the production manager wishes to have available in store and the quantity to be reordered. Provided the item is on that list, the buying department will send a *purchase order* to the supplier. In some cases the production manager may have issued a purchase requisition directly because a new item of materials, not previously held in store, is required. It is the responsibility of the buying department to choose a supplier who provides reliable service and a high-quality product at a competitive price. A copy of the purchase order will be sent to the storekeeper as notification that the materials have been ordered.

When the materials arrive from the supplier, the driver of the delivery vehicle will bring a *delivery note* which the storekeeper will sign, after checking against the quantities received and noting any discrepancies. The storekeeper will then prepare a

materials received note, sending one copy to the buying department and another to the accounts department. Soon after the materials arrive, the accounts department will receive the *supplier's invoice*, showing the quantities of the materials supplied and the price charged for them. The accounts department will check the quantities against the materials received note and will check the invoice price against an agreed price list provided by the buying department. If all is correct, the accounts department will pay the supplier.

Finally, the materials will be needed by the various production departments. To release the materials from store, the production departments will produce a *stores requisition* which the storekeeper will check and will then pass on to the accounts department for use in keeping the management accounting records.

Exhibit 18.4 provides a summary of the various documents, their origin, destination and use for recording purposes. The two essential pieces of information for determining the cost of materials used in production are the price per unit and the quantity of materials issued. These are highlighted in **bold** in Exhibit 18.4. As you will see, the price and quantity are taken from different documents, the supplier's price being taken from the invoice while the quantity of materials used is taken from the stores requisition.

The documents listed in Exhibit 18.4 are referred to as *primary sources* because they form the first evidence that a transaction or event has taken place. From these primary sources the accounting records are created. Clearly, the accuracy of the accounting records is heavily dependent on careful and accurate processing of the primary documents.

Exhibit 18.4

Documentation in materials control procedures

<i>Document</i>	<i>Origin</i>	<i>Destination</i>	<i>Use</i>
Purchase requisition	Storekeeper or production manager	Buying department	Authority for purchase of materials from supplier
Purchase order	Buying department	1 Supplier 2 Storekeeper	Authority to supply materials Indication that materials will arrive
Delivery note	Delivery driver	Storekeeper	Check on quantity received, in good state
Materials received note	Storekeeper	1 Buying department 2 Accounts department	Confirmation that buying process is complete Evidence of quantities for checking against invoice
Supplier's invoice	Supplier	Accounts department	Shows quantities received and unit price
Stores requisition	Production departments	1 Storekeeper 2 Accounts department	Authority to release materials from store Record of quantities used in production

18.2.2 Materials costs when input prices are changing

One problem faced by the accounts department is that suppliers change their prices from time to time. Materials held in store may have arrived at different times and

at different unit prices. How does the accounts department decide on the unit price to be charged to each job when all the materials look the same once they are taken into store? The usual procedure is to assume, for pricing purposes, that the first materials to arrive in store are the first ones to leave. This is usually abbreviated to FIFO (first-in-first-out).

Some businesses prefer to use the average cost of all items in inventory (stock) as the basis for pricing issues. For management purposes the best method for the purpose should be applied. Management accounting escapes the constraints of statute law, accounting standards and tax law which restrict practice in financial accounting. (Section 9.8.3 of Chapter 9 shows a detailed example of pricing the issue of materials when input prices are changing.)

18.2.3 Costs of wastage and scrap

The term **waste** is applied to any materials that have no value, whatever the reason. If some waste material can be sold for disposal, usually at a very low price in relation to its original cost, then it is called **scrap**.

In the ideal situation, all materials received into stores are issued to production. Real life is not always like that, because stores may disappear before they have a chance to be used in the production process. The disappearance may be caused by deterioration or damage in store, the materials may become obsolete or unsuitable for use in production or they may be stolen. Sometimes materials may appear to have gone missing when in reality it is the accounting records which are incorrect because a stores requisition note has been lost or an item has been allocated to the wrong **job cost record**, or perhaps there is a calculation error on a stores list. It is always worthwhile to check the accuracy of the accounting records before assuming that materials have disappeared.

For the management accountant the loss of materials creates another cost problem. The cost must be charged somewhere in the system but it cannot appear as a direct cost because the materials never reached the production department. The cost of wastage therefore has to be noted as a separate indirect materials cost, to be spread over the cost of all products. If any cash can be recovered by selling as scrap some obsolete or damaged materials, then the proceeds of sale may be recorded as reducing the overall cost of wastage.

18.2.4 Cost classification and materials costs

The cost classification system is required to show whether costs are **direct** or **indirect** costs and whether they are **fixed** or **variable** costs.

How are direct and indirect materials costs distinguished?

The earlier description of materials costing procedures has shown how multiplying unit price by the quantity of materials used will give a measure of cost, although there may need to be a choice of unit price to be applied (see section 18.2.2). Materials issued to production are usually made available on the basis of a stores requisition, so there should be no problem in identifying direct materials costs for the job in question.

Some materials costs may be spread over a range of products and activities, each of which must take a share. The case of wastage before the materials are issued to production has already been discussed. Other examples would include transportation costs and all the costs of receiving, issuing and handling stores (such as the store-keeper's wages). It is preferable to record materials costs as direct costs, identified with the job, wherever possible. On the other hand, the cost of spending time on keeping records must be weighed against more productive uses of that time.

How are fixed and variable materials costs distinguished?

Most materials costs will be **variable** costs, irrespective of whether they are direct or indirect so far as the job is concerned. If output is not being achieved, then materials will not be used and will be held in store for use in a future period.

To be a **fixed cost**, the materials would have to be required for use in a period irrespective of whether or not production takes place. That is an unlikely situation in most business operations.

Activity 18.2

You have been employed as a storekeeper at a superstore selling vehicle accessories. Write down the main procedures you would carry out to ensure that:

- *the materials in store are held securely;*
- *the accounting records of inventory (stock) are accurate; and*
- *the materials are issued only to authorised persons.*

18.3 Accounting for labour costs

The cost of any resource used in a business is the product of the amount of resource used and the price per unit of the resource. For the resource of labour, the amount of resource is usually measured in terms of hours worked and the price is usually expressed as a rate paid per hour.

18.3.1 Types of pay scheme

The first problem which the management accountant meets in dealing with labour costs is that different employees are on different pay schemes. Some employees receive a monthly salary, paid at the end of the month worked. They are expected to work whatever number of hours is necessary to complete the tasks assigned to them. This type of remuneration is most commonly found in the case of administrative staff where the emphasis is on undertaking tasks which are necessary to the overall duties and responsibilities of the post. Other employees receive a basic salary per week, or per month, which is augmented by extra payments depending on output levels or targets achieved. This type of pay scheme has a 'loyalty' element in the basic salary together with a reward for effort in the output-related extra payments. Other employees may be paid an hourly rate based on actual hours worked, receiving no payment where no hours are worked. Finally, there may be some employees paid on a piecework basis, receiving a fixed amount for every item produced, regardless of time taken. To add to the problem, there may be labour costs of the business which are not paid to the employee in the form of wages or salary. These would include the provision of a car, free medical insurance, clothing allowances, rent allowances, relocation and disruption payments, inducements to join the company and lump sum payments on leaving the company. There are also the employer's labour costs, such as employer's contributions to national insurance, which are part of the total labour cost as far as the business is concerned.

18.3.2 Determining the labour cost in an item of output

The differences outlined in section 18.3.1 all add to the problems of the management accountant in converting the variety of schemes to a uniform basis for costing purposes. Usually, calculating a rate per hour is sufficient to provide such a uniform

basis, provided the number of hours worked is known. The cost of labour used on any job may then be determined by multiplying the hourly cost by the number of hours worked.

18.3.3 Cost classification and labour costs

The classification system is concerned with whether costs are **direct** or **indirect** and whether they are **fixed** or **variable**.

How are direct and indirect labour costs distinguished?

Multiplying unit cost by the number of hours worked is fine provided there is a time record and provided that time can be allocated exclusively to one product at a time. In some businesses it might be feasible to keep track of specialist labour time spent on each product. This part of the labour cost is regarded as the direct cost.

Some labour costs may never be allocated directly to a specific job because they are spread over a range of jobs and activities, each of which must take a share (e.g. supervisor's salary, cleaner's wages, or non-productive time when skilled employees are not able to work because equipment needs attention). This part of the labour cost is called indirect cost. Indirect labour costs also include holiday pay, bonus payments and overtime pay. That gives the management accountant a further problem in deciding on a fair basis of apportionment of indirect labour costs. Apportionment of indirect costs will be dealt with in section 18.5 on production overhead costs.

How are fixed and variable labour costs distinguished?

One quite difficult question with labour costs is to decide whether they are **fixed** or **variable** costs. If the employee is on a contract which provides a fixed basic salary, then the total salary is a fixed cost for the organisation. The employee will then spend time on producing output and that amount of time will vary depending on the level of output. Thus the *direct* labour cost attributable to that employee will be a **variable** cost, depending on level of output. The remaining time, when the employee is not producing output, will be classed as an *indirect* cost of non-productive labour.

18.3.4 Recording labour costs

The system for recording labour costs must be capable of dealing with the payroll aspects (keeping track of how much is paid to each employee) and with the cost allocation aspect of tracing those payroll costs, together with other labour costs, to the products of the business. That in turn requires a careful recording of the total time worked by the employees each week, analysed into the time spent on each product and the amount of non-productive time.

Direct labour costs will be calculated using hours worked and the hourly rate for each employee. The hours worked will be collected from employee time sheets which show the time spent on each product unit. Hourly rates for each employee will be available from personnel records, based on the cost of employing that particular person.

In practice, it is likely that costing records will be kept by computer, with employees entering data on-line.

Activity 18.3

You are employed in the personnel department of a large organisation. Explain how the records kept by the personnel department would be useful to the accounting department in preparing the monthly payroll.

18.4 Production overheads: traditional approach

Production overhead was defined in Chapter 17 as comprising **indirect materials**, **indirect labour** and other **indirect costs** of production. Indirect materials and indirect labour have been explained earlier in this chapter. Other indirect costs will include any item which relates to production and which is not a materials cost or a labour cost. The type of **indirect cost** will depend on the nature of the business and, in particular, on whether it is a manufacturing business or a service business. Examples are:

- In a manufacturing business: repair of machinery; rent of factory buildings; and safety procedures.
- In a service business: cost of transport to jobs; replacement of tools; and protective clothing.

Whatever their nature, all the production overhead costs have to be **absorbed** into the products.

Normally the management accountant has to devise a scheme of **allocation** and **apportionment**. There are some essential features for any successful scheme. It must be:

- fair to all parties involved in the process of allocation and apportionment;
- representative of the benefit each party gains from the shared cost;
- relatively quick to apply so that provision of information is not delayed;
- understandable by all concerned.

This chapter will use arithmetically simple models for illustrative purposes, although the mechanism for apportionment does not have to be arithmetically simple provided a computer can be used.

The process to be described here has three stages:

- 1 **allocating** and **apportioning** indirect costs to cost centres;
- 2 **apportioning** service department costs over production cost centres;
- 3 **absorbing** costs into products.

Definitions

Allocate means to assign a whole item of cost, or of revenue, to a single cost unit, centre, account or time period.

Apportion means to spread costs over two or more cost units, centres, accounts or time periods. (It is referred to by some books as 'indirect allocation'.)

Absorb means to attach overhead costs to products or services.

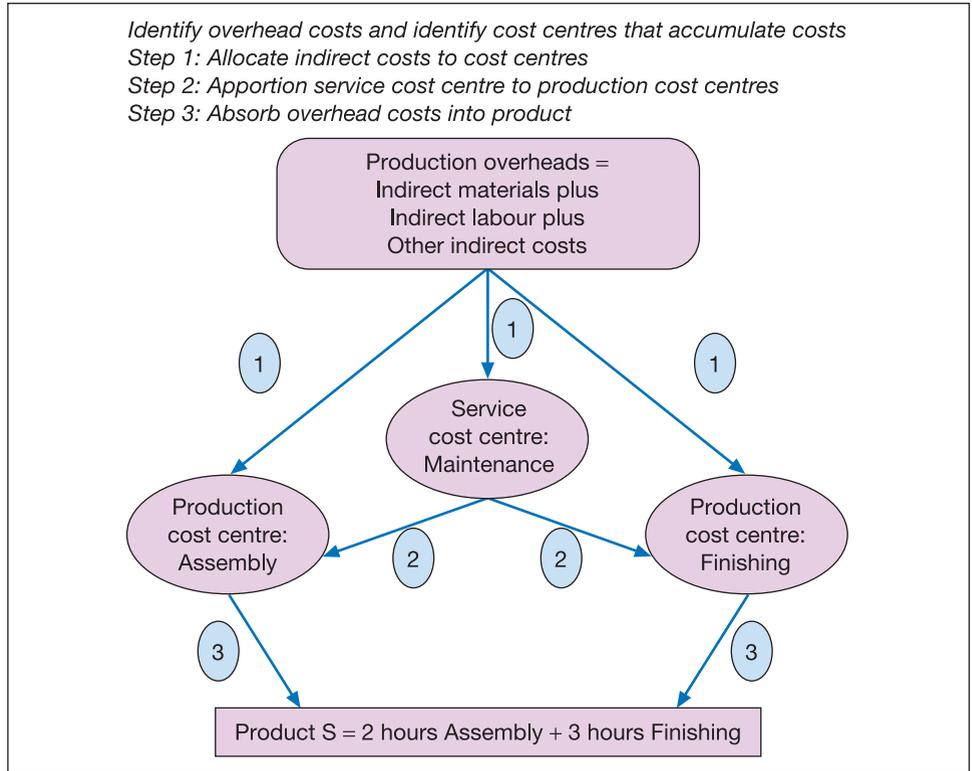
Allocation, apportionment and absorption in job costing

- Direct materials are **allocated** to products.
- Direct labour costs are **allocated** to products.
- Indirect materials costs and indirect labour costs are **allocated and apportioned** to cost centres.
- Total indirect costs of service cost centres are **apportioned** over production cost centres.
- Total overhead costs of production cost centres are **absorbed** into products.¹

Exhibit 18.5 provides a diagram to show the three stages in the flow of indirect costs. The calculations are explained in detail in Section 18.4.4.

Exhibit 18.5

Traditional approach to the flow of overhead costs



18.4.1 Allocating and apportioning indirect costs to cost centres

There are two main types of cost centre in any business, namely service cost centres and production cost centres. The **production cost centres** are those directly involved in the production activity. The **service cost centres** are not directly involved in the production activity but provide essential backup. To sustain long-term profitability, the products of the business must sell at a price which makes a profit after covering the costs of the service cost centres as well as those of the production cost centres.

The management accountant will first of all divide the overhead costs into two categories: those which may be **allocated** as a whole to each cost centre, and those which have to be **apportioned** (or shared) over a number of cost centres according to how the cost centres benefit from the cost incurred. Exhibit 18.6 sets out some common methods of **apportionment** where costs are regarded as **indirect** so far as each cost centre is concerned.

If the records were sufficiently detailed, then most of the costs in Exhibit 18.6 could be turned into items of cost which could be allocated as a whole to each cost centre, avoiding the need for apportionment. Electricity meters could be installed in each cost centre to measure directly the cost of heating and lighting. Employees could be given tickets for the canteen which could be collected and recorded for each cost centre. The production supervisor could keep a diary of time spent in each cost centre. Depreciation could be calculated for each machine. The insurance company could be asked to quote a separate premium for each machine. However, all these procedures would in themselves create a new cost of administration which the business might decide was too high a price to pay for a marginal improvement in the accuracy of allocation of costs.

Exhibit 18.6

Examples of methods of apportionment of costs over cost centres

<i>Cost item</i>	<i>Method of apportionment over cost centres</i>
Rent of building	Floor area of each cost centre
Lighting	Floor area of each cost centre
Power for machines	Number of machines in each cost centre
Production supervisor's salary	Number of employees in each cost centre
Canteen costs	Number of employees in each cost centre
Depreciation and insurance of machinery	Value of machinery in each cost centre

18.4.2 Apportioning service department costs over production cost centres

As explained earlier, **service cost centres** exist to support production but do not make a direct contribution to the product. Once the costs of the organisation have been channelled into the various cost centres, they must be apportioned from service cost centres over production cost centres. The essential features remain the same, namely that the method chosen must be:

- fair to all parties involved in the process of apportionment;
- representative of the benefit each party gains from the shared cost;
- relatively quick to apply so that provision of information is not delayed;
- understandable by all concerned.

Exhibit 18.7 sets out the titles of some service cost centres and gives examples of some methods by which their costs could be apportioned over production cost centres.

Exhibit 18.7

Examples of methods of apportioning total costs of service cost centres across production cost centres

<i>Service cost centre</i>	<i>Method of apportionment over production cost centres</i>
Maintenance department	Number of machines in each cost centre
Employees' restaurant and coffee bar	Number of employees in each cost centre
Stores department	Total value of stores requisitions from each cost centre
Finished goods quality inspection	Value of goods produced by each cost centre
Safety inspectors	Number of employees in each cost centre

18.4.3 Absorbing overhead costs into products

You have now reached the final stage of the process where all the overhead costs are collected in the **production cost centres**, ready to be **absorbed** into products. The essential features, as before, are that the method must be:

- fair to all parties involved in the process of absorption;
- representative of the benefit each party gains from the shared cost;
- relatively quick to apply so that provision of information is not delayed;
- understandable by all concerned.

To absorb a fair share of overhead into each product, the method must make use of the best measure of work done on a product. The best measure is usually labour hours or machine hours, depending on whether the production process is labour intensive or machinery intensive.

Direct labour hours are frequently used because overhead cost is incurred when people are working. The longer they work, the more overhead is incurred.

Sometimes direct labour hours are not the best measure of work performed. In a machinery-intensive environment, machine hours may be preferred to labour hours as a basis for absorbing overhead.

There are occasions when the direct labour hours worked on a job are not known because they are not recorded. In such circumstances a cost per £ of direct labour could be applied. This is acceptable but has a disadvantage in that a change in the labour rate could affect the amount of labour cost and hence the allocation of overhead.

Where all products are identical, a cost per unit would be sufficient. However, in a job-costing system such identical products are unlikely.

In summary, four possible methods of absorbing overhead costs into products are:

- 1 cost per direct labour hour;
- 2 cost per machine hour;
- 3 cost per £ of labour cost;
- 4 cost per unit.

18.4.4

Illustration

This section provides an illustration of the **allocation** and **apportionment** of overhead costs and shows how the overhead cost is absorbed into products. Kitchen Units Company assembles and finishes kitchen units to customers' orders. Assembly involves creating the basic units, while Finishing involves adding the laminated surfaces and interior fittings as specified by the customer. The machinery and tools required for the work are kept in working order by a Maintenance department. The Assembly and Finishing departments are **production departments** because they both do work on the product. The Maintenance department is a **service department** because it helps the work of the production departments but does not deal directly with the product. The illustration shows how the overhead costs of one month are **allocated** and **apportioned**, and then **absorbs** the costs into Product S, a kitchen unit which spends two hours in Assembly and three hours in Finishing. It follows the sequence of Exhibit 18.5, earlier.

A calculation of an overhead cost rate might be set out as in Exhibit 18.8, which shows a statement of overhead cost rate for an organisation having two production cost centres, the Assembly Department and the Finishing Department, and one service cost centre, the Maintenance Department. In Exhibit 18.8, the indirect costs incurred by the business are set out in Table 1. These costs relate to some or all of the three departments and must be shared among them on a fair basis. Table 2 sets out information about each department which will be helpful in this fair sharing. The remaining tables of Exhibit 18.8 show the sharing process, step by step.

Exhibit 18.8

Illustration of the calculation of an overhead cost rate

Table 1 sets out the indirect costs incurred by the business on behalf of all departments taken together. The costs must be apportioned (shared) over the departments because there is insufficient information to permit allocation of costs as a whole. Table 2 sets out relevant information about each department which will be used in the process of determining an overhead cost rate.

Exhibit 18.8 continued

Table 1
Indirect costs incurred by the business

Cost item	Total cost this month
	£
Indirect materials	36,000
Indirect labour	40,000
Rent	1,000
Insurance	1,600
Depreciation	2,000
<i>Total</i>	<i>80,600</i>

Table 2
Information about each department

	Assembly	Finishing	Maintenance
Direct materials used for production	£400,000	£500,000	not applicable
Number of employees	10	25	5
Floor area	100 sq m	200 sq m	100 sq m
Value of machinery	£30,000	£50,000	£20,000
Number of direct labour hours worked on production	55,000	64,000	not applicable

There are four steps in calculating the overhead cost to be allocated to each job.

Step 1: Apportioning costs over departments, using a suitable method for each cost

In Table 3, each of the cost items contained in Table 1 is shared across the three departments on an appropriate basis chosen from Table 2.

Table 3
Apportioning (sharing) cost items over the three departments

	Total	Assembly	Finishing	Maintenance
	£	£	£	£
Indirect materials ¹	36,000	16,000	20,000	nil
Indirect labour ²	40,000	10,000	25,000	5,000
Rent ³	1,000	250	500	250
Insurance ⁴	1,600	480	800	320
Depreciation ⁵	2,000	600	1,000	400
<i>Total</i>	<i>80,600</i>	<i>27,330</i>	<i>47,300</i>	<i>5,970</i>

Notes:

¹ The cost of indirect materials is likely to be dependent on direct materials so the proportions applied in sharing out the indirect materials costs are 4:5. The direct materials are used only in Assembly and Finishing, so the indirect materials will relate only to these two departments.

Exhibit 18.8 continued

- ² The cost of indirect labour is likely to be dependent on the total number of employees working in the organisation, so the proportions applied in sharing out the indirect labour costs are 10:25:5.
- ³ Rent costs may be shared out on the basis of floor space occupied by each department, in the proportions 1:2:1.
- ^{4,5} Insurance and depreciation may both be shared out by reference to the value of the machinery used in each department, in the proportions 3:5:2.

Step 2: Apportioning service department costs to production departments on the basis of value of machines in each department

The maintenance department provides service in proportion to the machinery used in each department, so it is appropriate to share out the maintenance costs on the basis of value of machinery in Assembly and in Finishing, in the proportions 30,000:50,000:

$$\frac{30,000}{80,000} \times 5,970 = 2,239$$

$$\frac{50,000}{80,000} \times 5,970 = 3,731$$

Table 4**Apportioning (sharing) of maintenance costs between Assembly and Finishing**

	Total	Assembly	Finishing	Maintenance
	£	£	£	£
Total cost per dept (from Table 3)	80,600	27,330	47,300	5,970
Transfer maintenance costs to Assembly and Finishing		2,239	3,731	(5,970)
Total per department	80,600	29,569	51,031	nil

Step 3: Absorbing total overhead costs of each production department into units produced during the period

Dividing the total cost of each department by the number of direct labour hours, we obtain the following overhead cost rates:

Assembly: £29,569/55,000 hours = 53.76 pence per direct labour hour
 Finishing: £51,031/64,000 hours = 79.74 pence per direct labour hour

Step 4: Finding the overhead costs of any job

Now the overhead cost rate may be used to determine how much overhead cost should be absorbed by (charged to) each job. The answer will depend on the number of direct labour hours required in each production department, for any job. Take as an example job S, which spends two hours in the Assembly department and three hours in the Finishing department. The overhead cost allocated to job S is calculated as follows:

Table 5**Example of absorbing overhead cost into a job**

Department	Calculation	£
Assembly	53.76 pence × 2 hours	1.075
Finishing	79.74 pence × 3 hours	2.392
Total overhead cost		3.467

That's all there is to it. The process of allocation, apportionment and absorption of production overheads takes time because every cost has to be traced through to the product, but it is systematic in that all costs eventually find their way through to a product.

Activity 18.4

Return to the start of Exhibit 18.8 and try to work the example for yourself. It is very important for later chapters that you understand the purpose of Exhibit 18.8 and the method of calculation used. There are some features of the tables in Exhibit 18.8 which are worth noting for future reference. First, it is important to keep totals for each column of figures and a total of all the column totals in order to ensure that there are no arithmetic errors that result in costs appearing from nowhere or disappearing to oblivion. Second, it is important to show working notes at all times because there are so many variations of possible method that the person who reads your calculations will need the working notes to understand the method chosen.

18.4.5 Predetermined overhead cost rates

This chapter has explained methods by which *actual* overhead cost for a period may be absorbed into jobs. However, the calculation of overhead cost rates based on the actual overhead costs incurred during the period means that job cost calculations have to be postponed until the end of the period, because the overhead cost cannot be obtained before that time. This creates practical problems where timely information on job costs is essential if it is to be used for estimating the value of work-in-progress or calculating monthly profit. As a result of this demand for information before the actual costs are known, many businesses will use **predetermined overhead cost rates**, estimated before the start of a reporting period. This rate will then be applied to all output of the period. At the end of the period, when the actual overhead is known, there will be an adjustment to bring the estimated overhead cost into line with the actual overhead cost.

Estimating the predetermined overhead rate

How does a manager make the estimate of the predetermined overhead cost rate? It could be based on the known overhead costs of previous periods. It could be a 'best guess' of what will happen in the forecast period. The predetermined overhead cost rate is then applied to the output of the period. This is also described as **overhead cost recovery** because the cost will be 'recovered' when the output is completed and sold.

Estimates abound in accounting and part of the reporting process involves explaining why the actual out-turn did, or did not, match up to the estimate. Chapter 23 will introduce the techniques of standard costing and variance analysis, which provide a formal means of analysing and investigating differences between estimated and actual amounts. Provided the estimation process is carried out with care, the benefits of using predetermined overhead costs, in terms of having information early rather than late, by far outweigh the possible negative aspects of having to explain differences between estimated and actual overhead costs charged to products.

Exhibit 18.9 gives the information necessary to calculate a **predetermined overhead cost rate**. The steps of the calculation are then described.

Exhibit 18.9

Calculating a predetermined fixed overhead cost rate

Estimated direct labour hours for normal activity	10,000 hours
Estimated fixed overhead cost in total	£50,000
Predetermined overhead cost rate	£5 per direct labour hour

Step 1

The accounting period is one month. Before the start of the month, the manager estimates that there will be 10,000 labour hours worked, under normal activity conditions, and that fixed overhead of £50,000 will be incurred.

Step 2

The manager calculates the predetermined fixed overhead cost rate as £5 per labour hour (= £50,000/10,000).

Step 3

Throughout the reporting period, as work is done, the manager applies £5 of fixed overhead for every labour hour of each item of output from the business. If exactly 10,000 hours of work are carried out then each item of output will carry its fair share of the overhead. The process of **overhead cost recovery** is complete.

18.4.6 Under-recovery and over-recovery of overheads

The calculations of overhead cost recovery are not always as neat and tidy as in section 18.4.5. This section explains how under-recovery and over-recovery can occur.

Under-recovered overhead: underestimating hours worked

Supposing things do not work out as planned in section 18.4.5. The manager finds out at the end of the month that only 8,000 hours were actually worked. In Step 3, fixed overhead of £5 will be charged to jobs for each hour worked, so £40,000 will be charged in total. We can also say that there is **recovery** of £40,000. At the end of the month the manager confirms that the cash book shows the **actual overhead cost** incurred is £50,000, corresponding exactly to the estimated amount. The manager has a total fixed overhead cost of £40,000 **recovered** (charged to jobs) but an actual cost of £50,000 as an expense for the financial profit and loss account. The fixed overhead cost recorded on the job records is said to be **under-recovered**. In the management accounting profit and loss account the fixed overhead element of the cost of goods sold is recorded at £40,000 using the predetermined rate, and a separate cost of £10,000 is recorded as **under-recovered fixed overhead**, so that the total fixed overhead expense of the month equals £50,000.

Under-recovered overhead: underestimating overhead cost

Suppose that the actual hours worked do match the expected hours, so that in Step 3 there is **recovery** of the full amount of £50,000 (based on 10,000 hours at £5 per hour). However when the manager checks the cash book, it shows that the actual overhead cost of the month is £55,000 due to an unforeseen rise in fixed service charges. The fixed overhead cost recorded on the job records is again said to be **under-recovered**. In the management accounting profit and loss account the fixed overhead element of the cost of goods sold is recorded at £50,000 using the predetermined rate, and a separate cost of £5,000 is recorded as **under-recovered fixed overhead**, so that the total fixed overhead expense of the month equals £55,000.

Definition

Under-recovered fixed overhead occurs when the overhead cost recovered (applied), using a predetermined overhead cost rate, is less than the actual overhead cost of the period. This may be because the actual hours worked are less than the estimate made in advance, or it may be because the actual overhead cost incurred is greater than the estimate of the overhead cost.

Over-recovered overhead: underestimating hours worked

Now suppose an alternative picture. The manager finds out at the end of the month that 11,000 hours were actually worked. In Step 3, fixed overhead of £5 will be charged to jobs for each hour worked, so £55,000 will be charged in total. We can also say that there is **recovery** of £55,000. At the end of the month the manager also confirms that the cash book shows the actual overhead cost incurred is £50,000, corresponding exactly to the estimated amount. The manager has a total fixed overhead cost of £55,000 recovered (charged to jobs) but an actual cost of £50,000 as an expense for the financial profit and loss account. The fixed overhead cost recorded on the job records is said to be **over-recovered**. In the management accounting profit and loss account the fixed overhead element of the cost of goods sold is recorded at £55,000 using the predetermined rate, and a separate reduction in cost of £5,000 is recorded as **over-recovered fixed overhead**, so that the total fixed overhead expense of the month equals £50,000.

Over-recovered overhead: overestimating overhead cost

Suppose that the actual hours worked do match the expected hours, so that in Step 3 there is **recovery** of the full amount of £50,000 (based on 10,000 hours at £5 per hour). However when the manager checks the cash book, it shows that the actual overhead cost of the month is £48,000 due to an unexpected rebate of charges for heating. The fixed overhead cost recorded on the job records is again said to be **over-recovered**. In the management accounting profit and loss account the fixed overhead element of the cost of goods sold is recorded at £50,000 using the predetermined rate, and a separate reduction in cost of £2,000 is recorded as **over-recovered fixed overhead**, so that the total fixed overhead expense of the month equals £48,000.

Definition

Over-recovered fixed overhead occurs when the overhead recovered (applied), using a predetermined overhead cost rate, is greater than the actual overhead cost of the period. This may be because the actual hours worked are greater than the estimate made in advance, or it may be because the actual overhead cost incurred is less than the estimate of the overhead cost.

Effect on profit

If there is **over-recovered fixed overhead** then too much cost is charged in the management accounts, when compared to the actual cost incurred. The management accounting profit will be too low. To restore the profit to the actual level achieved, the over-recovery must be deducted from the cost charged.

If there is **under-recovered fixed overhead** then too little cost is charged in the management accounts, when compared to the actual cost incurred. The management accounting profit will be too high. To restore the profit to the actual level achieved, the under-recovery must be added to the cost charged.

18.4.7 More questions about overhead cost rates

Overhead cost is one of those topics which make you want to ask a new question every time you have an answer to the previous question. Here are some of the questions which might have occurred to you in thinking about overhead cost rates:

- Is it necessary to have an overhead cost rate for each cost centre or could there be one rate to cover all production?
- How is it possible to calculate an overhead cost rate per direct labour hour for fixed overhead costs, when these do not vary with direct labour hours?
- What is the best way of ensuring that the process of allocation, apportionment and absorption of costs most closely represents the behaviour of those costs?

The answers to all these questions will be found in thinking about the four conditions for determining a suitable overhead cost rate:

- 1 fair to all parties involved in the process;
- 2 representative of the benefit each party gains from the shared cost;
- 3 relatively quick to apply so that provision of information is not delayed;
- 4 understandable by all concerned.

The answers are therefore as follows.

Is it necessary to have an overhead cost rate for each cost centre or could there be one rate to cover all production?

If there is a wide product range and products spend different amounts of time in different cost centres, it would be undesirable to have one rate to cover all production because that single rate would average out the time spent in the different departments. Thus it is said that 'blanket overhead cost rates' or 'plant-wide rates' should be avoided where possible, or used with great caution. The overhead cost rate to use will be one which can be used with confidence that it meets the four conditions stated earlier.

How is it possible to calculate an overhead cost rate per direct labour hour for fixed overhead costs when, by definition, fixed costs do not vary with direct labour hours?

This question is more difficult to answer and the best starting point is a reminder that accounting is often based on estimates. The fixed overhead costs will have to be absorbed into products eventually. However, this can only be achieved accurately after production is completed. Job cost estimation cannot always wait that long. Therefore, a predetermined fixed overhead cost rate is applied to each job on the basis of some measure of work done, such as direct labour hours. If the estimating process is accurate, the estimated hours to be worked will equal the actual hours worked and there will be no problem. If the actual hours are greater than, or less than, the estimate, then there will be a difference, referred to as overapplied or underapplied fixed overhead. Exhibit 18.9 has set out an illustration of underapplied fixed overhead.

What is the best way of ensuring that the process of absorbing costs into products most closely represents the behaviour of those costs?

This question has aroused considerable excitement in management accounting circles in recent years, as some thinking people realised that too much time had been spent in reading books and theorising. Researchers had omitted to find out whether the actual practice of management accounting was so bad after all. They therefore went out to look, and found that some practical management accountants were having some very good ideas but that those ideas were not finding their way into books.

As a result of those investigations, many articles and books have been written on the importance of *cost drivers*, which are the events that are significant determinants of the cost of an activity. If an oil company has an offshore platform where the supervisor is constantly calling up the helicopter for unplanned visits ashore, the total transport cost for the oil company will rise. The helicopter flight is the cost driver and the platform supervisor needs to be aware that the flight cost is part of the cost of running the platform. If a stores department is receiving frequent deliveries of small quantities, the cost driver for the stores department is the number of deliveries. Cost drivers are not an earth-shattering discovery in themselves, but they have been built into a description of activity-based costing (ABC) which you will find in section 18.5. Activity-based costing has led many companies to re-examine their approach to allocating overhead costs to products, based on finding a method which most closely models the factors driving the cost.

18.5 Activity-based costing (ABC) for production overheads

ABC is a relatively new approach to assigning overhead costs to products. The proponents of the subject claim that ABC provides product cost information which is useful for decision making. The claims of ABC will be explored in this chapter by outlining the principles and then examining a case study.

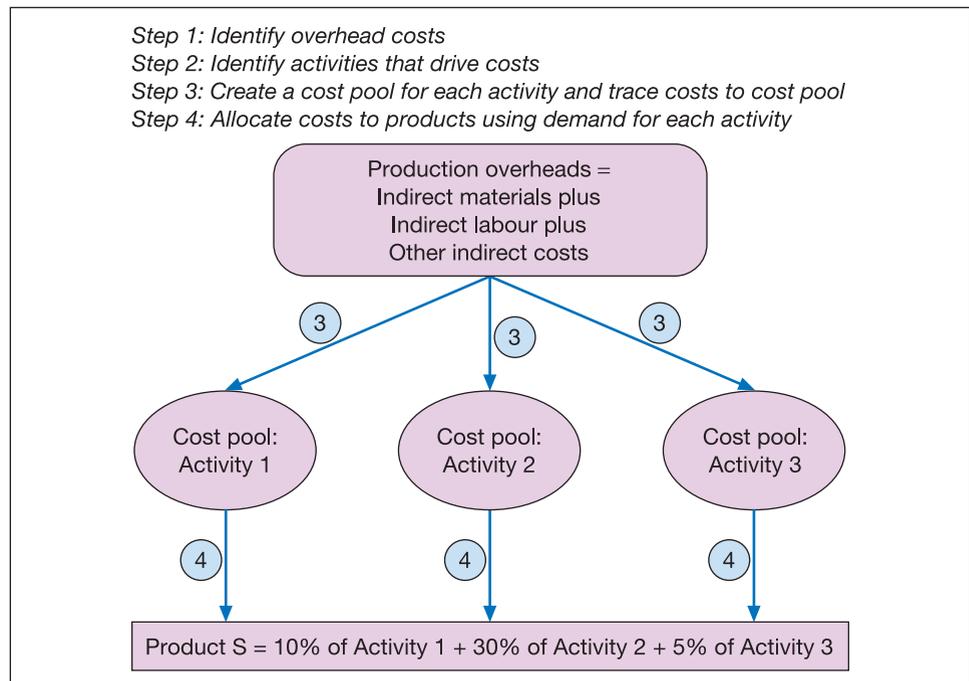
Definition **Activity-based costing (ABC)** traces **overhead costs** to products by focusing on the **activities** that drive costs (cause costs to occur).

There are five stages to establishing an activity-based costing system. These are:

- 1 Identify the major activities which take place in an organisation.
- 2 Identify the factors which most closely influence the cost of an activity. These factors are called the **cost drivers** and are a direct indication of how the activity demands cost.
- 3 Create a cost pool for each activity and trace costs to cost pools.
- 4 Calculate a **cost driver rate** as the total costs in a **cost pool** divided by the number of times that the **activity** occurs.
- 5 **Allocate costs** to products using the demand for each **activity**.

See Exhibit 18.10 which shows the costs flowing through cost pools to the product.

Exhibit 18.10
Activity-based approach to the flow of overhead costs



18.5.1 Reasons for the development of ABC²

In the 1980s Professors Cooper and Kaplan in the USA found the focus on activities and cost drivers in some large US manufacturing businesses which had become dissatisfied with the traditional approach to overhead costing. Cooper and Kaplan wrote up their observations as case studies at Harvard University and then published papers

on their findings. The cause of change was that business organisations were changing their nature at the time, with an increase in indirect costs related to changes in processes, new ways of dealing with customers, and new investment in more sophisticated operating systems. There was a swing from variable to fixed overhead costs. Labour resources were replaced to some extent by automation. It became apparent that production volumes were no longer the main drivers of overhead costs. Organisations were looking for a costing system that would be more realistic in tracking the consumption of resources that gives rise to cost.

18.5.2 Nature of an activity

An **activity**, in its broadest sense, is something which happens in the business. An activity could be using materials to make a physical product or using labour to carry out a service operation. In ABC language, that would be an example of a **unit activity**, which is performed each time a product is produced. Other activities are performed to enable output of products but are not so closely dependent on how many units are produced. These are called **product-sustaining activities**. Examples would be product design, product testing and marketing. Some activities are classified as **batch-related activities** which are fixed for a given batch of products. This would include costs of the buying department, costs of moving stores from the warehouse to the factory floor, and costs of planning a production schedule. Where there are expenses such as rent or insurance which are not driven by making products, they are designated as **facility-sustaining activities** and no attempt is made to allocate these to products. They are charged as a total cost against all products after the separate profit margins on each product are determined.

Example 1

A language college teaches English as a Foreign Language. It has two departments: E (European mother tongue) and A (Asian mother tongue). Information about each is shown in Exhibit 18.11. The overhead cost of cleaning rooms is £32,000 per year.

Exhibit 18.11

Information for Example 1: departments E and A

Department	E	A
Number of teaching staff	12	18
Annual teaching labour cost	£600,000	£1,000,000
Number of rooms	18	16

The traditional method of allocating cleaning overhead cost to departments has been to apply a rate of 2% of the labour cost of teaching. This is shown in Exhibit 18.12.

Exhibit 18.12

Traditional treatment of cleaning overhead

	E	A
Overhead cost rate	2% of labour cost	2% of labour cost
Apportionment of cost £32,000	£12,000	£20,000

The head tutor of Department A feels this is unfair because it has fewer classrooms than Department E and so requires less cleaning effort.

Assume that cleaning cost may be regarded as a cost pool and show how activity-based costing can be applied where the number of classrooms is the cost driver for cleaning.

The apportionment of cost by the activity-based method is shown in Exhibit 18.13 on the following page.

Exhibit 18.13

Activity-based costing for cleaning overhead

	E	A
Cost pool: Cleaning, £32,000		
Cost driver: Fraction of classroom usage	18/34	16/34
Apportionment of cost £32,000	£16,940	£15,060

Comment: The head of Department A will be happier with the use of **activity-based costing** because it reflects the lower usage of cleaning driven by fewer classrooms. On the other hand, it may be that this is not the best **cost driver**. For instance, suppose that the head of Department E responds by pointing out that their classrooms are kept tidy and are therefore easier to clean. The debate over **cost drivers** might take some time to resolve.

Example 2

In the office of a firm of solicitors and estate agents there are **overhead costs** incurred relating to the cost of office support for the staff preparing legal documentation. There are two departments preparing legal documentation. Department A has dealt with 15 property transactions having an average value of £100,000 each, while Department B has dealt with 5 property transactions having an average value of £1m each.

The total amount of the office overhead costs for the period is £100,000. The traditional approach to overhead cost has been to apportion the amount of £100,000 in proportion to the number of property deals dealt with by each department. They are now asking for an activity-based approach to costing, where the cost driver is the value of transactions in each department, because high-value transactions involve more work.

The traditional approach (see Exhibit 18.14) gives the same unit cost regardless of size of transaction.

Exhibit 18.14

Traditional treatment of cleaning overhead

	A	B
Cost pool: Office overhead, £100,000		
Cost driver: Number of transactions	15/20	5/20
Apportionment of cost £100,000	£75,000	£25,000
Cost per transaction	£5,000	£5,000

Comment: The **activity-based** approach (see Exhibit 18.15) puts much more of the **overhead cost** on to Department B because that one is driving more of the overheads. When the cost per transaction is calculated, the activity-based approach, based on value, loads the cost towards the high-value transaction and so produces a relatively higher cost per unit for these transactions.

Exhibit 18.15

Activity-based costing for office overhead

	A	B
Overhead cost rate	1,500/6,500	5,000/6,500
Apportionment of cost £100,000	100,000 × 1.5/6.5 = £23,000	100,000 × 5/6.5 = £77,000
Cost per transaction	£1,530	£15,400

18.5.3 Role of the management accountant

Activity-based costing allows the attention-directing functions of the management accountant to come to the fore. The management accountant takes a key role in understanding the operation of the business and translating into cost terms the **activities** as perceived by those who carry them out.

Because **activity-based costing** requires a very thorough analysis of how products drive the costs of various activities, it is not feasible to work through a full illustration here. Instead, one activity, that of purchasing materials for use in a hotel restaurant, will be explored by case study in some detail. Hopefully, that will give you a flavour of the complexity and fascination of ABC and encourage you to read further.

18.5.4 Case study: Glen Lyon Hotel

The Glen Lyon Hotel has two main product lines, with quite different characteristics. In the restaurant, meals are provided on a daily basis to the chef's high standards of perfection. In the conference suite, banquets are arranged for special functions such as weddings. There is a restaurant manager, responsible for restaurant meals, and a functions manager, responsible for banquets. The hotel seeks to offer competitive prices subject to meeting all costs and earning an adequate profit.

The hotel has a purchasing department which purchases the food required by the hotel restaurant and all supplies required for special functions, including crockery and cutlery. The purchasing officer is concerned that the restaurant manager insists on buying food in relatively small quantities, because the chef is very particular about monitoring the continued high quality of supplies. The functions manager also creates problems for the purchasing department because she insists on buying crockery and cutlery in bulk, to save cost, which requires time being taken by the purchasing officer to negotiate the best terms with the supplier. Even the suppliers can create a great deal of work because they are constantly changing their prices and this has to be recorded on the computer system of the purchasing department. The purchasing officer would like to show that these activities are all costly because they drive the amount of work undertaken by the purchasing department.

Fiona McTaggart was called in to help, and she now explains how she went about the task of applying activity-based costing in relation to the activities of the purchasing department.



FIONA: *First of all I asked for a list of all the costs incurred by the department in a year (see Exhibit 18.16).*

Exhibit 18.16

List of costs incurred by resources used in the purchasing department

<i>Resource cost</i>	£
Salary of purchasing officer	15,000
Wages of data processing clerk	9,000
Telephone calls	<u>3,000</u>
Total costs to be allocated	<u>27,000</u>

Identifying the cost drivers

Then I sat down with the purchasing officer for a long meeting during which we talked about how the purchasing process worked. From those discussions I found that a number of activities were driving the work of purchasing and I listed all those (see Exhibit 18.17).

Exhibit 18.17**List of activities in the purchasing department**

- Agreeing terms with supplier
- Processing an order
- Updating the price lists
- Updating the supplier records
- Processing queries about invoices.

I explained to the purchasing officer that, although the purchasing department was an identifiable unit of the organisation for staff management purposes, it would no longer be treated as a cost centre under activity-based costing. The purchasing process would be regarded as a set of activities consuming 'resources' such as salaries, wages and telephone calls. Each activity would collect a 'pool' of cost as the resources were used up. The pool of costs would be passed on to those other departments drawing on the services of the purchasing department and from those departments the costs would find their way into products.

Creating the cost pools

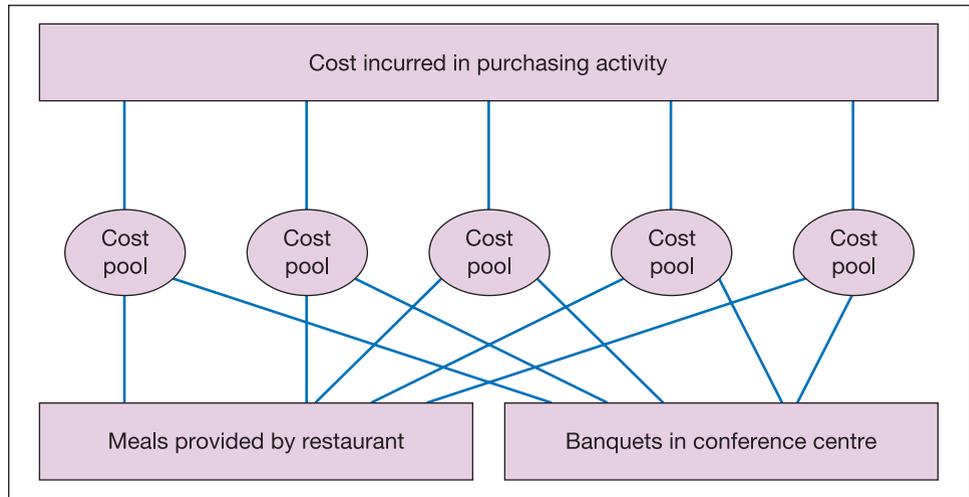
The next stage was to decide how much of each resource cost was attributable to the activity driving that cost. This part was quite tricky because the purchasing officer only had a 'feel' for the relative impact in some cases. Take as an example the processing of an order. When the restaurant manager asks for food to be ordered, the purchasing officer first has to phone the supplier to check availability and likely delivery time. Then she checks that someone will be available to open the cold store when the delivery arrives. She is then able to fax the order to the supplier who will phone back to confirm that the goods are available and that delivery will be as requested. Once the goods arrive, the purchasing officer has to check that the delivery note agrees with what was ordered. That whole process takes about 20 minutes for each order.

We carried on talking and I was able to identify, for each resource cost, some measure of how the activity was being driven. The starting point was salaries. We estimated that the purchasing officer spent the equivalent of two days per week agreeing terms with suppliers. The remaining three days were divided equally over the other activities listed. The data processing clerk spent three days per week in processing orders, half a day each week on updating price lists and updating suppliers' records, and one day per week on checking and processing questions from the accounts department about invoices received for payment. The final cost heading was telephone calls. The destination and duration of each call is logged by the telephone system so we took a sample of one week's calls and decided that 60% of telephone calls were routine calls to place an order, 20% were dealing with queries over price changes and the remainder were spread equally over agreeing terms, updating the supplier records and dealing with invoice queries. Following these discussions I sketched a diagram of the ABC approach (see Exhibit 18.18) and then drew up a table showing how each cost item could be allocated to the various activities so that a cost pool is created for each activity (see Exhibit 18.19).

Demand for each activity

The next stage was to determine how many times each activity driver was put into action. This involved measuring the volume of each activity, as a measure of the demand for that activity. Agreeing terms with the supplier is not easy to quantify, but we were aware that there are discussions with each supplier at some time during the year, so we took the number of suppliers as the measure of volume driving that activity. It was relatively easy to establish the number of orders processed at the request of the restaurant manager.

Exhibit 18.18
Sketch of the ABC approach applied to the activity of purchasing



The price list has to be updated every time the supplier changes the price of any items, and they all change at least twice per month, so we decided that the number of items on the order list was a reasonable measure. Updating supplier records involves changing minor details for existing suppliers but takes more time to record a new supplier. So we used the number of new suppliers as the measure of the volume of that activity. Processing invoice queries depends on the number of such queries.

Exhibit 18.19
Creating a cost pool: allocation of resource costs to activities

Resource	Resource cost £	Activity cost pools				
		Agreeing terms with supplier £	Processing an order £	Updating the price list £	Updating the supplier records £	Processing invoice queries £
Salary	15,000	6,000	2,250	2,250	2,250	2,250
Wages	9,000		5,400	900	900	1,800
Telephone	3,000	200	1,800	600	200	200
	<u>27,000</u>	<u>6,200</u>	<u>9,450</u>	<u>3,750</u>	<u>3,350</u>	<u>4,250</u>

Cost driver rates

My final accounting statement was a calculation of the cost per activity unit for each activity (see Exhibit 18.20). This was determined by dividing the cost in the pool by the measure of how that activity was being driven by products.

Using the calculation of cost per activity unit for each activity I was able to explain the benefits of activity-based costing. The purchasing department is providing a service to the rest of the organisation, but at a cost. That cost could be made more visible using activity-based costing because the factors driving the cost could be quantified in their effect. Looking at Exhibit 18.20, it is not difficult to see that the most significant cost drivers are the activities of agreeing terms with suppliers and of updating the suppliers' records. Each new supplier causes a further £159,166 (£103,333 + £55,833) to be incurred

at an early stage. The restaurant manager needs to be aware that placing large numbers of low-volume orders causes cost to be incurred on each order. The total cost incurred could be reduced by moving to a lower number of orders, each being of higher volume. (Someone would need to check that that did not create larger new costs in storage of the goods.) The next most costly activity, in terms of cost per unit, is that of answering queries about invoices. The accounts department should be made aware that each enquiry costs £28.333.

I also looked back to the old way of allocating the cost of the purchasing department (see Exhibit 18.21). Before activity-based costing was considered, the organisation charged the purchasing costs to products as a percentage of the value of materials ordered. Looking back to Exhibit 18.19, the total purchasing department costs are shown as £27,000. The purchasing department handles goods to the value of £800,000 in a year. The purchasing department costs were therefore charged to products at 3.375% of cost.

Exhibit 18.20

Calculation of cost per activity unit for each activity

	Activity cost pools				
	Agreeing terms with supplier	Processing an order	Updating the price list	Updating the supplier records	Processing invoice queries
Cost per Exhibit 18.19	£6,200	£9,450	£3,750	£3,350	£4,250
Activity driver	Number of suppliers	Number of orders	Number of items listed	Number of suppliers updated	Number of queries
Activity volume	60	1,600	7,000	60	150
Cost per activity unit	£103.333	£5.906	£0.536	£55.833	£28.333

Exhibit 18.21

Previous methods of allocation, based on percentage of value of items requested

	Restaurant manager	Functions manager	Accounts department
	£	£	£
Goods purchased through purchasing department	300,000	500,000	–
3.375% of goods purchased	10,125	16,875	nil

Note: Allocation base equals 3.375% of goods purchased.

Why was this not the best approach? The answer is that there were two main product lines, having quite different characteristics. One was restaurant meals provided on a routine basis and the other was special banquets for functions such as weddings. My further enquiries revealed that the high-price purchases required for special functions caused relatively few problems in agreeing terms with suppliers and relatively few queries arose over the invoices. Where problems of negotiation and invoicing did arise was in the

low-price, high-volume ingredients used routinely in the dining room meals. The information on cost per unit of each activity allowed a much more precise allocation of cost, although I was now in for even more work in tracing the costs from the various activity pools through to the products.

Tracing costs through to products

To trace costs through to products I obtained estimates of the quantity of each activity demanded by the restaurant manager and the function manager (see Exhibit 18.22) and multiplied each quantity by the cost per activity unit calculated in Exhibit 18.20. The result is shown in Exhibit 18.23.

Compare this with the cost allocation under the traditional system which is shown in Exhibit 18.21.

Exhibit 18.22

Quantity of activity demanded by each function

Activity	Demanded by restaurant manager	Demanded by functions manager
Agreeing terms with supplier	10 new suppliers	50 new suppliers
Processing an order	1,200 orders	400 orders
Updating the price list	4,000 items	3,000 items
Updating the supplier records	10 new suppliers	50 new suppliers
Processing invoice queries	All 150 demanded by accounts department	

Exhibit 18.23

Allocation of purchasing cost to restaurant manager, functions manager and accounts department

Activity	Restaurant manager	Functions manager	Accounts department	Total
	£	£	£	£
Agreeing terms with supplier	1,033	5,167		6,200
Processing an order	7,088	2,362		9,450
Updating the price list	2,143	1,607		3,750
Updating the supplier records	558	2,792		3,350
Processing invoice queries			4,250	4,250
Total cost allocated	10,822	11,928	4,250	27,000

My conclusions were that the accounts department had previously been unaware of the costs it was causing the purchasing manager whenever an invoice query was raised. Using activity-based costing would allow the allocation of cost to the accounts department each time a question was raised. Some care might need to be taken to examine the size and significance of the invoice query in relation to the cost allocation. It would not be a good idea for the accounts department to allow a £50,000 error to go unchecked because they feared a charge of £28.33. The implementation of activity-based costing might need to be accompanied by the use of performance measures which show how the benefits of an activity exceed the costs incurred.

The functions manager would incur less overhead cost under the activity-based system than under the previous approach. The recorded cost of functions would therefore decrease. As I explained earlier, the high-priced purchases of food for special functions cause relatively few problems in processing a smaller number of orders. The functions manager seems to have a relatively high number of new suppliers. Cost could be controlled further if fewer suppliers were used for functions. Less purchasing effort would be required.

The restaurant manager experiences little difference in cost under either approach. To improve overhead costs there would need to be a quantum leap in practice, such as reducing the order frequency to the stage where one less person was employed in the purchasing department, or else where a part-time employee could do the work presently undertaken full-time. Merely reducing the order frequency would not be enough if the purchasing staff are still present full-time and the same cost is being spread over a lower volume of activity. Although there is little impact, these figures give the restaurant manager food for thought.

Product costs

In the full application of ABC, the costs would be taken into the final product cost. I have not done that here because the purchasing department's costs are only one small corner of the total business. Activity-based costing creates a lot of work, but a well-coded computerised accounting system can handle that. I spent the best part of one day dealing only with the analysis of the purchasing department costs, so it would take a few weeks of consultancy to cover the entire range of activities which contribute to the cost of the products. My consultancy fees would be another overhead to be allocated, but I believe the hotel would find the effort well worth it in terms of more effective management over a period of years.

Activity 18.5

Imagine you are the owner of a business which rents ice-cream stalls from the local council. You employ persons to run each stall. Write down a list of the costs you would expect to incur. Write another list of the drivers of cost. How could activity-based costing help you understand and control the costs of your business?

18.6 Comparing traditional approach and ABC

18.6.1 Contrasting treatments

Allocating direct costs to products is not a problem. The particular need for activity-based costing lies in the area of absorbing overhead costs into products. The traditional approach to absorbing overhead costs to products was explained in section 18.4. In that section it was shown that, traditionally, costs are first allocated and apportioned to cost centres and then absorbed into products which pass through those cost centres. Activity-based costing follows a different approach to channelling costs towards products. Exhibit 18.24 sets out the contrasting treatments.

Exhibit 18.24**Contrasting activity-based costing and traditional overhead cost allocation**

<i>Traditional overhead cost allocation</i>	<i>Activity-based costing</i>
Identify <i>cost centres</i> in which costs may be accumulated. Cost centres are determined by the nature of their function (e.g. production or service department cost centres).	Identify the way in which products drive the activity of the business and define suitable <i>cost pools</i> for collecting the costs relating to each activity. Activity cost pools are determined by the activities which drive the costs (e.g. obtaining new customers, negotiating customer contracts).
↓	↓
Collect costs in cost centres.	Collect costs in activity cost pools.
↓	↓
Determine an <i>overhead cost rate</i> for each production cost centre (e.g. cost per direct labour hour).	Determine a <i>cost driver rate</i> for each activity cost pool (e.g. a cost per customer contract, cost per customer order received).
↓	↓
Allocate cost to products using the calculated cost rate and the measure of the <i>product's consumption of that department's cost</i> (e.g. number of labour hours required).	Allocate cost to products according to the <i>product's demand for the activity</i> which drives cost.

18.6.2**Benefits claimed for activity-based costing**

Activity-based costing appeared first in the academic literature during the late 1980s. It had reached the professional accountancy journals by the early 1990s and by that time was already being used (or tested) by companies with progressive attitudes. The main benefits claimed are that it provides product cost information which, although it includes an allocation of overheads, is nevertheless useful for decision-making purposes. It is useful because the overhead costs are allocated to the products in a way that reflects the factor driving the cost. If a product cost is thought to be too high, then it can be controlled by controlling the factors driving the most significant elements of its cost. Attention is directed towards problem areas. Activity-based costing is seen as a valuable management tool because it collects and reports on the significant activities of the business. It is also attractive for service-based organisations which have found the traditional, manufacturing-based costing methods not suited to the different nature of the service sector.

You may ask at this point, 'If activity-based costing is the best approach, why has it not replaced the traditional approach to overhead cost apportionment?' The answer to that question is, first, that the technique is still relatively rare in practical application, despite the amount written about it. Second, no allocating mechanism can produce accurate results unless the cost item which is being processed is of high reliability and its behaviour is well understood. The successful application of activity-based costing depends on a thorough understanding of basic principles of cost behaviour and the ability to record and process costs accurately.

Activity-based costing will not solve all problems of forward planning. The analytical method relies on historical data and therefore shares with many other aspects of

accounting the disadvantage of being a backward-looking measure which must be used with caution in forward-looking decisions.

Finally, activity-based costing requires detailed accounting records and a well-structured cost-coding system so that costs are allocated correctly to cost pools and from there to products. There may need to be a considerable investment in discovering and installing the best information system for the job.

18.7 Summary

Key themes in this chapter are:

- **Total product cost** is defined as consisting of **direct materials**, **direct labour** and **production overhead cost**.
- **Prime cost** is the cost of direct materials, direct labour and other direct costs of production.
- The purchasing, storage and use of materials are controlled by documentation and processes that are designed to safeguard the assets and ensure the accuracy of recording systems.
- FIFO (first-in-first-out) and LIFO (last-in-first-out) are methods of pricing the issue of goods from inventory, and the valuation of inventory, in times when prices are changing.
- Accounting for materials is explained, highlighting the importance of documentation, the distinction between **direct** and **indirect** costs of materials and between **fixed** and **variable** costs of materials.
- The costs of **waste** and **scrap** are **indirect** costs that form part of the total **production cost**. Any cash received for scrap should be deducted from the cost of buying the materials.
- Labour costs are recorded and controlled in a way that ensures employees are paid correctly for work done and labour costs of activities are recorded accurately.
- Accounting for labour costs is explained, highlighting the distinction between **direct** and **indirect** labour costs and between **fixed** and **variable** costs of labour.
- **Total product cost** is defined as consisting of direct materials, direct labour and production overhead cost.
- **Production overhead costs** comprise indirect materials, indirect labour and other indirect costs of production.
- **Allocation** of indirect costs to cost centres means that the entire cost item is identified with one cost centre.
- **Apportionment** of indirect costs across cost centres means that the cost item is shared across those cost centres on some basis which is a fair representation of how the cost item is used by each cost centre.
- **Absorption** is the process by which overhead costs are absorbed into units of output, or 'jobs'.

The processes of **apportionment** and **absorption** are said to be *arbitrary* (meaning 'a matter of choice rather than of strict rules'). To ensure that the best result is obtained, the scheme of apportionment and absorption must be:

- fair to all parties involved in the process
- representative of the benefit each party gains from the shared cost
- relatively quick to apply so that the provision of information is not delayed; and understandable by all concerned.

- The sequence of **allocate**, **apportion** and **absorb** is called the **traditional approach** to product costing.
- **activity-based costing** (ABC) traces **overhead costs** to products by focusing on the **activities** that **drive** costs (cause costs to occur).
- **activity based costing** provides a method of spreading overhead costs by asking: what **drives** each cost?
- **Costs** are collected in **cost pools** and then spread over products based on cost per unit of activity for the **activity** in question.
- **Costs** are then allocated to products on the basis of a **cost per unit of activity**.
- **Cost drivers** have taken on an increasingly important role in apportioning indirect costs to cost centres.
- Contemporary management accounting practice focuses on the accountant becoming part of the operational team so as to ensure that the job costs derived are understood and reflect the factors that drive the costs to be incurred.

Further reading

- Bjørnenak, T. and Mitchell, F. (2002) 'The development of activity-based costing journal literature, 1987–2000', *The European Accounting Review*, 11(3): 281–508.
- Innes, J. and Mitchell, F. (1995) Activity-based costing, Chapter 6 in Ashton, D., Hopper, T., and Scapens, R. (eds). *Issues in Management Accounting*, Prentice Hall.
- Soin, K., Seal, W. and Cullen, J. (2002) 'ABC and organizational change: an institutional perspective', *Management Accounting Research*, Vol. 13, pp. 249–271.

QUESTIONS

The Questions section of each chapter has three types of question. 'Test your understanding' questions to help you review your reading are in the 'A' series of questions. You will find the answers to these by reading and thinking about the material in the book. 'Application' questions to test your ability to apply technical skills are in the 'B' series of questions. Questions requiring you to show skills in problem solving and evaluation are in the 'C' series of questions. A letter **[S]** indicates that there is a solution at the end of the book.

A Test your understanding

- A18.1** What are the main items in a statement of the cost of production of an item of output? (Section 18.1)
- A18.2** How may a system of materials control procedures ensure accurate accounting information for job-costing purposes? (Section 18.2.1)
- A18.3** Which source documents should be used to create the accounting record for direct materials costs? (Section 18.2.1)
- A18.4** What is meant by the term 'FIFO', when used in deciding on the cost price of goods issued to production? (Section 18.2.2)
- A18.5** What are the problems of accounting for wastage and scrap? (Section 18.2.3)
- A18.6** Is direct labour cost a fixed cost or a variable cost? Explain your answer. (Section 18.3)

- A18.7** Give three examples of production overheads in (Section 18.4)
- a manufacturing business; and
 - a service business.
- A18.8** For each of your answers to the previous question, say whether the cost is a fixed cost or a variable cost. (Section 18.4)
- A18.9** What are the important features of any successful scheme of allocating, apportioning and absorbing indirect costs to products? (Section 18.4.2)
- A18.10** For each of the following overhead costs, suggest one method of apportioning cost to cost centres: (Section 18.4.2)
- employees' holiday pay;
 - agency fee for nurse at first-aid centre;
 - depreciation of floor-polishing machines used in all production areas;
 - production manager's salary;
 - lighting;
 - power for desktop workstations in a financial services business;
 - cost of servicing the elevator;
 - fee paid to professional consultant for advice on fire regulation procedures.
- A18.11** Explain how each of the following service department costs could be apportioned over production centres: (Section 18.4.2)
- Cleaning of machines in a food-processing business.
 - Vehicle maintenance for a fleet of vans used by service engineers.
 - Canteen services for a company operating a large bus fleet.
 - Quality control department of an engineering business.
 - Planning department of a bridge-building company.
 - Research department of a chemical company.
- A18.12** State the principles to be applied in absorbing costs into products. (Section 18.4.3)
- A18.13** Using your answer to question **A18.12**, compare the relative merits of calculating overhead costs per unit of products using each of the following methods: (Section 18.4.3)
- Cost per direct labour hour.
 - Cost per unit of output.
 - Cost per direct machine hour.
 - Cost per £ of direct labour.
- A18.14** What are the benefits and what are the possible problems of using overhead cost rates estimated in advance of the actual costs being recorded? (Section 18.4.5)
- A18.15** How does under-recovery of production overhead arise? (Section 18.4.6)

B Application

B18.1 [S]

A factory manufactures garden huts. The production process is classified into two production departments, Assembly and Joinery. There is one service department, the canteen. The relevant forecast information for the year ahead is as follows:

Indirect costs for all three departments in total:

	<i>Total</i> £
Indirect labour	90,000
Indirect material	81,000
Heating and lighting	25,000
Rent and rates	30,000
Depreciation	56,000
Supervision	45,000
Power	<u>36,000</u>
Total	<u>363,000</u>

The following information is available about each department:

	<i>Total</i> £	<i>Assembly</i> £	<i>Joinery</i> £	<i>Canteen</i> £
Floor space (sq metres)	50,000	20,000	24,000	6,000
Book value of machinery (£)	560,000	300,000	240,000	20,000
Number of employees	150	80	60	10
Kilowatt hours of power	18,000	9,000	8,000	1,000
Direct materials (£)		100,000	50,000	
Direct labour (£)		50,000	42,000	
Maintenance hours		8,000	6,000	
Labour hours		12,640	8,400	

The canteen is used by both production cost centres.

Required

- 1 Apportion production overhead costs over the Assembly, Joinery and Canteen departments using a suitable method for each department.
- 2 Apportion service department costs over production departments.
- 3 For each production department, calculate an overhead cost rate, based on labour hours, which may be used to absorb production overhead cost into jobs.
- 4 Find the overhead cost of a job which spends three labour hours in the Assembly department and four labour hours in the Joinery department.

B18.2 [S]

A company manufactures golf bags. Golf bags have the following manufacturing costs:

	<i>£ per bag</i>
Labour (5 hours at £5.00/hour)	25
Materials	40
Variable production overheads	10

In addition, the company has monthly fixed production overhead costs of £100,000. 5,000 golf bags are manufactured every month.

Required

Prepare a statement of total product cost for a batch of 5,000 golf bags which shows prime cost and production overhead cost as subtotals.

B18.3 [S]

Budgeted information relating to two departments of Rydons Tables Ltd for the next period is as follows:

<i>Department</i>	<i>Production overhead</i>	<i>Direct material cost</i>	<i>Direct labour cost</i>	<i>Direct labour hours</i>	<i>Machine hours</i>
	£	£	£		
1	270,000	67,500	13,500	2,700	45,000
2	18,000	36,000	100,000	25,000	300

Individual direct labour employees within each department earn differing rates of pay according to their skills, grade and experience.

Required

- Rydons Tables intends to use a production overhead cost rate of £6 per machine hour for absorbing production overhead cost into jobs, based on the budget. Write a short note to the managers of the business commenting on this proposal.
- During the past year, Rydons Tables has been using a production overhead cost rate of £5.60 per machine hour. During the year overheads of £275,000 were incurred and 48,000 machine hours worked. Were overheads underabsorbed or overabsorbed, and by how much?

C Problem solving and evaluation

C18.1

In a general engineering works the following routine has been followed for several years to arrive at an estimate of the price for a contract.

The process of estimating is started by referring to a job cost card for some previous similar job and evaluating the actual material and direct labour hours used on that job at current prices and rates.

Production overheads are calculated and applied as a percentage of direct wages. The percentage is derived from figures appearing in the accounts of the previous year, using the total production overhead cost divided by the total direct wages cost.

One-third is added to the total production overhead cost to cover administrative charges and profit.

You have been asked to draft a short report to management outlining, with reasons, the changes which you consider desirable in order to improve the process of estimating a price for a contract.

C18.2

You have been asked for advice by the owner of a small business who has previously estimated overhead costs as a percentage of direct labour cost. This method has produced quite reasonable results because the products have all been of similar sales value and have required similar labour inputs. The business has now changed and will in future concentrate on two products. Product X is a high-volume item of relatively low sales value and requires relatively little labour input per item. It is largely produced by automatic processes. Product Y is a low-volume item of relatively high sales value and requires considerably more labour input by specially skilled workers. It is largely produced by manual craft processes.

What advice would you give to the owner of the business about allocation of overhead costs comprising:

- the owner's salary for administrative work;
- rent paid on the production facilities; and
- depreciation of production machinery?

Compare the effect of having one overhead recovery rate for all three costs in aggregate, and the effect of identifying the factors which 'drive' each cost in relation to the production process.

Cases for study groups

Case 18.1

As a group you are the senior teaching staff of a school where each subject department is regarded as a cost centre. The direct costs of each cost centre are teachers' salaries, books and worksheets for pupils. The overhead costs of the school administration are charged to each cost centre as a fixed percentage of teachers' salaries in the cost centre. The languages department argues that this is unfair to them as they have a higher ratio of teachers to pupils due to the need for developing spoken language skills. The art department objects to the percentage charge because it includes accommodation costs without recognising that they are housed in portacabins where the roof leaks. The maths department says that they should not have to share the costs of expensive technical equipment when all they need for effective teaching is a piece of chalk. One member of staff has read about 'cost drivers' and the teachers have decided that they would like to meet the school accountant to put forward some ideas about using cost drivers. So far they have made a list of the main overhead costs as:

- heating and lighting
- head teacher, deputy heads and office staff salaries
- cleaning
- maintenance
- library
- computing services for staff
- computing labs for pupils
- insurance of buildings and contents.

Allocate among your group the roles of staff in the languages department, art department and maths department. Discuss cost drivers for each of the overhead costs listed and attempt to arrive at an agreement on cost drivers to be presented to the school accountant. What are the problems of agreeing the drivers? What are the benefits?

Case 18.2

Two bus companies are competing for passengers on the most popular routes in a major city. The long-established company has strong customer loyalty, provides weekend and evening services as well as frequent day-time services and covers the cost of unprofitable routes from the profits on popular routes. The incoming company has larger resources from which to support a price war and can be selective in running only at peak times on the most popular routes. There are fears that if the incomer wins the bus war, the quality of service provision will diminish in the evenings and at weekends and on unprofitable routes.

As a group allocate the roles of: (a) passenger representatives, (b) the financial controller's department of the long-established company, (c) members of the city council's transport committee, (d) representatives of the police force. In the separate roles discuss the areas where cost savings might be achieved by the long-established company to make it competitive on price. Then come together and negotiate a support package for the company which focuses on improving the financial performance of the company.

Notes and references

1. CIMA (2000), *Management Accounting Official Terminology*, Chartered Institute of Management Accountants.
2. Innes, J. and Mitchell, F. (1995), *Activity Based Costing*, ch. 6 in Ashton, D., Hopper, T. and Scapens, R. (eds), Prentice Hall.