

3

Functional budgets

this chapter covers...

In this chapter we begin our examination of the preparation of budgets.

We start by learning the purposes of budgets, and see how some organisations view particular purposes as more important than others. We examine how budget setting links with the organisation's objectives and strategy, and must be built around the key (or principal) budget factor – which is often sales.

Next we examine the various budgets that are usually prepared, and how they are sequenced. The key budget factor is normally forecast first, and the other budgets are based around this important data.

We examine in detail how the budgets for a manufacturing organisation are prepared, including dealing with rejection rates, wastage and inefficiency.

Finally we discuss some techniques that can be applied to the construction of budgets for indirect costs and support functions.

THE PURPOSES OF BUDGETS

A budget is a financial plan for an organisation, prepared in advance.

In any organisation the budget provides the mechanism by which the objectives of the organisation can be achieved. In this way it forms a link between the current position and the position that the organisation's managers are aiming for. By using a budget firstly to plan and then to monitor, the managers can ensure that the organisation's progress is co-ordinated to achieve the objectives of the organisation. The specific purposes and benefits of using budgets are as follows.

1 the budget compels planning

By formalising the agreed objectives of the organisation through a budget preparation system, an organisation can ensure that its plans are achievable. It will be able to decide what resources are required to produce the desired outputs, and to make sure that they will be available at the right time.

2 the budget communicates and co-ordinates

Because a budget will be agreed by an organisation, all the relevant personnel will be working towards the same ends. During the budget setting process any anticipated problems should be resolved and any areas of potential confusion clarified. All the organisation's departments should be in a position to play their part in achieving the overall goals. This objective of all parts of the organisation working towards the same ends is sometimes referred to as 'goal congruence'.

3 the budget can be used to authorise

For organisations where control of activities is deemed to be a high priority the budget can be used as the primary tool to ensure conformity to agreed plans. Once the budget is agreed it can effectively become the authority to follow a particular course of action or spend a certain amount of money. Public sector organisations, with their necessary emphasis on strict accountability, will tend to take this approach, as will some commercial organisations that choose not to delegate too much authority.

4 the budget can be used to monitor and control

An important reason for producing a budget is that management is able to monitor the actual results against the budget. This is so that action can be taken to modify the operation of the organisation as time passes, or possibly to change the budget if it becomes unachievable. This is similar to the way that standard costing is used to monitor and control costs, and can be used alongside that technique.

5 the budget can be used to motivate

A budget can be part of the organisation's techniques for motivating managers and other staff to achieve the organisation's objectives. The extent to which this happens will depend on how the budget is agreed and set, and whether it is perceived as fair and achievable. The budget may also be linked to rewards (for example bonuses) where targets are met or exceeded. We will examine how the way budgets are prepared can affect motivation a little later in this chapter.

THE INITIAL STEPS IN BUDGET PREPARATION

the aims of an organisation

Before an organisation's managers can begin to build a useful budget there are several initial steps that must be taken. These are based around the fundamental questions about the **aims** – the 'vision' – of the organisation:

'where do we want it to go?' and

'how do we get it there?'

These are essentially long-term issues, and once agreed upon would not tend to be changed very often.

objectives and strategy

For a budget to be of use to an organisation it must be a mechanism of helping the organisation achieve its **objectives**. The objectives are the targets that the managers of the organisation wish it to achieve. The way in which these objectives are expressed will depend upon the type of organisation and the way in which it operates. For example a pet food manufacturer may have the specific objective of obtaining sales penetration of 25% of the UK dog food market, whereas an independent TV production company may have the objective of achieving a certain number of viewers on average.

The organisation must then develop a **strategy** for achieving those objectives. Several alternatives may need to be considered before the final strategy is decided upon. The pet food company mentioned in the above example may decide that it needs to develop and market a new food product for young dogs to help it to achieve its objective. The independent TV production company may have a strategy of producing pilots for ten new programmes each year from which it can then develop the most promising.

relevant data

Before any progress can be made in preparing a budget, relevant data must be identified and collected. We have already seen that information must be available about the aims, objectives and strategy of the organisation so that the budget that is prepared will be consistent with these. The following are examples of the types of data that can be used in developing the budget. The data is divided into data from internal and external sources.

data from internal sources

■ accounting information

This will include information about the accounting system (eg specific accounting policies) and how they will affect the budget, as well as data collected through the accounting system (for example historical costs).

■ wage and salary information

The resource of labour is clearly fundamental to many organisations, and sufficient information must be available to incorporate as appropriate.

data from external sources

■ information about suppliers and availability of inputs

Information must be available about suppliers' ability to supply the inputs required by the organisation, as well as data about relevant prices. This issue may be relevant to the consideration of limiting factors (to be discussed shortly), and can also force revisions to the budget as examined in the next chapter.

■ information about customers and markets

It would not make sense to plan to make goods or provide services that were not required in the market place. The information of this type is fundamental to developing valid budgets.

■ general economic information

The impact of the economy on projections is discussed later in this chapter. No organisation can exist in a vacuum and those preparing budgets must recognise the importance of the health of the economy in which they operate.

Information from all these areas will be needed at various points in the budgeting process that is described in this chapter and the next.

limiting factors – the 'key' budget factor

When an organisation prepares a budget, it must first analyse its **limiting factors** – the issues that determine the level of its output. For a commercial organisation these could include:

- the size of its market
- capacity of its premises
- availability of raw material
- amount of working capital
- availability of skilled workers

One of the factors will be the main one that affects the activity level of the organisation – the **key budget factor**. This is the factor (sometimes known as the ‘principal budget factor’) that all the aspects of the operation depend upon. For most manufacturing or trading operations the key budget factor is **sales**; the assumptions that are made about the level of sales in the budget will affect all the other parts of the budget. This is because the organisation will plan to support the budgeted sales level and build the budgets and assumptions around this one factor.

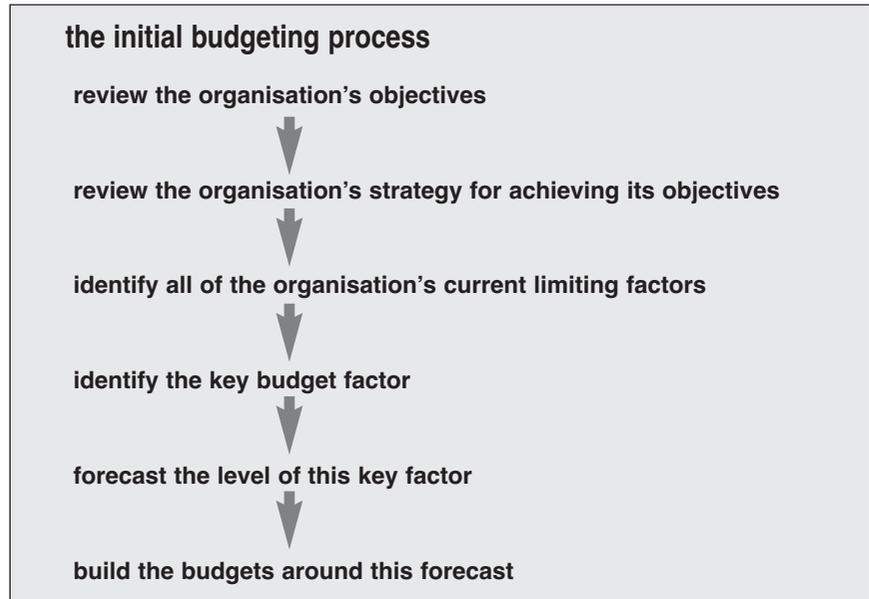
Although sales level is the most common key factor, some commercial organisations may decide that a different factor is the most important in their particular circumstances. For example, if a manufacturer can sell all that it produces, but has production restricted by lack of skilled labour then the assumed labour level would become the key budget factor. A similar situation would arise if there were production restrictions caused by shortages of raw materials, or limited machine capacity.

Non-commercial organisations will also need to identify their key budget factor, and build their budgets around their assumptions concerning it. Charities and government agencies may consider that there is a demand for their services that is virtually limitless; their principal budget (key) factor is the amount of money they receive to fund what they do. For example, the Government’s healthcare provision is limited by the amount of funding it can get from the government spending allocation and from private enterprise. The demand for Oxfam’s aid is very high, but its key budget factor is the amount of money it can expect to raise to fund that aid.

There may be times when a limiting factor changes during a budget period as a result of changing demand or availability of resources. In the next chapter we will examine the issues of dealing with limited materials, labour and production capacity.

the initial budgeting process

If we combine the ideas just discussed then the initial budget process for an established organisation would follow the pattern in the diagram at the top of the next page.



CO-ORDINATING THE MAIN TYPES OF BUDGET

Once the key factor has been determined, and an appropriate forecast developed, the budgets for the whole organisation can be generated. For a manufacturing organisation these would typically include:

sales budget	usually generated directly from the key factor – the forecast data
production budget	based on the sales budget together with the anticipated finished goods inventory levels
materials usage budget	based on the production budget
materials purchase budget	based on the materials usage budget, together with the anticipated materials inventory levels
labour utilisation budget	also based on the production budget
functional budgets	to support the operation (often based on departments), for example administration budget, finance budget; these may not be so dependent upon the sales level as other budgets that are linked more closely
capital expenditure budget	this would also have to be developed in conjunction with the revenue budgets to ensure that the agreed spending on new or replacement equipment was in place

cash flow budget

this would take account of all the other budgets and their effect on the organisation's liquidity – note that this is not a functional budget, but is a part of the master budget

master budget

the calculations from all the revenue and capital budgets contribute to the **master budget** which takes the form of a budgeted statement of profit or loss (income statement) and a budgeted statement of financial position (balance sheet) together with a cash budget

The choice and format of the main budgets will need to be appropriate to the organisation. In Chapter 1 we examined responsibility accounting, and how responsibility centres can be used. Appropriate cost centres, profit centres and investment centres will need to be defined, and the budgets will need to be structured accordingly. For example, if there are separate cost centres for 'administration' and 'marketing' then there needs to be administration and marketing budgets. In this way managers can be held to account for their department's performance.

the effect of changing inventory levels

You will have noticed several references in the list of budgets to **inventory levels**. Where inventory levels are to remain constant the situation is simple. For example the production budget will be identical to the sales budget if the finished goods inventory level is to remain unchanged, ie the amount you will produce will be the amount you estimate you are going to sell. However if the inventory level is to increase then the extra units of goods that will go into inventory will need to be produced in addition to the units that are to be sold in the budget period. This is a concept that we will return to frequently.

CREATING BUDGETS

Earlier in this chapter we examined the methods and implications of creating budgets and using budgetary control. We will now look at the numerical work that is needed to produce a budget. This will involve co-ordinating the various budgets so that they are all based on the same assumptions and fit together in a logical sequence. In any tasks involving the preparation of budgets, you may be requested to state the assumptions that they are based on.

The procedure that we will need to follow when creating budgets is based on the system described in the earlier section on co-ordinated budgets. Limiting factors need to be considered and the 'key' factor identified. For a

manufacturing business sales volume is often the principal (key) budget factor. The system of budgets that will be created is shown in the diagram on the next page and explained in the text that follows. The diagram also shows how the relevant budgets link with the cash budget.

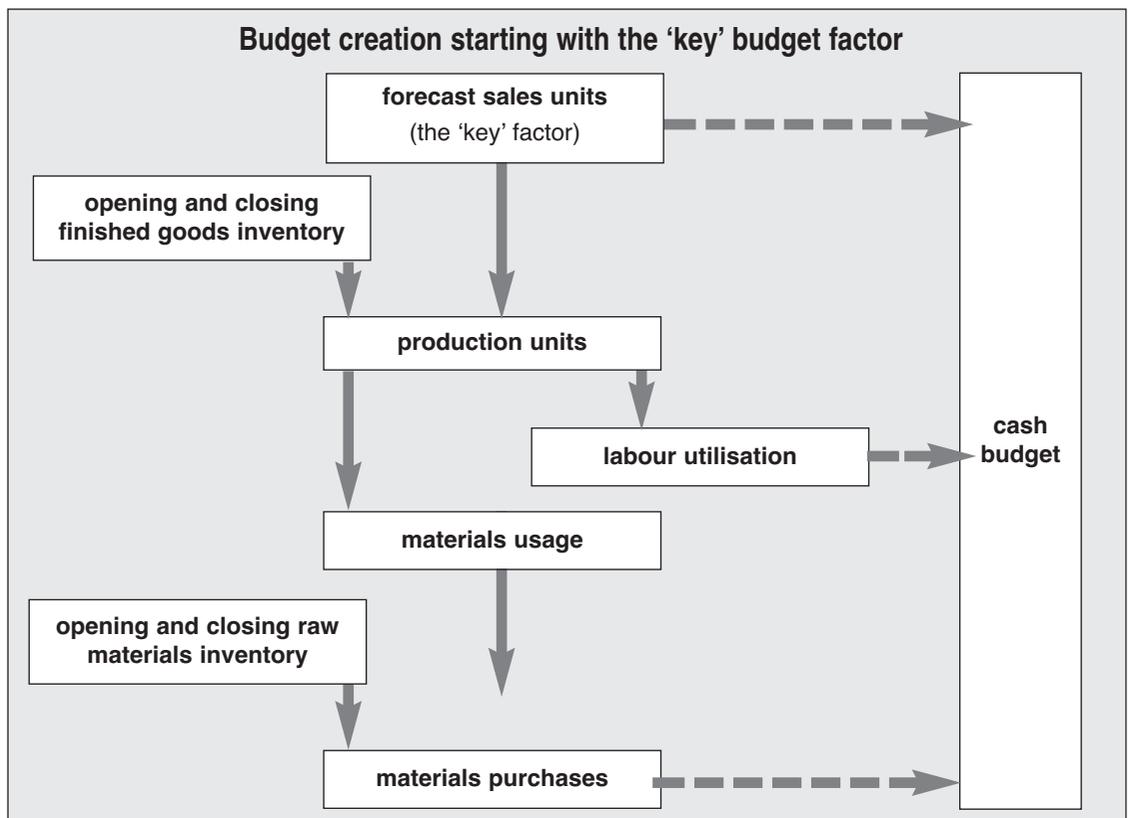
sales budget

The forecast of sales units will need to be developed first, as this is fundamental to the whole series of budgets. The level of actual production that is required will depend on two issues:

- the amount of finished goods the business plans to hold in stock ready to be sold (inventory)
- whether any of the finished goods are likely to be rejected.

sales revenue budget

The sales budget in units can be used to develop the sales revenue budget. This uses the sales units multiplied by the unit selling prices to arrive at the budgeted sales revenue. This budget will ultimately be used to develop the budgeted statement of profit or loss. The data from the sales revenue budget will also link with the cash budget, which will use information on the timing of the receipts.



production budget

We will generally need to plan to produce the units that we intend to sell, but we can

- plan to reduce our production by the intended fall in the level of finished goods inventory, or
- plan to increase our production to increase the level of our finished goods inventory

The production budget in units for a period therefore equals:

Budgeted Sales Units

– *Opening Inventory of Finished Goods*

+ *Closing Inventory of Finished Goods*

This can be justified since:

- the **opening inventory** of finished goods has already been produced, and can therefore be deducted from our calculation of what needs to be made, and
- the **closing inventory** has yet to be made so needs to be added in to our total of goods to be produced

In summary, the common-sense rule is:

- if inventory of finished goods is to increase, then production must be greater than sales
- if finished goods inventory is to remain constant production will be the same as sales
- if finished goods inventory is to fall production will be less than sales

materials usage budget

Once the production budget has been developed in units, we can calculate the quantity of material we need to use. The **materials usage budget** is created to ascertain the amount of raw material that will be consumed in production. The use of materials can also be valued at this point if required. The data for these calculations may come from standard costing information, or some less formal estimates of the material and labour content of production units.

materials purchases budget

The materials purchases budget can be created once the materials usage budget has been established. Here differences between the quantity of material to be consumed in production and the quantity to be purchased will be due to:

- the required movement in raw material goods inventory (adjusting for opening and closing inventory)
- any wastage or loss of raw materials

We will examine how to account for wastage in the next chapter. At this point we will consider the adjustments needed for raw material inventory movements.

The reasoning follows a similar pattern to the one described for sales, finished goods and production. If we already have raw materials in the opening inventory this amount does not have to be purchased, but the quantity that we plan to have remaining at the end of the period must be purchased in addition to the amount that will be used in production.

The **quantity of material purchased** (as recorded in the material purchases budget) will therefore equal:

$$\begin{aligned} & \text{Quantity of material to be used (per materials usage budget)} \\ & - \text{opening inventory of raw materials,} \\ & + \text{closing inventory of raw materials.} \end{aligned}$$

The rule is therefore:

- if inventory of raw materials are to increase, then purchases must be greater than materials usage
- if raw materials inventory is to remain constant purchases will be the same as materials usage
- if raw materials inventory is to fall purchases will be less than materials usage

One vital reason for creating a material purchases budget is that the information on the timing of purchases will feed into the cash budget which shows when the payments will need to be made.

Case Study

FLUMEN LIMITED: BUDGETS FOR MATERIALS USED AND PURCHASED

situation

A manufacturing company, Flumen Limited, makes a single product, the Wye. The sales forecast for February is 5,900 units. Each unit of Wye uses 5 kilos of Monnow and 3 kilos of Lugg.

The anticipated inventory levels at the beginning of February are:

Finished Wyes	1,400 units
Unused Monnow	350 kilos
Unused Lugg	200 kilos

The required inventory levels at the end of February are:

Finished Wyes	1,800 units
Unused Monnow	250 kilos
Unused Lugg	450 kilos

required

Produce the following budget figures for the month of February:

- (a) Production of Wye (in units)
- (b) Materials usage of Monnow and Lugg (in kilos)
- (c) Materials purchases of Monnow and Lugg (in kilos)

solution

(a)	Production units =		
	Budgeted Sales Units	5,900	
	– Opening Inventory of finished goods	(1,400)	
	+ Closing Inventory of finished goods.	1,800	
	Production units =	<u>6,300</u>	Wyes.

- (b) Materials usage
- Monnow: $6,300 \times 5 \text{ kilos} = 31,500 \text{ kilos}$
- Lugg: $6,300 \times 3 \text{ kilos} = 18,900 \text{ kilos}$

(c)	Materials purchases:		
	Monnow:		
	Quantity of material to be used	31,500 kilos	
	– opening inventory of raw materials,	(350 kilos)	
	+ closing inventory of raw materials.	250 kilos	
	Required purchases of Monnow	<u>31,400 kilos</u>	
	Lugg:		
	Quantity of material to be used	18,900 kilos	
	– opening inventory of raw materials,	(200 kilos)	
	+ closing inventory of raw materials.	450 kilos	
	Required purchases of Lugg	<u>19,150 kilos</u>	

labour utilisation budget (sub heading)

This budget (also known as the direct labour budget) is developed based on the production requirements (in units) shown in the production budget. The labour utilisation budget is usually based on direct labour time in hours, but could be converted into full time equivalent employees.

At this point it will be determined whether there are sufficient basic labour hours available for the production requirements, or whether overtime will be needed to be worked. Sometimes the amount of labour time available is a limiting factor (as discussed earlier) and it may be that sub-contractors can be used to make up any shortfall. This is an example of the benefits of good budgeting – so that the labour resources can be planned to ensure that production can go ahead as required.

worked example – calculating overtime hours

During week 50, the production budget shows a requirement for manufacturing 12,083 units. Each unit takes 11 minutes of direct labour time. There are 52 direct labour employees, each working 38 hours per week. Overtime hours can be worked if necessary.

Calculate the overtime requirement, rounded up to the next whole hour.

Direct labour hours needed:

$$12,083 \text{ units} \times 11 \text{ minutes} / 60 = 2,216 \text{ hours (rounded up)}$$

Basic rate hours available:

$$52 \text{ employees} \times 38 \text{ hours} = 1,976 \text{ hours}$$

Overtime hours required:

$$2,216 \text{ hours} - 1,976 \text{ hours} = 240 \text{ hours}$$

worked example – calculating sub-contracting work

During week 51, the production budget shows a requirement for manufacturing 14,180 units. Each unit takes 11 minutes of direct labour time. There are 52 direct labour employees, each working 38 hours per week. Overtime hours can be worked if necessary, but only up to an average 8 hours per employee. Production requirements in excess of those that can be carried out by employees must be sub-contracted to another company.

Calculate how many units can be made in-house (rounded down) and how many must be sub-contracted (rounded up to the next whole unit).

Total number of units to be produced: = 14,180 units

Maximum number of units to be made in-house:

$$(52 \text{ employees} \times (38 + 8) \text{ hours}) / (11 \text{ minutes} / 60) = 13,047 \text{ units (rounded down)}$$

Number of units to be sub-contracted:

$$14,180 - 13,047.27 = 1,133 \text{ units (rounded up)}$$

Note the way that the rounding is carried out in this example. It would not make sense to only make a part of a unit in-house. All units made must add up to the total requirement.

Once the direct labour requirement has been established, then costs can be calculated based on known basic labour and overtime rates. Where sub-contracting is also needed then these costs can be determined based on relevant quotations or estimates.

Indirect costs in the form of fixed and variable overheads can also be ascertained at this stage if required. If absorption costing is being used then the overheads may be absorbed using a direct labour hour rate. If marginal costing is adopted all fixed costs will be considered as relating to the time period rather than the production units.

machine utilisation budget

Another useful budget that can be prepared once the production budget has been finalised is the machine utilisation budget. This shows the extent to which existing production machines are used for the planned production level, and also provides an opportunity to plan for short term hire of additional machines.

worked example – calculating machine utilisation

During week 52, the production budget shows a requirement for manufacturing 10,120 units. The company owns twelve machines, each one is capable of producing up to 1,125 units per week.

Calculate the machine utilisation percentage (to the nearest whole percentage), and state whether all twelve machines are needed in week 52.

The maximum total machine capacity is $12 \times 1,125 = 13,500$ units

$$\begin{aligned} \text{Machine utilisation} &= \frac{\text{production requirement}}{\text{maximum total machine capacity}} \times 100 \\ &= \frac{10,120}{13,500} \times 100 = 75\% \text{ (rounded)} \end{aligned}$$

The unused capacity is $(13,500 - 10,120) = 3,380$ units. This is just over the capacity of three machines, so three machines are not needed at all during week 52.

If this production level was expected to continue for the foreseeable future, then consideration could be given to selling or scrapping up to three machines. However care would have to be taken to avoid leaving the organisation with a problem should production levels rise.

Based on the current twelve machines, if the production budget had a requirement for more than 13,500 units, then additional machines may need to be hired. This is provided, of course, that there was sufficient direct labour for the expected production level.

REJECTS, WASTAGE AND INEFFICIENCY

the problems

The range of problems that we must be able to deal with include:

■ producing finished goods that are not up to standard

Depending on the production process and the quality control system, some finished goods that are not up to standard may be only detected once they have been manufactured. This means that we must plan to produce more than we need so that the expected number of rejects is allowed for. An example of the type of product where rejection may occur after completion is electronic components that would undergo a final quality test.

■ **wastage of raw materials**

In some situations the amount of raw materials that are contained in the finished product may be less than the amount that must be purchased. This can be due to a variety of situations occurring before or during manufacture, including deterioration, spillage, or evaporation. It can also occur due to the raw materials naturally including unusable parts. An example of this could be timber that needs to have the bark removed before being cut to size.

■ **a labour force that is not operating at 100% efficiency**

When standard efficiency levels are used to plan for the amount of direct labour time to produce the required output, problems will arise if the workforce is significantly slower (or faster) than expected. When this difference can be anticipated the budgets can be modified to take account of the different efficiency level. This could occur (for example) if a workforce was undergoing training to use new equipment.

how to deal with the problems

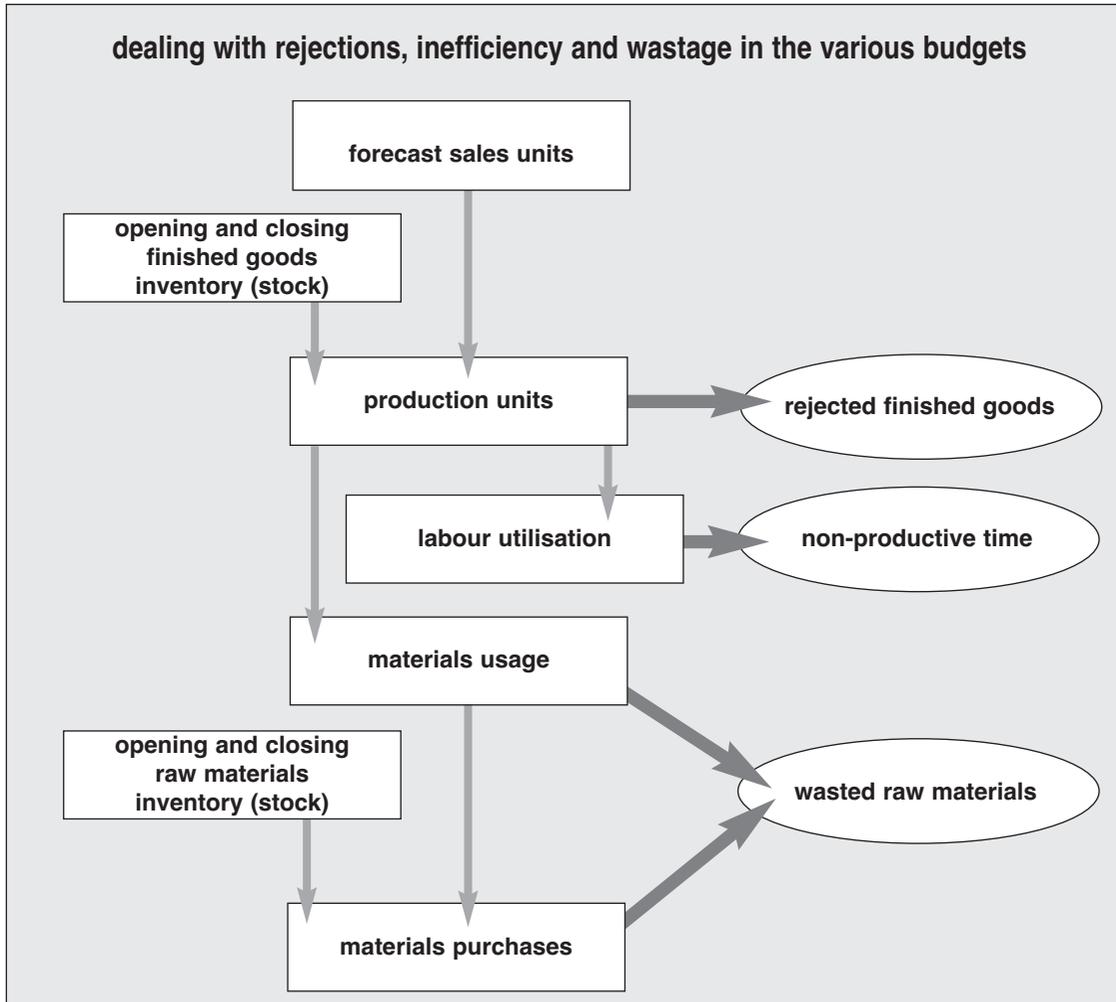
The issues that we face when preparing budgets incorporating these situations are:

- In which budget should we account for the situation?
- How do we accurately account for the situation?

The diagram on the next page summarises the first of these issues. It is based on the budget preparation diagram shown earlier in this chapter.

The problems described earlier are dealt with at the following points in the overall budgeting process:

- anticipated **rejections** of finished goods are built into the **production budget**. We therefore plan to produce enough so that when some output has been scrapped there is still enough to sell and account for changes in finished goods inventory levels
- **wastage of materials during production** is accounted for when determining the **materials usage budget**. A higher level of usage is planned for so that the materials will still be sufficient, despite wastage during production
- **wastage of materials before the production process** commences is taken account of when the **materials purchases budget** is prepared. In this way sufficient materials are acquired to deal with wastage, the amount needed for the materials usage budget, and the required changes in raw materials inventory levels
- **non-productive time** is built into the **labour utilisation budget**. We plan for sufficient time to be available so that the productive part is enough to satisfy the needs of the production budget



REJECTION OF FINISHED GOODS

The approach to take when dealing with a situation where finished goods are scrapped after a final inspection is to work back from the number of perfect products that we need to make. This is illustrated in the following Case Study.

Case Study

OSBORNE ELECTRICAL COMPONENTS: REJECTION OF FINISHED GOODS

An electrical component manufacturer's system involves a quality control check of all the completed components. The records show that on average 6% of completed components will fail this check and will need to be scrapped.

The forecast sales volume for the month of March is 5,200 components, and the production budget is to incorporate an increase in finished goods inventory from 1,000 components to 1,440 components, as well as the typical failure rate.

required

Calculate the production budget (in numbers of components) for March.

solution

Both the sales forecast and the finished goods inventory increase must be based on 'good' components. It would not make sense to sell or place into inventory any units that had failed the quality inspection.

The number of 'good' components required is therefore:

Budgeted Sales Units	5,200
– Opening Inventory of Finished Goods	(1,000)
+ Closing Inventory of Finished Goods.	1,440
= production of 'good' components	<u>5,640</u>

But actual production must be greater than this amount to account for rejects. Since the rejection rate is assumed to be 6%, the 5,640 'good' units must equal 94% of the required production level, as demonstrated in this diagram.

reject units	6% of production
'good' units (5,640)	94% of production

The production budget must therefore equal $5,640 \times 100 \div 94 = 6,000$ units.

You should be careful to note that the calculation does not involve simply adding 6% to the good production, but is effectively adding $6/94$, because the good production is 94% of the total production. This technique is often examined, and is a frequent source of confusion amongst students.

Notice that you can always check your answer. If 6% of 6,000 units are rejected, ie 360 are rejected, 5,640 units are left.

MATERIAL WASTAGE DURING PRODUCTION

Wastage during manufacture is a common problem, and occurs in industries as diverse as food production and house building. There can also be situations where one material incurs wastage, while another adds to the weight of the finished product. The next case study examines this problem.

Case Study

COOL CHIP COMPANY: MATERIAL WASTAGE

A frozen potato chip manufacturer purchases whole potatoes with skins. These are then peeled, any imperfections are removed, and the potatoes are sliced into chips and fried before freezing. The average wastage that occurs during peeling and imperfection removal is 20% of the weight of the whole potatoes.

No further wastage occurs during slicing, or frying.

The production budget for July is for 100,000 kilos of frozen chips, based on their weight immediately prior to freezing.

required

Calculate the materials usage budget (in kilos) for July for whole raw potatoes.

solution

In order to calculate the usage we must work back from the production budget:

To produce 100,000 kilos of uncooked chips we need to start with a larger weight of whole potatoes. The uncooked chips represent 80% of the weight of the whole potatoes, since 20% is lost as skin and imperfections.

Therefore whole potatoes will equal $100,000 \times 100 \div 80 = 125,000$ kilos.

The materials utilisation budget will therefore be:

125,000 kilos whole potatoes.

It is worth double-checking our calculation. This can be done as follows:

125,000 kilos whole potatoes used, less 20% wastage at the peeling stage, leaving 100,000 (80%) chips.

MATERIAL WASTAGE BEFORE PRODUCTION

The final type of situation that you may need to deal with involves wastage occurring while the material is being stored, prior to production. In the next Case Study this idea has been combined with the technique from the last Case Study to show how to deal with wastage when it occurs at two points; one before production starts and the other during production.

Case Study

WALVERN WATER LIMITED: MATERIAL WASTAGE

A manufacturer uses large quantities of distilled water in its production process. It buys the water in bulk and keeps it in large storage tanks. Due to the temperature in the vicinity of the factory, it is estimated that 3% of the distilled water will have evaporated between being purchased and being drawn from the storage tanks. A further 5% of the distilled water that is used in the process evaporates during production.

The final product has a distilled water content that is 89% of its volume.

The production budget for June shows that 390,000 litres of the finished product is required.

The distilled water inventory is estimated at 50,000 litres at the start of June, and 80,000 litres at the end of June (both figures assume that the initial evaporation in storage has taken place).

required

Calculate the following data for the distilled water for June:

- 1 the volume to be input into the production process, and
- 2 the volume to be purchased

Carry out calculations to the nearest litre.

solution

As in the other case studies, we need to work back from the required output.

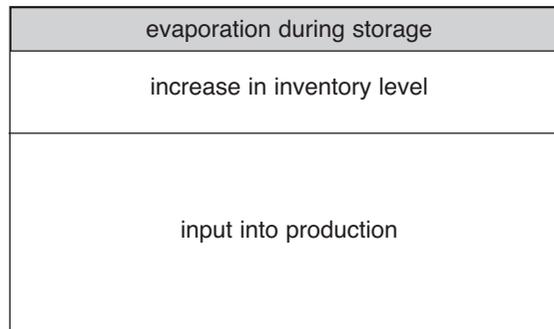
- 1 The finished goods will contain $(390,000 \text{ litres} \times 89\%) = 347,100$ litres of distilled water.

Evaporation during the production process means that this figure is equal to 95% of the distilled water input into the process.

The volume to be input is therefore $(347,100 \times 100 \div 95) = 365,368$ litres

- 2 We therefore need to purchase sufficient distilled water to allow for:
 the evaporation in storage, *plus*
 the required increase in distilled water inventory, *plus*
 the volume to be input into the production process.

The following diagram illustrates the amount of water that will need to be purchased:



As calculated in part 1, 365,368 litres needs to be input into production. A further 30,000 litres are needed to increase the inventory level (from 50,000 litres to 80,000 litres).

This means that $(365,368 + 30,000) = 395,368$ litres are needed after evaporation in storage.

Since the evaporation in storage is estimated at 3% of the amount initially acquired, the above amount that we need must represent 97% of the amount that we must purchase.

We therefore need to purchase $(395,368 \times 100 \div 97) = \underline{\underline{407,596}}$ litres

LABOUR EFFICIENCY

When a lack of efficiency results in non-productive time, the problem should be dealt with at the time the labour utilisation budget is being drawn up. By definition, non-productive time cannot be used to produce output, and so the amount of time that can be effectively used in production is less than the time that must be allowed for in total (and paid for).

If, on the other hand, it is anticipated that the efficiency level will be more than 100% (ie the work is to be carried out more quickly than the standard) this would also be accounted for at the same point in the process.

These two possibilities – inefficiency and a high level of efficiency – are dealt with in the Case Studies that follow.

**Case
Study**

PERFECT PATIOS: LOW LABOUR EFFICIENCY

A company that manufactures paving slabs has traditionally used standard labour times to build up the labour utilisation budget. Output is measured in hundreds of slabs, and the standard direct labour time to manufacture 100 type A slabs is 3.6 hours, and 100 type B slabs is 4.2 hours.

Recent legislation means that additional break times need to be accounted for in the labour utilisation budget. It is estimated that break times will in future account for 12% of the direct labour time allocated to production work, This has not been accounted for in the standard times quoted.

The production budget for January is for 24,000 type A slabs and 58,000 type B slabs.

required

Calculate the labour utilisation budget (in total direct labour hours) for January.

solution

The productive time (excluding breaks) is as follows:

Type A slabs:		
	240 (hundreds of slabs) x 3.6 hours =	864 hours
Type B slabs:		
	580 (hundreds of slabs) x 4.2 hours =	2,436 hours
Total productive time		<u>3,300</u> hours

This productive time will equal 88% of the total paid time due to the 12% allowance for breaks, as shown here.

break times	12%
productive time (3,300 hours)	88%

The total paid time will therefore equal $3,300 \text{ hours} \times 100 \div 88 = 3,750$ hours, and 3,750 direct labour hours will form the labour utilisation budget.

Case Study

SLICK PERFORMERS LTD: HIGH LABOUR EFFICIENCY

A small pottery that makes rustic crockery by hand set its standards some time ago, when the potters were relatively inexperienced. These standards included a time of 8 hours to create a 48-piece dinner service using a potter's wheel. Since that time all the potters have become more proficient, and can now produce work of the same standard more quickly. It is estimated that they are currently working at a 120% efficiency level based on the old standards. During the coming month of April the pottery needs to fulfil orders for 32 dinner services, and also increase its inventory level from 3 dinner services to 7 dinner services.

required

Calculate the labour utilisation budget for creating dinner services (in total direct labour hours) for April.

solution

The production required for April will be:

32	dinner services (for current orders), <i>plus</i>
4	dinner services (for increase in inventory)
<u>36</u>	dinner services

At standard time of 8 hours per dinner service, this would take 288 standard hours. Since the potters are working at 120% efficiency they will take less time than standard. This is calculated as:

$$288 \text{ hours} \times 100 \div 120 = \underline{240 \text{ hours.}}$$

The logic can be checked by working back from the solution as follows:

At standard rate (of 8 hours per set) in 240 hours they could make
 $240 \div 8 = 30$ dinner services.

Operating at 120% efficiency they can produce 20% more output, i.e.
 $30 \times 120\% = 36$ dinner services.

BUDGETING FOR INDIRECT COSTS AND SUPPORT ACTIVITIES

We discussed in Chapter 1 how budgets are used based on responsibility accounting. Separate budgets will be prepared for each function of the organisation (divided up if appropriate) and individual managers will be held accountable for their department's performance against their budget. As we move away from budgets for the production department into the budgets

which manage indirect costs in the various support functions (for example distribution, marketing, administration and finance), there are a number of different approaches that could be used. The indirect costs in these functions will typically not vary directly with production output, and so can be budgeted for in ways that best suit the organisation.

The following alternative approaches can be taken to preparing these functional budgets.

incremental budgeting

Preparing budgets using incremental budgeting is the traditional approach. It involves basing the budget for a period on the previous period's budget (or actual costs), and then making adjustments for anticipated inflation and any other expected changes. In this way, incremental budgeting produces a series of budgets over time that change only gradually. This provides consistency and security within the departments, and can avoid conflict between departments as resources are allocated based on agreed principles.

There are, however, disadvantages to incremental budgeting:

- there are no incentives for developing new ideas, or reducing costs. Managers may feel that they must spend all their budget to avoid it being reduced in future
- over time the budgets may become out of line with the amount of work carried out in the department, or the usefulness of that work
- if the departmental managers build in some 'budgetary slack' - by obtaining a larger budget than is really needed - then this may go unchallenged for many years

zero based budgeting (ZBB)

This method of budgeting takes the opposite approach to incremental budgeting. In each period the budget starts from a base of zero, with no account taken of the previous period's budget. Each cost that is agreed for the department has to be justified based on the benefit that will arise to the organisation from spending the amount allocated.

Often alternative 'decision packages' are prepared for the department showing the costs that would be incurred to deliver certain levels of benefits. For example alternative decision packages for a credit control section could involve:

- an option of a high level of interaction with debtors including active management of credit limits and a variety of appropriate action on outstanding amounts to provide maximum receipts. This package would be labour intensive and expensive

- An option involving a lower level of interaction with debtors, with fewer options to use to chase outstanding amounts. The receipts would flow into the organisation more slowly and bad debts may increase, but the cost of running the department would be much less than the first option.

The costs and benefits of providing each level of service would need to be analysed and a decision made based on the outcome that was best for achieving the organisational objectives.

The following are some advantages of zero based budgeting:

- it forces re-evaluation of the activities within each function, and how they contribute to the achieving the organisation's objectives
- it encourages innovation and links the uses of resources to the achievement of results
- it avoids wastage and budgetary slack

However, there are some disadvantages:

- the process is very time-consuming and expensive to operate
- it may focus on short-term benefits at the expense of the long term (for example when applied to training or marketing)
- the judging of decision packages may be difficult and subjective

One approach that could be taken is to rotate the use of zero base budgeting so that each budget centre does not go through the process each year. For example a department may undertake a full zero base exercise once every 5 years, with incremental budgeting used in the other years. This would reduce the cost, but retain some of the benefits.

priority based budgeting

Priority based budgeting shares some of its ideas with zero base budgeting in that it can ignore previous budgets. It examines the outcomes that an organisation is attempting to achieve and prioritises them – allocating resources to the outcomes that are judged to be most important. It is a technique that is frequently used in the public sector where diverse services compete for limited resources, for example local authorities and police forces. It is especially useful for situations where resources are being reduced, and provide some rigour for making tough decisions.

Where appropriate, it can use input from the service users as well as the organisation managers. For example, views about the relative priority that should be given to public library services, rubbish collection, and street lighting could be sought from the public in a local area.

Some organisations use a scale (for example 10 points) to link to each element of a service provided ranging from 'critical' (must be funded) through

'desirable' (may be funded) to services that are unjustifiable. The resources are then applied to programmes or services working down the list from the most important until the budgeted resources are used up.

activity based budgeting (ABB)

Unlike the three approaches to budgeting that we have just discussed, activity based budgeting is often used to manage indirect costs within the production department. In Chapter 1 we discussed how activity based costing could be used to allocate costs in the most appropriate way based on how activities use resources. Activity based budgeting links with ABC to provide a system that uses the same mechanism to budget as is used to develop costs.

Activity based budgeting uses the same cost drivers that were identified through ABC. The budgeting follows three stages:

- activities and their cost drivers are first identified
- the number of units of cost driver that are required to complete the required activity level are then forecast
- the budgeted 'cost driver rate' can then be used

For example, suppose the production department was planning to manufacture 5,000 units of a particular product using 10 batches of 500 units each. As each batch required one set-up (the cost driver) of the production machinery, the cost of 10 'set-ups' would be budgeted for. This would be a more precise way of budgeting than just considering set-up costs as part of general production overheads.

It would make sense to use activity based budgeting in conjunction with activity based costing.

**Chapter
Summary**

- Budgets can be used to compel planning, to communicate and co-ordinate ideas, and to monitor and control outcomes. They may also be used to help motivate managers and employees.
- Budgets must be in line with the objectives of the organisation, and the organisation's chosen strategy to achieve those objectives. Before starting to create a budget, the key budget factor must be recognised, and its numerical impact forecast. For most commercial organisations this factor is the sales level, but it could be based on specific resources or factors.
- Budgets that are prepared for manufacturing organisations typically include Sales, Production, Materials Usage, Materials Purchases, and Labour Utilisation, together with other budgets including various functional (including departmental) budgets, capital expenditure budgets and cash budgets. These are co-ordinated and amalgamated to form a set of Master Budgets.
- When preparing budgets we must accurately account for rejection of finished goods, a labour force that is not operating at 100% efficiency, or wastage of materials that occurs during or before production. In each situation care must be taken to allow for the correct quantity of unusable resources.
- The expected level of rejection of finished goods that are not up to standard is allowed for when the production budget is prepared. An additional amount of production is planned so that once goods have been scrapped there is still sufficient to sell and place in inventory.
- Any expected over or under efficiency of the direct labour force is built into the labour utilisation budget so that the amount of productive working will be sufficient to meet the needs of the production budget.
- Planned wastage of raw materials during production is built into the materials utilisation budget. In this way the plan is modified to input additional materials to allow for the situation. Where the wastage is expected to occur before production, the materials purchases budget must be modified so that there will be enough materials to be used in production, once wastage and inventory movements have taken place.
- A range of techniques can be used to help create ongoing budgets for indirect costs and support activities. These include the traditional incremental budgeting as well as the more recent developments of zero based budgeting, priority based budgeting and activity based budgeting.

**Key
Terms**

budget	a financial plan for an organisation, prepared before the period starts
key budget factor	the main factor (internal or external) that determines the planned activity level of the organisation
production budget	a budget that plans how much should be produced in a particular period, to allow for anticipated sales, inventory movements of finished goods, and rejections due to poor quality
labour utilisation budget	a budget that details the labour input required to meet the needs of the production budget
materials usage budget	a budget that plans the amount of materials that is required to satisfy the production budget, after allowing for wastage during production
materials purchases budget	a budget that plans for the level of purchases needed to meet the demands of the materials utilisation budget, as well as allowing for wastage before production and changing inventory levels
machine utilisation budget	a budget that shows the extent to which owned or rented machinery will be utilised by production
incremental budgeting	preparing a budget by basing it on the budget for the previous period with adjustments for inflation and known changes
zero based budgeting	preparing a budget without reference to the previous period, but by analysing the costs and benefits of a series of decision packages
priority based budgeting	ranking outcomes into levels of priority as a means of budgeting only for those with the highest priorities
activity based budgeting	using the techniques of activity based costing to prepare budgets based on activities and their cost drivers

Activities

- 3.1** Suggest the key (or principal) budget factors for the following organisations:
- (a) A partnership of two craftsmen who make high quality violins for leading musicians. The work is labour intensive and highly skilled. They are able to easily sell all they produce.
 - (b) A transport company that has a contract to work only for a major supplier of turkeys. The turkey supplier is currently expanding, but there is an agreement in place for all their transport requirements to be met by this one company for the next 12 months.
 - (c) A company whose team of engineers has a contract to maintain the Metro in Manchester. They have no plans to seek other contracts.
 - (d) A company that has opened a new baked potato outlet on a busy business park. The firm has the sole rights to supply potatoes to the 3,000 staff on the site, and has the capacity to cook and sell 100 baked potatoes per day.

- 3.2** The following table shows the sales level in units planned for the next three months. The company policy is to hold inventory of finished goods at the end of each month equal to 20% of the next month's sales.

Period	October	November	December
Sales (units)	20,400	21,600	24,000
Opening inventory	4,080		
Closing inventory			
Production (units)			

Complete the table to show the opening and closing inventory and production in units for October and November.

- 3.3** A manufacturing company that makes kitchen chairs is planning its activities for month 5 in the current year. The following data is available:

Sales in month 5 are forecast at 1,800 units.

Each completed unit requires 4 kilos of raw material.

Planned inventory levels are:

	Raw Materials	Finished Goods
At end of month 4	1,200 kilos	500 units
At end of month 5	1,500 kilos	400 units

Required:

Calculate the following budgets for month 5:

- production budget (in units),
- raw materials usage (in kilos)
- raw materials purchases (in kilos).

- 3.4** During month 4, the production budget shows a requirement for manufacturing 25,430 units. Each unit takes 9 minutes of direct labour time. There are 22 direct labour employees, each working 160 basic hours per month. Overtime hours can be worked if necessary.

Calculate the overtime requirement for month 4, rounded up to the next whole hour.

- 3.5** Labour hours

- 72,000 units of product M are to be manufactured in May.
- Each one takes 5 minutes to produce.
- 30 staff will each work 180 hours basic time.

How many overtime hours must be worked to complete the production?

Select from:

(a) 360	
(b) 600	
(c) 720	
(d) 5,400	
(e) 6,000	

- 3.6** During month 5, the production budget shows a requirement for manufacturing 27,365 units. Each unit takes 9 minutes of direct labour time. There are 22 direct labour employees, each working 160 hours per month. Overtime hours can be worked if necessary, but only up to an average 20 hours per employee. Production requirements in excess of those that can be carried out by employees must be sub-contracted to another company.

Calculate how many units can be made in-house (rounded down if necessary) and how many must be sub-contracted.

- 3.7** Department Y manufactures three products, A, B and C.

- (a)** Calculate the machine hours required to manufacture these in November, using the following table.

Product	Units	Hours per unit	Hours required
A	240	1.5	
B	210	2.0	
C	170	3.0	
Total hours for department Y			

- (b)** There are three machines in the department.

Each machine can be used for 300 hours in November. Additional machines can be hired if required.

Calculate how many additional machines should be hired.

- 3.8** A company that manufactures a single product (the Zapp) is planning for the next six months. Each unit of Zapp produced uses 2 litres of Woo and 3 litres of Koo.

Each unit of Zapp takes 0.5 hours of direct labour to produce.

The anticipated demand for Zapp is as follows:

January	5,000	units
February	4,000	units
March	6,500	units
April	5,000	units
May	6,500	units
June	5,000	units,

after which the demand can be assumed to stabilise at 5,000 units per month.

It will be company policy to maintain raw material inventory at a level of 100% of the following month's usage, and to maintain finished goods inventory at a level to satisfy half of the following month's estimated sales. Inventory held on 31 December was 3,000 finished Zapps, and 8,000 litres of Woo and 16,000 litres of Koo.

Required:

Calculate the following budgets for each month and in total:

- Production of Zapps (in units)
- Materials Usage (in litres of Woo and Koo)
- Materials Purchase (in litres of Woo and Koo)
- Direct Labour (in hours)

3.9 State which budget should be used to take account of each of the following anticipated situations.

- (a) Reduction in finished goods inventory.
- (b) Deterioration of raw materials whilst in storage.
- (c) Rejection of finished goods at final inspection.
- (d) Spillage of raw materials during production.
- (e) Direct Labour working at 80% standard efficiency level.
- (f) Increased demand for finished goods.
- (g) Increase in raw material inventory.

3.10 The quarterly production requirements for product M are shown below.

10% of production fails the quality checks and must be scrapped.

How many items of product M must be manufactured to allow for waste?

	Month 1	Month 2	Month 3
Required units	144,000	180,000	162,000
Manufactured units			

- 3.11** The sales budget for A B Wainwright Limited's product is 13,000 units in April, 15,000 units in May, and 20,000 units in June. The company policy is to plan for month end finished goods inventory of half of the following month's sales demand. All goods are inspected upon completion, and at this point an estimated 12.5% of finished goods are scrapped due to faults.

Required:

Calculate the production budget for May in numbers of units.

- 3.12** The following table (in units) shows the sales level planned for the next three months. The company policy is to hold inventory of finished goods at the end of each month equal to 15% of the next month's sales. 4% of completed production is expected to fail a quality check and be rejected.

Period	January	February	March
Sales	61,200	64,800	63,000
Opening inventory	9,180		
Closing inventory			
Good Production			
Rejects			
Total Production			

Complete the table to show all the relevant figures for January and February. Round up the figures for rejects and total production if necessary.

- 3.13** The Super Soup Company needs 50 kg of prepared carrots as an ingredient in a one tonne batch of soup. During preparation 20% of the weight of the raw unprepared carrots is lost in peel and imperfections. What should the unprepared carrots utilisation budget be (in kilos) for week 15, when 30 tonnes of soup are to be made?

(a) 7,500 kg	
(b) 1,800 kg	
(c) 1,875 kg	
(d) 1,200 kg	

3.14 Raw Material purchases

- 30,000 items of product N are to be manufactured in April.
- Each requires 1.5 metres of raw material.
- 10% of raw material is wasted during manufacture.
- The opening inventory of raw materials will be 24,000 metres.
- The closing inventory of raw materials will be 20,000 metres.

How much material must be purchased?

Select from:

(a) 18,000m	
(b) 26,222m	
(c) 45,500m	
(d) 46,000m	
(e) 54,000m	