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Performance Management (PM)

FORMULAE

Learning curve

$Y = ax^b$

Where Y = cumulative average time per unit to produce x units
a = the time taken for the first unit of output
x = the cumulative number of units produced
b = the index of learning (log LR/log2)
LR = the learning rate as a decimal

Demand curve

$P = a - bQ$

$b = \frac{\text{change in price}}{\text{change in quantity}}$

a = price when Q = 0

$MR = a - 2bQ$

Chapter 1

ACTIVITY BASED COSTING

1. Introduction

The traditional method of dealing with overheads is to split them between variable overheads and fixed overheads. If we are using absorption costing we then decide on a suitable basis for absorption (e.g. labour hours) and absorb the overheads on that basis.

Activity Based Costing (ABC) attempts to absorb overheads in a more accurate (and therefore more useful) way.

2. The steps to be followed are as follows:

- identify the major activities that give rise to overheads (e.g. machining; despatching of orders)
- determine what causes the cost of each activity – the **cost driver** (e.g. machine hours; number of despatch orders)
- calculate the total cost for each activity – the **cost pool** (e.g. total machining costs; total costs of despatch department)
- calculate an absorption rate for each cost driver
- calculate the total overhead cost for each product manufactured
- calculate the overhead cost per unit for each product

Example 1

Una manufactures three products: A, B, and C.

Data for the period just ended is as follows:

	A	*B*	*C*
Production (units)	20,000	25,000	2,000
Sales price (per unit)	$20	$20	$20
Material cost (per unit)	$5	$10	$10
Labour hours (per unit)	2 hours	1 hour	1 hour

(Labour is paid at the rate of $5 per hour)

Overheads for the period were as follows:

Set-up costs	90,000
Receiving	30,000
Despatch	15,000
Machining	55,000
	US$190,000

Cost driver data:

	A	*B*	*C*
Machine hours per unit	2	2	2
Number of set-ups	10	13	2
Number of deliveries received	10	10	2
Number of orders despatched	20	20	20

(a) Calculate the cost (and hence profit) per unit, absorbing all the overheads on the basis of labour hours.

(b) Calculate the cost (and hence profit) per unit absorbing the overheads using an Activity Based Costing approach.

3. Advantages of, and problems with, activity based costing.

When you finished this chapter you should attempt the online PM MCQ Test

Chapter 2

TARGET COSTING

1. Introduction

An important reason for calculating the cost of the product or service is in order to decide on a selling price. There is a chapter later in these notes that covers pricing decisions in detail, but traditionally a very common approach to determining a selling price has been to take the cost and then add on a profit percentage.

One problem with this approach is that it can clearly result in a price that is unacceptable to customers and at the same time provides no direct incentive to cut costs.

Target costing is a more modern and more market driven approach.

2. Target costing

2.1. The steps involved are:

- From research of the market determine a selling price at which the company expects to achieve the desired market share (the target selling price)
- Determine the profit required (e.g. a required profit margin, or a required return on investment)
- Calculate the maximum cost p.u. in order to achieve the required profit (the target cost)
- Compare the estimated actual costs with the target cost. If the actual cost is higher than the target cost then look for ways of reducing costs. If no way can be found of meeting the target cost then the product should not be produced.

Example 1

Packard plc are considering whether or not to launch a new product. The sales department have determined that a realistic selling price will be $20 per unit.

Packard have a requirement that all products generate a gross profit of 40% of selling price.

Calculate the target cost.

Example 2

Hewlett plc is about to launch a new product on which it requires a pre-tax ROI of 30% p.a..

Buildings and equipment needed for production will cost $5,000,000.

The expected sales are 40,000 units p.a. at a selling price of $67.50 p.u..

Calculate the target cost.

3. The use of the target cost

Once the target cost has been determined, it will be compared with the estimated actual cost of production. The excess of the actual cost over the target cost is known as the target cost gap, and the company will then be looking for ways of closing this gap.

4. Possible ways of attempting to close the target cost gap

5. Target costing in service industries

It is much more difficult to use target costing in service industries due to the characteristics of service businesses.

5.1. The five major characteristics that distinguish services from manufacturing are:

- **Intangibility**
- **Inseparability / Simultaneity**
- **Variability / heterogeneity**
- **Perishability**
- **No transfer of ownership**

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Chapter 3

LIFE-CYCLE COSTING

1. Introduction

The costs involved in making a product, and the sales revenues generated, are likely to be different at different stages in the life of a product. For example, during the initial development of the product the costs are likely to be high and the revenue minimal – i.e. the product is likely to be loss-making.

If costings (and decisions based on the costings) were only to be ever done over the short term it could easily lead to bad decisions.

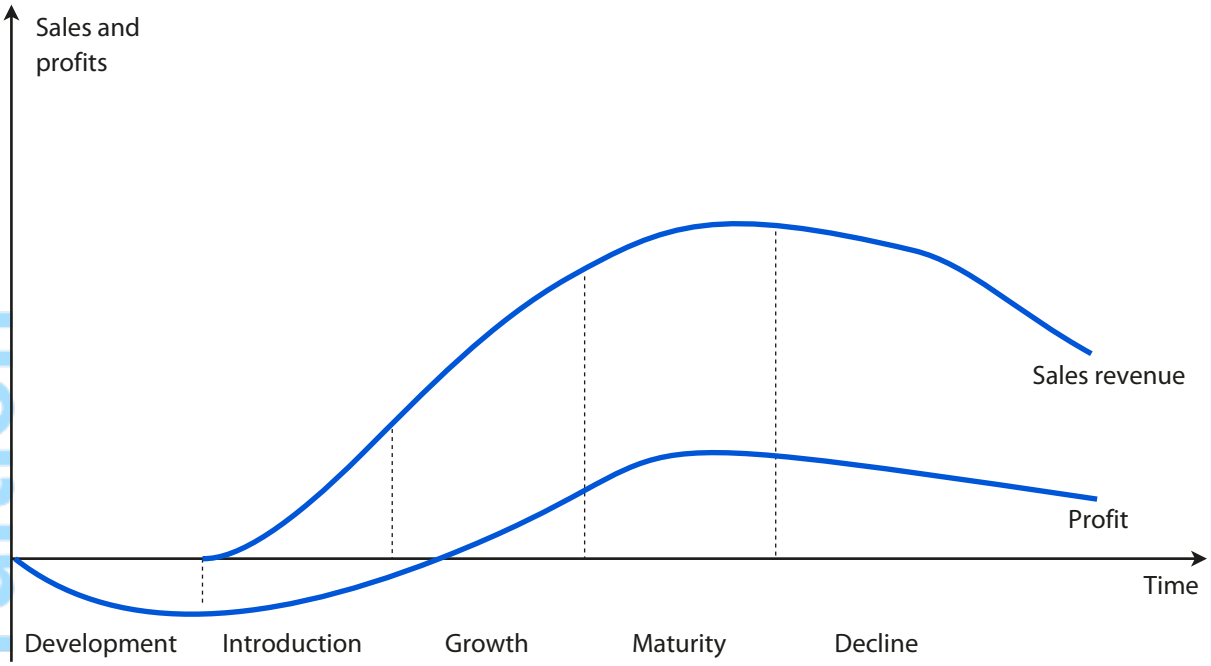
Life-cycle costing identifies the phases in the life-cycle and attempts to accumulate the costs over the entire life of the product.

2. The product life cycle

2.1. The product life cycle may be divided into five phases:

- **Development**
- **Introduction**
- **Growth**
- **Maturity**
- **Decline**

The effect of these can be illustrated diagrammatically as follows:



2.2. Maximising the return over the product life cycle

- **Design costs out of products**

- **Minimise the time to market**

- **Minimise breakeven time**

- **Maximise the length of the life span**

Example 1

A company is planning a new product. Market research suggests that demand for the product would last for 5 years. At a selling price of $10.50 per unit they expect to sell 2,000 units in the first year and 12,000 units in each of the other four years.

The company wishes to achieve a mark up of 50% on cost.

It is estimated that the lifetime costs of the product will be as follows:

Manufacturing costs - $6.00 per unit

Design and development costs - $60,000

End of life costs - $30,000

Calculate:

(a) the target cost for the product.

(b) the lifecycle cost per unit and determine whether or not the product is worth making.

It has been further estimated that if the company were to spend an additional $20,000 on design, then the manufacturing costs per unit could be reduced.

(c) If the additional amount on design were to be spent, calculate the maximum manufacturing cost per unit that could be allowed if the company is to achieve the required mark-up.

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Chapter 4

ENVIRONMENTAL MANAGEMENT ACCOUNTING

1. Introduction

Environmental management accounting (EMA) focuses on the efficient use of resources, and the disposal of waste and effluent.

In this chapter we will discuss the types of costs faced by businesses, and describe the different methods a business may use to account for these costs.

2. The importance of considering environmental costs

If a company is wasteful in its use of resources, or alternatively causes pollution, then this impacts in three ways:

(1) there is the direct cost to the company of spending more than is needed on resources, or having to spend money cleaning up the pollution

(2) there is the damage to the reputation of the company – consumers are becoming more and more environmentally aware

(3) there are possible fines or penalties as a result of breaking environmental regulations.

For all of the above reasons it is important for the company to attempt to identify and to manage the various costs involved.

3. Typical environmental costs

The cost that comes to the mind of most people immediately are those relating to dealing with waste. However there are many other costs that are likely to be just as important.

For example:

The amount of raw materials used in production. A publisher should consider ways of using less paper (or recyclable paper) as a way of saving costs for themselves as well as helping the environment.

Transport costs. Consideration of alternative ways of delivering goods could perhaps reduce costs and reduce the impact on the environment.

Water and energy consumption. EMA may help to identify inefficiencies and wasteful practices and, therefore, opportunities for cost savings.

4. Different methods of accounting for environmental costs

Although you cannot be required to perform any calculations for this section of the syllabus, you should be able to explain briefly four methods that have been suggested as ways of accounting for environmental costs.

(a) Inflow / Outflow analysis

This approach balances the quantity of resources that is input with the quantity that is output either as production or as waste. Measuring these in physical quantities and in monetary terms forces the business to focus on environmental costs.

(Resources includes not simply raw materials but also energy and water. i.e. all resources)

(b) Flow cost accounting

This is really inflow/outflow analysis (as described above) but instead of applying simply to the business as a whole, it takes into account the organisational structure. Resources input into the business are divided into three categories:

Material: the resources used in storing raw materials and in production

System: the resources used in (for example) storing production and quality control

Delivery and disposal: resources used in delivering to the customer and in disposing of any waste.

As in (a), the aim is to reduce the quantities of resources used, which saves costs for the company and leads to increased ecological efficiency.

(c) Lifecycle costing

This has been discussed in an earlier chapter. The relevance to EMA is that it is important to include environmentally driven costs such as the costs of disposal of waste. It may be possible to design-out these costs before the product is launched.

(d) Environmental Activity Based Costing

Activity Based Costing has been discussed in an earlier chapter. Its application to environmental costs is that those costs that are environment-related (e.g. costs related to a sewage plant) are attributed to joint environmental cost centres.

As with ABC in general, this focusses more attention on these costs and potentially leads to greater efficiency and cost reduction.

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Chapter 5

THROUGHPUT ACCOUNTING

1. Introduction

Key factor analysis deals with the situation where several products are being made but where there are limited resources available.

In this chapter we will look at key factor analysis first, and then explain how this may be adapted in a modern environment to perhaps a more meaningful approach known as **throughput accounting**.

2. Key Factor Analysis

In a situation where we are manufacturing several products, all of which use the same limited resource, then we need to decide on how best to use the limited resource in production.

The standard key factor approach is to rank the products on the basis of the contribution earned per unit of the limited resources.

Example 1

Pi plc manufactures 2 products, A and B.

The cost cards are as follows:

	A	*B*
Selling price	25	28
Materials	8	20
Labour	5	2
Other variable costs	7	2
Fixed costs	3	2
	23	26
Profit	$2	$2
Machine hours p.u.	2 hrs	1 hr
Maximum demand	20,000 units	10,000 units

The total hours available are 48,000.

Calculate the optimum production plan and the maximum profit using conventional key factor analysis

3. Throughput Accounting

The key factor approach described in the previous section is very sensible, and the throughput approach is effectively the same. However, there are two main concepts of throughput accounting which result in us amending the approach.

3.1. The main concepts of throughput accounting are:

- in the short run, all costs in the factory are likely to be fixed with the exception of materials costs
- in a JIT environment then we should be attempting to eliminate inventories. Use of a limited resource in production of inventories should be avoided and therefore any work-in-progress should be valued at only the material cost

4. Definitions:

- Throughput = sales revenue – material cost
- Total factory costs = all production costs except materials
- Return per factory hour = $\frac{\text{Throughput}}{\text{Time on key resource}}$
- Cost per factory hour = $\frac{\text{Total factory cost}}{\text{Total time available on key resource}}$
- Throughput accounting ratio = $\frac{\text{Return per factory hour}}{\text{Cost per factory hour}}$

4.1. Target for decision making:

The TA ratio should be greater than 1 if a product is to be viable. Priority should be given to those products which generate the highest TA ratios.

Example 2

Pi plc manufactures 2 products, A and B.

The cost cards are as follows:

	A	*B*
Selling price	25	28
Materials	8	20
Labour	5	2
Other variable costs	7	2
Fixed costs	3	2
	23	26
Profit	$2	$2
Machine hours p.u.	2 hrs	1 hr
Maximum demand	20,000 units	10,000 units

The total hours available are 48,000.

(a) Calculate the optimum production plan and the maximum profit, on the assumption that in the short-term only material costs are variable i.e. using a throughput accounting approach

(b) Calculate the Throughput Accounting ratios

5. Bottleneck Resource

In practice, it is likely that a product will have to be worked on by several machines - one after the other.

The rate of production will be restricted by the slowest of the machines, and this machine is known as the **bottleneck resource**.

The calculations that we have been through in the earlier examples will be performed using the hours per unit in this bottleneck resource.

Example 3

Yam Co is involved in the processing of sheet metal into products A, B and C using three processes, pressing, stretching and rolling.

The factory has 50 production lines each of which contain the three processes: Raw material for the sheet metal is first pressed then stretched and finally rolled. The processing capacity varies for each process and the factory manager has provided the following data:

Processing time per metre in hours

	Product A	*Product B*	*Product C*
Pressing	0.50	0.50	0.40
Stretching	0.25	0.40	0.25
Rolling	0.40	0.25	0.25

The factory operates for 225,000 hours.

Identify the bottleneck process and explain why this process is described as a 'bottleneck'.

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Chapter 6

LIMITING FACTORS

1. Introduction

We have already looked at how to deal with one limited resource – key factor analysis and throughput accounting.

In this chapter we will look at the situation where there is more than one limited resource, and a technique known as linear programming.

2. Linear Programming

If there are two or more scarce resources then we are unable to use the Key Factor approach. Instead, we must use Linear Programming.

2.1. The steps are as follows:

(1) Define the unknowns in terms of symbols

(2) Formulate equations for the constraints

(3) Formulate an equation for the objective

(4) Graph the constraints and the objective

(5) Find the optimum solution

Example 1

Peter makes two types of chair – the 'Executive' and the 'Standard'.

The data relating to each as follows:

	Standard	*Executive*
Materials	2 kg	4 kg
Labour	5 hours	6 hours
Contribution	$6	$9

There is a maximum of 80 kg of material available each week and 180 labour hours per week. Demand for 'Standard' chairs is unlimited, but maximum weekly demand for 'Executive' chairs is 10.

Find the optimal production plan and the maximum contribution that this will generate.

3. Spare capacity

In the previous example, there were limits on the resources available. However, there was no requirement to use all of the resources – only that we could not use more than the maximum available.

If the optimum solution results in using less that the maximum available of a particular resource, then we have spare capacity of that resource or slack.

Example 2

Using the information from example 1, calculate the slack for each of the constraints i.e. for materials, for labour, and for demand for 'Executive' chairs.

4. Shadow prices

In real life there are unlikely to be any truly limited resources – it will almost always be possible to get more, but we are likely to have to pay a premium for it. For example, the supply of labour may be limited by the length of the normal working week, but we can get more hours if we are prepared to pay overtime.

The **shadow price** (also known as the **dual price**) of a limited resource is the most extra that we would be prepared to pay for one extra unit of the limited resource. We calculate it by calculating the extra profit that would result if we have one extra unit of the limited resource.

Example 3

Using the information from example 1, calculate the shadow price of each of the contraints i.e. for materials, for labour, and for demand for 'Executive' chairs.

When you finished this chapter you should attempt the online PM MCQ Test

Chapter 7

PRICING

1. Introduction

An important decision for the management accountant is that of fixing a selling price.

In this chapter we will consider the practical considerations that are likely to apply, and also some theoretical calculations that you need to know.

2. Factors influencing selling price

Many factors are relevant when considering what price to charge.

2.1. The main areas to be considered are the following:

- **costs**
- **competitors**
- **customers**

3. Cost plus pricing

Using cost-plus pricing, the selling price is calculated by estimating the cost per unit of a product and adding an appropriate percentage mark-up.

A primary consideration will be as to what is to be regarded as the cost – full cost, marginal cost, or opportunity cost.

3.1. Full cost plus

Full cost includes a share of overheads and also often includes non-production costs.

- **advantages**

- **disadvantages**

3.2. Marginal cost plus

The price of the product is determined by calculating the marginal (or incremental) cost of producing a unit and adding a mark-up.

- **advantages**

- **disadvantages**

3.3. Opportunity cost plus

This is a marginal cost approach but also includes within the cost any opportunities foregone. It is a relevant costing approach.

Example 1

A new product is being launched, and the following costs have been estimated:

Materials	$10 per unit
Labour	$8 per unit
Variable overheads	$5 per unit

Fixed overheads have been estimated to be $50,000 per year, and the budgeted production is 10,000 units per year.

Calculate the selling price based on:

(a) full cost plus 20%

(b) marginal cost plus 40%

4. Optimal pricing – tabular approach

One major disadvantage of a cost plus approach to pricing is that it completely ignores the possible effect of the selling price on the level of demand.

For many products (but not all) it is the case that a higher selling price will result in lower demand, and vice versa.

It could therefore be worthwhile to reduce the selling price and sell more – provided of course that this resulted in a higher total profit.

Example 2

Kennedy plc has established that the price demand relationship is as follows:

S.P. p.u.	*Demand*
16	100
15.5	200
15	300
14.5	400
14	500
13.5	600
13	700

They have also established that the cost per unit for production of jars of coffee is as follows:

Quantity	*Cost p.u.*
100	14.0
200	13.9
300	13.8
400	13.7
500	13.6
600	13.5
700	13.4
800	13.3
900	13.2

Determine the optimal selling price in order to maximise profit

S.P. p.u.	*Demand*	*Cost p.u.*	*Total Revenue*	*Total Cost*	*Total Profit*	*Marginal Revenue*	*Marginal Cost*

Whichever way you choose to calculate the optimum selling price in the above example, do be aware that it occurs at the point where marginal revenue = marginal cost. You could be specifically asked to use this fact in the examination.

5. Price elasticity of demand

In the previous example, a reduction in the selling price results in an increase in demand (and vice versa). This is true of many products, but the effect of selling price on demand will be different for different products. The effect of selling price on demand is also likely to be different for the same product at different levels of selling price.

A measure of the size of the effect on demand of a change in selling price is called the price elasticity of demand.

$$\text{Price elasticity of demand (PED)} = \frac{\%\text{ change in demand}}{\%\text{ change in price}}$$

A high PED means that the demand is very sensitive to changes in price, or **elastic**.

A low PED means that the demand is not very sensitive to changes in price, or **inelastic**.

Example 3

Using the figures from example 2, calculate the price elasticity of demand
if the current selling price is $16 per unit
if the current selling price is $15 per unit

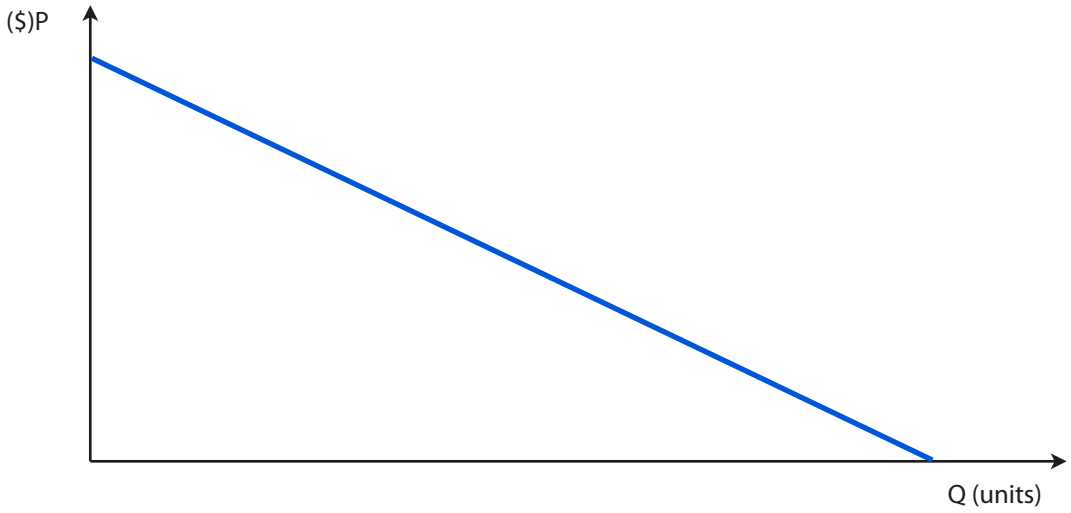
6. Optimal pricing – equations

In section 4, we were presented with the price/demand relationship as a table, and used these figures to calculate the optimum level of selling price from those available.

In principle, it would be possible to have an equation relating the selling price to the demand, and to then solve the problem algebraically.

6.1. Price/demand equation

In the exam you could be asked to derive the price/demand equation yourself from information given, or alternatively you could be given the equation. If you were asked to derive the equation yourself, then it would always be on the basis that the relationship was linear (as is the case in example 2, from inspection).



The equation would therefore be of the form:

P = a – bQ

where:

P = selling price

Q = quantity demanded at that price

a = theoretical maximum price (if the price is set at 'a' or above, then the demand will be zero)

b = the change in price required to change demand by 1 unit (the gradient of the line)

Example 4

A company sells an article at $12 per unit and has a demand of 16,000 units at this price.

If the selling price were to be increased by $1 per unit, it is estimated that demand will fall by 2,500 units.

On the assumption that the price/demand relationship is linear, derive the equation relating the selling price to the demand.

6.2. Optimal selling price

Having identified the price/demand relationship, it is easy to derive the equation for the revenue at any level – the total revenue will be equal to PQ.

We could then show on a graph the total revenue and total costs for any level of demand. It would be of this sort of shape:

Our objective is to maximise profit. We can do this by calculating the Marginal Revenue and Marginal Cost, and using the fact that the profit is maximised when the two are equal.

Example 5

A company currently has a demand for one of its products of 2000 units at a selling price of $30 per unit.

It has been determined that a reduction in selling price of $1 will result in additional sales of 100 units.

The costs of production are $1000 (fixed) together with a variable cost of $20 per unit.

(Note: see the note at the top of the next page)

Calculate the selling price p.u. at which the profit will be maximised.

Note: you cannot be required to differentiate in the examination, and therefore the formula for the marginal revenue is given on the formula sheet: MR = a – 2bQ

Example 6

At a selling price of $100 p.u. the company will sell 20,000 units p.a..

For every $2 change in the selling price, the demand will change by 2,000 units.

The costs comprise a fixed cost of $100,000, together with a variable cost of $5 p.u..

Calculate the selling price p.u. that will result in maximum profit p.a., and the amount of that profit.

7. Pricing strategies

In particular circumstances, for particular reasons, the company may decide on a special strategy with regard to its pricing policy.

You should be aware of the following common strategies, and be able to give examples of circumstances where they may be considered.

- **Penetration pricing**
- **Price skimming**
- **Product-line pricing**
- **Complementary products**
- **Price discrimination**
- **Volume discounting**

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Chapter 8

COST VOLUME PROFIT ANALYSIS

1. Introduction

Cost-volume-profit analysis considers how costs and profits change with changes in the volume or level of activity.

2. Breakeven

Breakeven is the level of activity which gives rise to zero profit. Since profit is the difference between total contribution and fixed costs, breakeven is where the total contribution equals total fixed costs.

$$\text{Breakeven volume} = \frac{\text{Fixed costs}}{\text{Contribution per unit}}$$

Example 1

Product X has variable costs of $2 per unit, and selling price of $6 per unit.

The fixed costs are $1,000 per year

(a) If budgeted sales and production are 300 units, what is the budgeted profit (or loss) for the year?

(b) What is the breakeven point (in units)?

(c) What is the breakeven revenue?

(d) How many units need to be sold to achieve a target profit of $300 per year?

3. Margin of safety

The Margin of Safety measures the %'age fall in budgeted sales that can be allowed before breakeven is reached.

$$\text{Margin of safety} = \frac{\text{Budgeted sales - breakeven}}{\text{Budgeted sales}} \times 100\%$$

It is useful in identifying how big a problem any inaccuracy in the budgeted sales is likely to be.

Example 2

Calculate the margin of safety for example 1

4. Contribution to sales ratio

The contribution to sales ratio (or C/S ratio) is calculated as follows:

$$\text{C/S ratio} = \frac{\text{Contribution in \$}}{\text{Sales in \$}}$$

Since the contribution and the sales revenue both vary linearly with the volume, the C/S ratio will remain constant.

[Note: the C/S ratio is sometimes called the profit to volume (or P/V ratio)].

Example 3

Calculate the C/S ratio for example 1
What sales revenue is needed to generate a target profit of $320?

5. Breakeven chart

The breakeven chart plots total costs and total revenues at different levels of volume, and shows the activity level at which breakeven is achieved.

Example 4

Draw a breakeven chart for example 1

6. Profit-volume chart

The profit volume chart shows the net profit or loss at any level of activity

Example 5

Draw a profit-volume chart for example 1

7. Multi-product CVP analysis

In practice a company is likely to make several products, each with different CS ratios.

They are still likely to be interested in the break-even sales revenue (in order to cover the fixed overheads), but the existence of several products makes it less certain and all we can really do is calculate breakeven on the assumption that the mix of products remains as per the budgeted mix – even if total sales are lower.

However, as will be illustrated in the following example, the company could reach the breakeven position sooner if it were to sell the product with the highest CS ratio first.

Example 6

A company produces and sells three products: C, V and P.

The budget information for the coming year is as follows:

	C	*V*	*P*
Sales (units)	4,800	4,800	12,000
Selling price (p.u.)	$5	$6	$7
Variable cost (p.u.)	$3.75	$5.25	$4.35
Contribution (p.u.)	$1.25	$0.75	$2.65

The total budgeted fixed overheads for the year are $8,000

(a) Calculate the CS ratio for each product individually

(b) Calculate the average CS ratio (assuming that the budget mix of production remains unchanged)

(c) Calculate the breakeven revenue (assuming that the budget mix of production remains unchanged)

(d) Construct a PV chart (assuming that the budget mix of production remains unchanged)

Assuming that the products are produced in order of their CS ratios, construct a table showing the cumulative revenue and cumulative profits

Calculate the breakeven sales revenue on this basis

Add the information to the P/V chart already produced for Example 6

8. Limitations of CVP analysis

- The selling price per unit is assumed to remain constant at all levels of activity
- The variable cost per unit is assumed to remain constant at all levels of activity
- It is assumed that the total fixed costs remain constant
- It is assumed that the level of production is equal to the level of sales (i.e. that there are no changes in the levels of inventory)

When you finished this chapter you should attempt the online PM MCQ Test

Chapter 9

SHORT-TERM DECISION MAKING

1. Introduction

This chapter looks at various techniques for the making of decision in the short-term. You should be already familiar with them from your previous studies. First we will revise the terminology and then revise the techniques by way of examples.

2. Terminology

2.1. Variable costs

These are costs where the total will vary with the volume. In the case of production costs, the total will vary with the level of production, whereas in the case of selling costs the total will vary with the level of sales.

Normally, the variable cost per unit will be constant, although this is not always the case. In the case of materials cost, it may be that the cost per unit falls with higher quantities due to discounts being received. In the case of labour, again the cost per unit may fall with higher production due to the learning effect (covered in a later chapter).

The total of the variable production costs is also called the marginal cost of production.

2.2. Fixed costs

These are costs where the total will not vary with volume. An example perhaps is factory rent, where the same total rent is payable whether we produce 1 unit or 1,000 units.

2.3. Contribution

The contribution per unit is the difference between the selling price and all variable costs per unit. (Or, alternatively, the profit before charging any fixed costs).

The contribution is of fundamental importance in decision making, because it is this element of profit that will vary with volume – the fixed costs, by definition, staying fixed.

2.4. Avoidable (or discretionary) fixed costs

These are the specific fixed costs of an activity or sector of a business which would be avoided if that activity or sector did not exist. These costs are usually associated with decisions as to whether or not to shut down a sector. If we were to shut down a sector, then any contribution from that area would be lost, but any avoidable fixed costs of that area would be saved.

Note that not all fixed costs are avoidable by shutting down an area. For example, there may be head office fixed costs that remain payable in full even if one sector of the business were to be closed.

2.5. Sunk costs

These are costs that have already been incurred. They are irrelevant for decision making. The reason for this is that in any decision we will be concerned with whether or not the future benefits from the decision will outweigh the future costs. Any costs already incurred will remain payable whatever decision we make.

2.6. Relevant costs

A relevant cost is simply a cost that is relevant to the decision being made. A sunk cost is not a relevant cost for the reasons stated above.

2.7. Opportunity cost

This is the value of a benefit sacrificed when one course of action is taken in preference to an alternative.

For instance, one factor that might be involved in deciding whether or not to launch a new product could be that sales of another existing product may fall. If, as a result we would lose (say) $20,000 of existing contribution, then for the purpose of making the decision about the new product we would consider the $20,000 as being a cost of the new product. (The new product will only be worthwhile if the revenue from it covers not only any direct costs of production but also the $20,000 that we would be losing.)

2.8. Incremental costs

Incremental means extra, or additional. These are any extra costs which would be incurred as a result of the decision and will therefore be relevant to the decision.

3. Shutdown problems

This sort of question is asking for a decision as to whether or not to close part of the business.

Example 1

(a) A company manufactures three products, Pawns, Rooks and Bishops. The present net annual income from these is as follows:

	Pawns	*Rooks*	*Bishops*	*Total*
	$	*$*	*$*	*$*
Sales	50,000	40,000	60,000	150,000
Less variable costs	30,000	25,000	35,000	90,000
Contribution	20,000	15,000	25,000	60,000
Less fixed costs	17,000	18,000	20,000	55,000
Profit/loss	3,000	(3,000)	5,000	5,000

The company is considering whether or not to cease selling Rooks. It is felt that selling prices cannot be raised or lowered without adversely affecting net income. $5,000 of the fixed costs of Rooks are direct fixed costs which would be saved if production ceased. All other fixed costs would remain the same.

(b) Suppose, however, that it were possible to use the resources released by stopping production of Rooks to produce a new item, Crowners, which would sell for $50,000 and incur variable costs of $30,000 and extra direct fixed costs of $6,000.

Consider whether the company should cease production and sale of Rooks under each of the scenarios in (a) and (b) above.

4. Relevant costing

This sort of question is really testing that you can determine what information in the question is relevant to the decision, and what information (for example, sunk costs) is irrelevant.

This is not a topic for which you can really learn rules. The main thing is to understand the thought process involved and then to read questions very carefully and to state the assumptions you have made where relevant.

Example 2

The managing director of Parser Ltd, a small business, is considering undertaking a one-off contract and has asked her inexperienced accountant to advise on what costs are likely to be incurred so that she can price at a profit. The following schedule has been prepared:

Costs for special order:

	Notes	*$*
Direct wages	1	28,500
Supervisor costs	2	11,500
General overheads	3	4,000
Machine depreciation	4	2,300
Machine overheads	5	18,000
Materials	6	34,000
		98,300

Notes:

1. Direct wages comprise the wages of two employees, particularly skilled in the labour process for this job, who could be transferred from another department to undertake work on the special order. They are fully occupied in their usual department and sub-contracting staff would have to be bought-in to undertake the work left behind. Subcontracting costs would be $32,000 for the period of the work. Different subcontractors who are skilled in the special order techniques are available to work on the special order and their costs would amount to $31,300.
2. A supervisor would have to work on the special order. The cost of $11,500 is comprised of $8,000 normal payments plus $3,500 additional bonus for working on the special order. Normal payments refer to the fixed salary of the supervisor. In addition, the supervisor would lose incentive payments in his normal work amounting to $2,500. It is not anticipated that any replacement costs relating to the supervisor's work on other jobs would arise.
3. General overheads comprise an apportionment of $3,000 plus an estimate of $1,000 incremental overheads.
4. Machine depreciation represents the normal period cost based on the duration of the contract. It is anticipated that $500 will be incurred in additional machine maintenance costs.
5. Machine overheads (for running costs such as electricity) are charged at $3 per hour. It is estimated that 6000 hours will be needed for the special order. The machine has 4000 hours available capacity. The further 2000 hours required will mean an existing job is taken off the machine resulting in a lost contribution of $2 per hour.
6. Materials represent the purchase costs of 7,500 kg bought some time ago. The materials are no longer used and are unlikely to be wanted in the future except on the special order. The complete inventory of materials (amounting to 10,000 kg), or part thereof, could be sold for $4.20 per kg. The replacement cost of material used would be $33,375.

Because the business does not have adequate funds to finance the special order, a bank overdraft amounting to $20,000 would be required for the project duration of three months. The overdraft would be repaid at the end of the period. The bank's overdraft rate is 18%.

The managing director has heard that, for special orders such as this, relevant costing should be used that also incorporates opportunity costs. She has approached you to create a revised costing schedule based on relevant costing principles.

Adjust the schedule prepared by the accountant to a relevant cost basis, incorporating appropriate opportunity costs.

5. Make or Buy decisions

In order to overcome problems of limited resources, a firm may buy in a product instead of making it itself.

Where incremental costs of manufacture are less than those of buying in, the firm should make – assuming that there are not limited resources.

Where resources are limited, the firm should concentrate on making those products which give the greatest saving (over buying in) per unit of the scarce resource.

To decide which products should be made and which should be bought, we calculate the saving per unit of scarce resource from making the product rather than buying it in.

Example 3

The availability of Material B is limited to 8,000 kg

Product	*X*	*Y*	*Z*
Demand (units)	2,000	2,500	4,000
Variable cost to make ($ per unit)	10	12	14
Buy-in price ($ per unit)	13	17	16
Kg of B required per unit (included in variable cost)	3	2	1

Which products should the company make and which should it buy?

When you finished this chapter you should attempt the online PM MCQ Test

Chapter 10

RISK AND UNCERTAINTY

1. Introduction

Decision making involves making decisions now which will affect future outcomes which are unlikely to be known with certainty.

Risk exists where a decision maker has knowledge that several possible outcomes are possible – usually due to past experience. This past experience enables the decision maker to estimate the probability or the likely occurrence of each potential future outcome.

Uncertainty exists when the future is unknown and the decision maker has no past experience on which to base predictions.

Whatever the reasons for the uncertainty, the fact that it exists means that there is no 'rule' as to how to make decisions. For the examination you are expected to be aware of, and to apply, several different approaches that might be useful.

2. Risk preference

As will be illustrated by an example, the approach taken to make the decision will depend on the decision-makers attitude to risk.

A risk seeker will be interested in the best possible outcome, no matter how small the change that they may occur.

Someone who is risk neutral will be concerned with the most likely or 'average' outcome.

A risk avoider makes decisions on the basis of the worst possible outcomes that may occur.

Example 1

John has a factory capacity of 1,200 units per month.

Units cost him $6 each to make and his normal selling price is $11 each. However, the demand per month is uncertain and is as follows:

Demand	*Probability*
400	0.2
500	0.3
700	0.4
900	0.1

He has been approached by a customer who is prepared to contract to a fixed quantity per month at a price of $9 per unit. The customer is prepared to sign a contract to purchase 300, 500, 700 or 800 units per month.

The company can vary production levels during the month up to the maximum capacity, but cannot carry forward any unsold units in inventory.

(a) Calculate all possible profits that could result

(b) Determine for what quantity John should sign the contract, under each of the following criteria:

i) expected value

ii) maximin

iii) maximax

iv) minimax regret

(c) What is the most that John would be prepared to pay in order to obtain perfect knowledge as to the level of demand?

3. The limitations of expected values.

Although we say that someone who is risk neutral would take an expected value approach to decision making, there are two serious limitations of this approach:

4. Decision Trees

A decision tree is a diagrammatical representation of the various alternatives and outcomes. It is relevant when using an expected value approach and where there are several decisions to be made – it makes the approach more understandable.

Example 2

Combi plc are having problems with one of their offices and have decided that there are three courses of action available to them:

(a) shut down the office, raising proceeds of $5 million

(b) have an expensive refurbishment of the office costing $4,000,000

(c) have a cheaper refurbishment of the office at a cost of $2,000,000

If they do the expensive refurbishment, then a good result will yield a return of $13,500,000 whereas a poor result will yield a present value of only $6,500,000.

If they alternatively decide to do the cheaper refurbishment, then a good result will yield a return of $8,500,000 whereas a poor result will yield $4,000,000.

In either case, the probability of the refurbishment achieving a good result has been estimated to be 2/3.

An independent company has offered to undertake market research for them in order to identify in advance whether the result of refurbishment is likely to be good or poor. The research will cost $200,000 and there is a 68% probability that it will indicate a good result.

Unfortunately, the research cannot be guaranteed to be accurate. However, if the research indicates a good result, then the probability of the actual result being good is 91%.

If the survey indicates a poor result, then the probability of the actual result being good is 13%.

Combi have already decided that if they do have market research, and if the research indicates a poor result, then they will only be prepared to consider the cheaper refurbishment.

Use a decision tree to recommend what actions should be taken.

Note: In this example, the market research is not guaranteed to be accurate. This is likely to be the case in real life and is an example of **imperfect knowledge**

When you finished this chapter you should attempt the online PM MCQ Test

Chapter 11

BUDGETING

1. Introduction

Budgeting is an essential tool for the management accounting in both planning and controlling future activity. In this chapter we will discuss the benefits of budgeting, the types of budget, and the preparation of budgets.

2. Benefits of budgeting

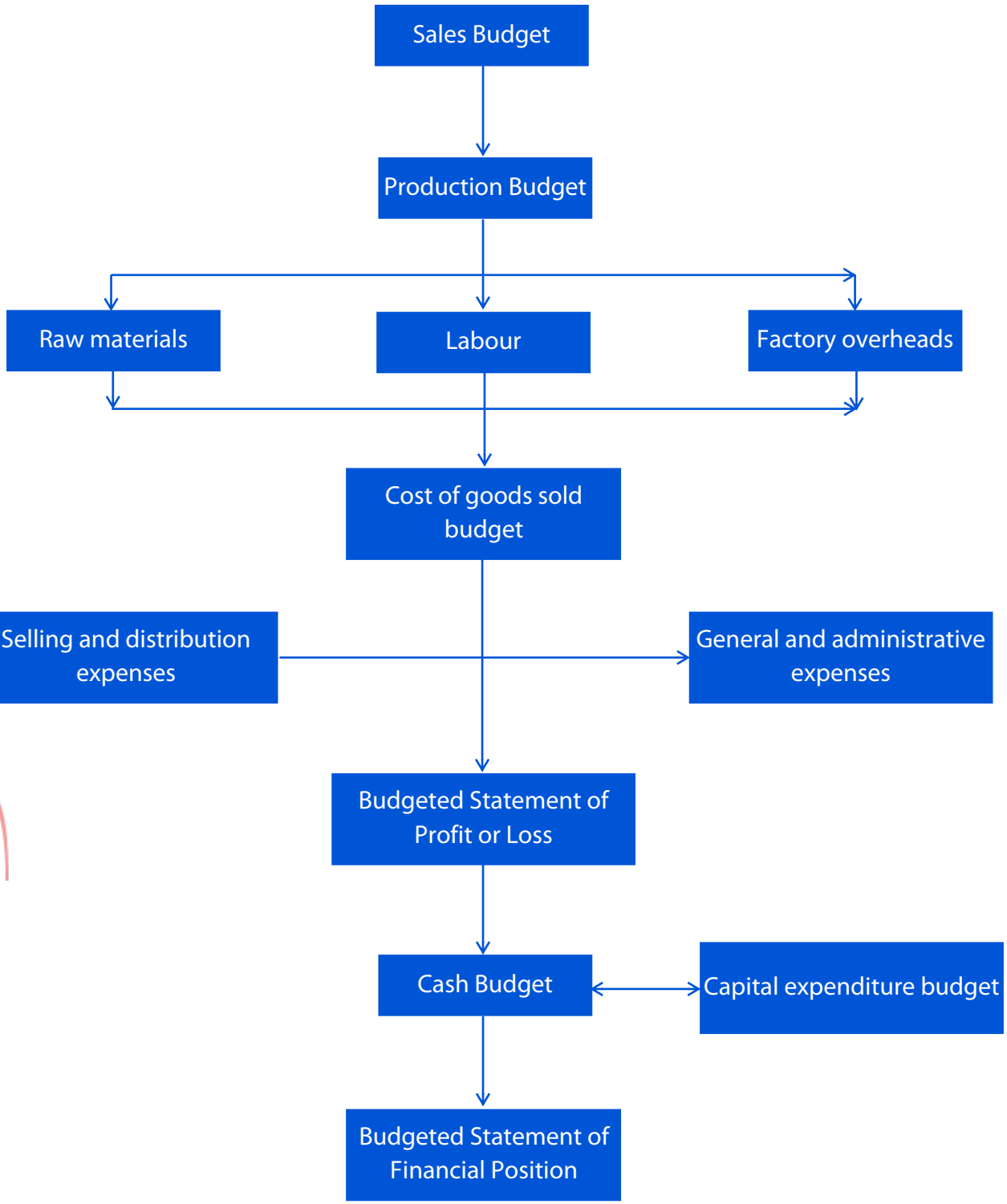
- Planning
- Co-ordination
- Control
- Authorising and delegating
- Evaluation of performance
- Communicating and motivating

3. Principal budget factor

The principal budget factor is the factor that limits the activity for the budget period. Normally this is the level of sales and therefore the sales budget is usually the first budget to be prepared and this leads to the others.

However, it could be (for example) a limit on the availability of raw materials that limits activity. In this case Raw Materials would be the principal budget factor, and this would the first budget to be prepared.

4. The preparation of budgets



Example 1

The XYZ company produces three products, X, Y, and Z. For the coming accounting period budgets are to be prepared using the following information:

Budgeted sales

Product X	2000 units at $100 each
Product Y	4000 units at $130 each
Product Z	3000 units at $150 each

Standard usage of raw material

	Wood (kg per unit)	*Varnish (litres per unit)*
Product X	5	2
Product Y	3	2
Product Z	2	1
Standard cost of raw material	$8	$4

Inventories of finished goods

	X	*Y*	*Z*
Opening	500u	800u	700u
Closing	600u	1000u	800u

Inventories of raw materials

	Wood	*Varnish*
Opening	21,000	10,000
Closing	18,000	9,000

Labour

	X	*Y*	*Z*
Standard hours per unit	4	6	8

Labour is paid at the rate of $3 per hour

Prepare the following budgets:

(a) Sales budget (quantity and value)
(b) Production budget (units)
(c) Material usage budget (quantities)
(d) Material purchases budget (quantities and value)
(e) Labour budget (hours and value)

5. Types of budget

- **Fixed budget**

- **Flexed budget**

- **Rolling budget**

Example 2

A company has prepared the following fixed budget for the coming year.

Sales	10,000 units
Production	10,000 units

	$
Direct materials	50,000
Direct labour	25,000
Variable overheads	12,500
Fixed overheads	10,000
	$97,500

Budgeted selling price $10 per unit.

At the end of the year, the following costs had been incurred for the actual production of 12,000 units.

	$
Direct materials	60,000
Direct labour	28,500
Variable overheads	15,000
Fixed overheads	11,000
	$114,500

The actual sales were 12,000 units for $122,000

(a) Prepare a flexed budget for the actual activity for the year

(b) Calculate the variances between actual and flexed budget, and summarise in a form suitable for management. (Use a marginal costing approach)

6. Methods of budgeting

6.1. Incremental budgeting

This approach is to take the previous years results and then to adjust them by an amount to cover inflation and any other known changes.

It is the most common approach, is a reasonably quick approach, and for stable companies it tends to be fairly accurate.

However, one large potential problem is that it can encourage the continuation of previous problems and inefficiencies.

The reason for this is that the budget is a plan for the coming year – not simply a financial forecast.

If we require a wages budget, we will probably ask the wages department to produce it and they (using an incremental approach) will assume that our workers will continue to operate as before. They will therefore simply adjust by any expected wage increases.

As a result, the 'plan' for our workers stays the same as before. Nobody has been encouraged to consider different ways of operating that may be more efficient. It is at budget time that we perhaps should be considering different ways of operating.

6.2. Zero-based budgeting

With zero-based budgeting we do not consider the previous period. Instead, we consider each activity on its own merits and draw up the costs and benefits of the different ways of performing it (and indeed whether or not the activity should continue).

We then decide on the most effective way of performing each activity.

Clearly any changes to the way an activity is performed may require funding, and there may not be sufficient funding available for all changes proposed, and therefore they are ranked to decide which changes are made.

Although this approach is in principle a much better approach to budgeting, it is time-consuming and also requires much more expertise than incremental budgeting. For this reason, it is often restricted just to a few activities each year in order that training and help may be given to the people involved. Other activities are budgeted using the incremental approach.

7. Behavioural aspects

7.1. Participation

If the budget process is not handled properly, it can easily cause dysfunctional activity. It is therefore necessary to give thought to the behavioural aspects.

- **Top-down budgeting**

  This is where budgets are imposed by top management without the participation of the people who will actually be involved for implementing it.

- **Bottom-up budgeting**

  Here the budget-holders do participate in the setting of their own budgets.

- **Advantages and disadvantages**

7.2. Target setting and motivation

Targets can assist motivation and appraisal if they are set at the right level.

- if they are too difficult then they will demotivate
- if they are too easy then managers are less likely to strive for optimal performance
- ideally they should be slightly above the anticipated performance level

Good targets should be:

- agreed in advance
- dependant on factors controllable by the individual
- measurable
- linked to appropriate rewards and penalties
- chosen carefully to ensure goal congruence

7.3. Responsibility accounting

A system of accounting that separates revenues and costs into areas of separate responsibility, which can then be assigned to specific managers

7.4. Management by objectives

A system of management incorporating clearly established objectives at every level of the organisation.

Here there is less emphasis on monetary budgets and more emphasis on taking action which helps the business to achieve its objectives.

8. Beyond budgeting

There has been much recent criticism of the annual budgeting process for many reasons, including the following:

- Time consuming and costly to put together
- Restricts responsiveness and flexibility and is a barrier to change
- Rarely strategically focused (most budgets are for one year only)
- Adds little value
- Concentrates on cost reduction, not on creating value
- Encourages 'gaming' and perverse behaviour just to meet the budget.
- Not updated often enough
- Based on assumptions, estimates and guesses
- Reinforces departmental barriers rather than sharing and cooperation
- Makes people feel undervalued: the budget is seen as a strict control mechanism and employees have to stick to the budget no matter what.

Several companies are adopting a 'beyond budgeting' approach whereby instead of preparing budgets and measuring the performance of managers by reference to the budget, managers are measured by comparison with other similar companies or by comparison with other similar divisions of the same company.

"The annual budgeting process is a trap. Pressured by fixed targets and performance incentives, managers focus on making the numbers instead of making a difference, meeting set goals instead of maximizing potential. With their compensation at stake, managers often resort to deceitful - even unethical-behaviour. In the end, everybody loses - the employee, the company, and ultimately the customer. The Beyond Budgeting model argues that companies should abandon traditional budgeting in favour of a new model that links performance measurement to evolving competitive benchmarks-and shifts the firm's focus from controlling employee behaviour to delivering customer value."

8.1. Principles of beyond budgeting

- The creation of a performance management climate that measures success against the competition and not against an internally focused budget. The motivation and reward process is based on the success of the team compared to the competition.
- The target setting process is based on the agreement of external benchmarks.
- Motivation through challenges and delegating responsibility to operational managers who can make decisions themselves.
- The empowerment of operational managers by giving them the means to act independently (access to resources). The resource utilisation process is based on direct local access to resources (within agreed parameters). The coordination process coordinates the use of resources on the basis of internal markets

The two fundamental elements of the Beyond Budgeting model are:

- New leadership principles based on the principle of the empowerment of managers and employees, and
- New more adaptive management processes.

The new leadership principles (devolution) should unlock the full potential of managers and employees in order to enable the organization to react in an appropriate way and as quickly as possible to new chances and risks in the market environment.

Adaptive management processes are not based on fixed targets and resource plans like under the budgeting model. Instead, they enable an organization for a high degree of flexibility.

When you finished this chapter you should attempt the online PM MCQ Test

Chapter 12

QUANTITATIVE ANALYSIS IN BUDGETING

1. Introduction

In this chapter we will look at two numerical techniques that can be useful in the preparation of budgets.

One is the high-low method of cost estimation, which should be revision from Paper F2. The other is something known as learning curves.

(Note that although you are expected to have heard of time series and regression analysis from Paper F2, you cannot be asked calculations on these in Paper F5.)

2. High-low method

We assume always that there are two types of costs – variable costs and fixed costs.

In practice, there are many costs which are semi-variable, i.e. part of the cost is fixed and part variable.

For budgeting purposes it is important to identify the variable and the fixed elements.

The high-low method is a very quick and simple approach to identifying the variable and fixed elements of costs.

This approach assumes that there is a linear relationship and uses just the highest and lowest observations in order to calculate the costs.

Example 1

The following table shows the number of units produced each month and the total cost incurred:

	Units	*Cost ($)*
January	100	40,000
February	400	65,000
March	200	45,000
April	700	85,000
May	600	70,000
June	500	70,000
July	300	50,000

Estimate the variable cost per unit, and the fixed cost per month

This approach is very simplistic. It assumes that the relationship is perfectly linear.

3. Learning curves

The high-low method assumes that the total variable cost is reasonably linear – that the variable cost per unit is fixed.

In the case of labour, this is very often not the case in the early stages of a new product. If we were intending to start production of a new product, then the obvious thing to do would be to produce a prototype in order to assess how long it would take to produce each unit. However, this would be dangerous because as we were to produce more and more units it is likely that the time taken for each unit would reduce as the workers gained experience. This reduction in time per unit is known as the learning effect.

3.1. Conditions

The theory of learning curves will only hold if the following conditions apply:

(1) There is a significant manual element in the task being considered.

(2) The task must be repetitive.

(3) Production must be at an early stage so that there is room for improvement.

(4) There must be consistency in the workforce.

(5) There must not be extensive breaks in production, or workers will 'forget' the skill.

(6) Workforce is motivated.

3.2. Theory

As cumulative output doubles, the cumulative average time per unit falls to a given percentage of the previous average time per unit.

Example 2

The time taken to produce the first unit is 100 hours.

There is a learning rate of 75%.

How long will it take to produce an additional 7 units?

3.3. Steady State

Eventually, the time per unit will reach a steady state where no further improvement can be made.

3.4. Cessation of learning effect

Practical reasons for the learning effect to cease are:

(a) When machine efficiency restricts any further improvement

(b) The workforce reach their physical limits

(c) If there is a 'go-slow' agreement among the workforce

3.5. Formula

$y = ax^b$

where

y = cumulative average time per unit

x = cumulative output

a = time taken for 1st

b = a learning factor which is given by the formula $\frac{\log r}{\log 2}$

r = learning rate expressed as a %.

Example 3

Flogel Ltd has just produced the first full batch of a new product taking 200 hours.

Flogel has a learning curve effect of 85%.

(a) How long will it take to produce the next 15 batches?

(b) Flogel expects that after the 30th batch has been produced, the learning effect will cease.

From the 31st batch onwards, each batch will take the same time as the 30th batch.

What time per batch should be budgeted?

When you finished this chapter you should attempt the online PM MCQ Test

Chapter 13

STANDARD COSTING AND BASIC VARIANCE ANALYSIS

1. Introduction

In an earlier chapter we stated that one important use that is made of budgets is that of controlling. As the company progresses through the year, the budget gives us something to which we can compare the actual results in order to help identify any problems. Having identified problems we can then investigate as to whether or not these problems can be controlled in the future.

In this chapter we will look at the setting of standard costs for these purposes and also revise from your earlier studies the calculations of variances (or differences) between actual and budgeted results.

NOTE: You will not be asked full questions calculating basic variances, but you can be examined on them as part of an advanced variances question (see the next chapter) and you are expected to understand them.

2. Standard costs

Standard costing is a system of accounting based on pre-determined costs and revenue per unit which are used as a benchmark to assess actual performance and therefore provide useful feedback information to management.

Illustration 1

Standard cost card for Product X

	$ per unit	
Sales price		100
Materials	(2 kg @ $20/kg)	40
Labour	(1.5 hrs @ $2/hr)	3
Variable o/h	(1.5 hrs @ $6/hr)	9
Fixed o/h	(1.5 hrs @ $10/hr)	15
Standard cost of production		67
Standard profit per unit		33

2.1. Uses of standard costing

- inventory valuation (for internal and/or external use)
- as a basis for pricing decisions
- for budget preparation
- for budgetary control
- for performance measurement
- for motivating staff using standards as targets

2.2. Limitations of standard costing

- accurate preparation of standards can be difficult
- it may be necessary to use different standards for different purposes (see next section)
- less useful if not mass production of standard units
- traditional standards are based on companys own costs – a more modern approach is benchmarking, where the practices of other organisations are taken into account
- the use of standard costing can lead to an over-emphasis on quantitative measures of performance at the expense of qualitative measures (e.g. customer satisfaction; employee morale)

2.3. Types of standards

Ideal standard

Calculated assuming that perfect conditions apply.

E.g. 100% efficiency from men and from machines.

Could form the basis for long-term aims, but not useful for variance analysis because unattainable.

Basic standard

This is a long-run underlying average standard.

It is only really of use in very stable situations where there are unlikely to be fluctuations in prices, rates etc..

Expected standard

This is a standard expected to apply to a specific budget period and is based on normal efficient operating conditions.

This is used for variance analysis routine reporting. However, it may be too 'easy' to be used as a target.

Current standard

This is the current attainable standard which reflects conditions actually applying in the period under review.

This should be used for performance appraisal, but the calculation of a 'fair' current standard can be complicated and time-consuming.

3. Variance analysis

In the chapter on budgeting, we looked at the comparison between the actual results for a period and the flexed budget. The differences between the two are know as the variances.

In this section we will repeat the exercise, and then analyse them into their different components. If we are to investigate variances properly and use them for control, then it is important that we should analyse the reasons for their occurrence.

3.1. Total variances

Example 1

A company has prepared the following standard cost card:

	$ per unit
Materials (4 kg at $4.50 per kg)	18
Labour (5 hrs at $5 per hr)	25
Variable overheads (5 hrs at $2 per hr)	10
Fixed overheads (5 hrs at $3 per hr)	15
	$68

Budgeted selling price $75 per unit.

Budgeted production	8,700 units
Budgeted sales	8,000 units

There is no opening inventory

The actual results are as follows:

Sales:	8,400 units for $613,200
Production:	8,900 units with the following costs:

Materials (35,464 kg)	163,455
Labour (45,400 hrs paid, 44,100 hrs worked)	224,515
Variable overheads	87,348
Fixed overheads	134,074

Prepare a flexed budget and calculate the total variances

3.2. Analysis of variances

The total variance that we have calculated for materials indicates that the actual expenditure on materials was not $18 per unit. However, this could be either because we used the wrong amount of materials (which should have been 4 kg per unit) or that we paid the wrong price (which should have been $4.50 per kg). More likely of course, it would be a combination of the two.

We will therefore analyse this and the other variances in as much detail as possible.

Example 2

Using the data from example 1, analyse the variances and use them to produce on Operating Statement reconciling the budgeted profit with the actual profit.

3.3. Marginal costing

In the previous example, the company had been using absorption costing. They could alternatively have used marginal costing. The variances will be calculated in very much the same way, but when using marginal costing the focus is on contribution (rather than profit) and the fact that we will not be absorbing fixed overheads means that any fixed overhead volume variance is not relevant.

Example 3

Using data from example 1

(a) prepare the original fixed budgets using marginal costing

(b) prepare an Operating Statement using a marginal costing approach

3.4. Interpretation of variances

Example 4

In the previous example there was a materials price variance.

Suggest possible reasons for its occurrence.

Chapter 14

MORE VARIANCE ANALYSIS

1. Introduction

In this chapter we will look more at variances and several ways of making them more useful to management.

Planning and Operational variances involve further analysis of the variances to assist management in deciding where more investigation should be focussed; whereas Mix and Yield variances looks at a specific situation where conventional variances might be misleading; and finally we will take another look at labour idle time variables.

2. Planning and Operational variances

We discussed in the previous chapter that the purpose of variance analysis is to assist management in exercising control by identifying areas where perhaps there are operational problems.

We also discussed possible reasons for variances. Although these included factors such as inefficiency of the workforce – a factor that perhaps may be controlled for the future – they also included factors such as an increase in raw material prices and an incorrect standard having been used in the budgets. These last two are examples of factors that certainly can not be controlled and where it would be silly to waste time re-investigating each month. It would make more sense to compare actual results with a standard that reflects any changed conditions and is therefore realistic.

2.1. Planning variance (or revision variance)

This is a classification of variances calculated by comparing the original budget (or ex **ante budget**) to a budget revised for any permanent changes to a more realistic budget (**ex post** budget).

Operational variance

This is a classification of variances calculated by comparing actual performance with a revised (or ex post) budget. These variances are worth investigating more as they are variances caused by operating factors that potentially might be controllable.

Example 1

Original budget:

Standard cost of materials:	10 kg at $5 per kg
Budget production:	10,000 units

Actual results:

Production:	11,000 units
Materials:	108,900 kg at $4.75 per kg

Since preparation of the budget the price per kg has changed to $4.85 and the usage to 9.5 kg per unit.

Calculate the expenditure and usage variances, and analyse each into planning and operational variances.

Example 2

Original budget:

Standard cost of labour:	8 hrs at $4 per hour
Budget production:	20,000 units

Actual results:

Production:	24,000 units
Labour:	190,000 hrs for $769,500

Since preparation of the budget the price per hour had increased to $4.10 and the time had been revised to 7.5 hrs per unit.

Calculate the rate of pay and efficiency variances, analysed into planning and operational variances.

3. Mix and Yield variances

3.1. It is quite common in practice for one product to use several different materials.

For example, a desk may use wood for the top and metal for the legs.

For each of the materials we can calculate price and usage variances in the normal way, and usually this is sufficient for our purpose.

However, suppose we were manufacturing a mixed fruit juice that contained a mixture of strawberry juice and banana juice. To calculate usage variances for each material separately would be of little use – if we used less strawberry juice than budgeted, we would automatically use more banana juice. We would therefore end up with one variance favourable and one adverse, and yet the overall effect on costs could be either favourable or adverse depending on which juice was the most expensive.

In this situation, when the materials may be substituted for each other (or are **substitutable**) then we look at all the materials together and analyse the usage variance into the following variances:

- **mix variance**

  this shows the effect of changing the proportions of the mix of materials input into the process

- **yield variance**

  this shows the difference between the actual and expected output or yield from the process

Example 3

The standard material cost per unit of a product is as follows:

		$
Material X	2 kg @ $3 per kg	6
Material Y	1 kg @ $2 per kg	2
		8

The actual production during the period was 5,000 units and the materials used were:

Material X	9,900 kg costing $27,000
Material Y	5,300 kg costing $11,000

Calculate the total materials cost variance; the materials price variance; the materials usage variance; the mix variance; and the yield variance.

3.2. Other mix variances

Although the calculation of mix variances most commonly relates to materials, exactly the same sort of situation could be relevant for labour if there were more than one grade (paid at different rates) that were substitutable.

The approach would be exactly the same as for materials.

Slightly less obvious (although essentially the same approach) is the situation where sales are 'substitutable'.

For example, suppose a company sold two types of desk which although similar had different profit margins. Clearly the company would hope for higher sales, but they would also be interested in the mix of sales – it would be better if customers bought more of the desks giving higher profit p.u., even if it were to mean selling fewer of the desks that gave lower profit p.u..

Again, in this situation, the approach used for materials may be useful.

Example 4

Olga plc sells three products – A, B and C.

The following table shows the budget and actual results for these products:

	A	*B*	*C*
Budget:			
Sales (units)	200	100	100
Price (p.u.)	$20	$25	$30
Cost (p.u.)	$17	$21	$24
Actual:			
Sales (units)	180	150	170
Price (p.u.)	$22	$22	$26
Cost (p.u.)	$16	$18	$25

Calculate the total sales margin variance, and analyse into the sales price variance; the sales mix variance; and the sales quantity variance.

4. Advanced Idle Time variances

When we looked at labour variances in the previous chapter, we said that any difference between the hours paid and the hours worked was Idle Time.

However, since there is likely to be some idle time in almost every business, it would be more sensible to build some idle time into the budget and then an idle time variance would only occur if the actual idle time were more or less than budgeted.

We will look at the 'rules' with an example.

Example 5

A company budgets that each unit will take 7.6 hours to make.

It budgets on paying workers at the rate of $5.70 per hour, and that 5% of the hours paid for will be idle.

The actual results (for production of 1000 units) are:

Hours paid:	8,200 hours at a cost of $50,020
Hours worked:	7,740 hours

(a) Calculate what will appear on the standard cost card as the labour cost per unit
(b) calculate the effective standard cost per hour worked
(c) calculate the total labour variance
(d) Analyse the total variance into rate of pay, idle time, and efficiency variances.

5. Activity Based Costing Variances

You will remember from an earlier chapter that ABC is a way of allocating overheads to products using cost drivers.

The main reason for doing this was not just to encourage cutting the total cost of the overhead, but also to encourage more efficient use of the overhead.

For example, we may have had an overhead cost for despatch of $100,000 and a total of 5,000 despatches. This would mean that it was costing $20 per despatch. We could reduce the cost per despatch by either cutting the total cost (an expenditure variance) or by increasing the number of despatches (an efficiency variance).

Example 6

The following information is available for a period:

	Budget	Actual
Production	48,000 units	50,400 units
Activity level	2,000 despatches	2,200 despatches
Total overhead cost of despatching	$120,000	$126,720

Calculate the total overhead variance for despatching, and analyse into the expenditure and efficiency variances.

6. The application of standard costing (and variance analysis) in the modern environment.

Modern management places great emphasis on quality - Total Quality Management (TQM), and on increasing efficiency and reducing waste - Just In Time (JIT).

However, traditional standard costing tends to make allowances for waste and for idle time, which is contrary to the TQM and JIT culture.

Traditional variance analysis focuses on quantity rather than quality. This could mean, for example, using lower quality material to save money. This would again be contrary to the TQM and JIT culture.

Another element of the TQM culture is the idea of trying to achieve continuous improvement. Traditional variance analysis does not really accomodate this.

When you finished this chapter you should attempt the online PM MCQ Test

Chapter 15

FINANCIAL PERFORMANCE MEASUREMENT

1. Introduction

Financial statements are prepared to assist users in making decisions. They therefore need interpreting, and the calculation of various ratios makes it easier to compare the state of a company with previous years and with other companies.

In this chapter we will look at the various ratios that you should learn for the examinations.

2. The main areas

When attempting to analyse the financial statements of a company, there are several main areas that should be looked at:

- **Profitability**
- **Liquidity**
- **Gearing**

The importance of each area depends on whose behalf that we are analysing the statements.

We will work through an example to illustrate the various ratios that you should learn under each heading.

3. Worked example

Example 1

Statements of Financial Position as at 31 December

	2007		2006	
	$	$	$	$
ASSETS				
Non-current assets				
Tangible assets		1,341		826
Current assets				
Inventory	1,006		871	
Trade receivables	948		708	
Cash	360		100	
		2,314		1,679
TOTAL ASSETS		3,655		2,505
LIABILITIES AND CAPITAL				
Capital and reserves				
$1 ordinary shares	1,200		720	
Retained profit	990		681	
		2,190		1,401
Non-current liabilities				
10% loan 2015		500		400
Current liabilities				
Trade payables	653		516	
Tax payable	228		140	
Dividends payable	84		48	
		965		704
TOTAL LIABILITIES AND CAPITAL		3,655		2,505

Statement of Profit or Loss for the year ended 31 December

	2007	2006
	$	$
Revenue	7,180	5,435
Cost of sales	5,385	4,212
Gross profit	1,795	1,223
Distribution costs	335	254
Administrative expenses	670	507
Profit from operations	790	462
Finance costs	50	52
Profit before taxation	740	410
Company tax expense	262	144
Profit after taxation	478	266
Dividends	169	95
Retained profit for the period	309	171

You are required to calculate the profitability, liquidity and gearing ratios.

Profitability

$$\text{Net profit margin} = \frac{\text{Profit before interest and tax}}{\text{Revenue}}$$

$$\text{Gross profit margin} = \frac{\text{Gross profit}}{\text{Revenue}}$$

$$\text{Return on capital employed} = \frac{\text{Profit before interest and tax}}{\text{Total long term capital}}$$

(= capital + reserves + long-term liabilities)

$$\text{Asset turnover} = \frac{\text{Revenue}}{\text{Total long term capital}}$$

NB: ROCE = asset turnover × net profit margin

Liquidity

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$$

$$\text{Quick ratio (or acid test)} = \frac{\text{Current assets} - \text{Inventory}}{\text{Current liabilities}}$$

$$\text{Inventory days} = \frac{\text{Inventory}}{\text{Cost of sales}} \times 365 \text{ days}$$

Average collection period (receivables days)	=	$\frac{\text{Trade receivables}}{\text{Revenue}} \times 365 \text{ days}$
Average payment period (payables days)	=	$\frac{\text{Trade payables}}{\text{Purchases}} \times 365 \text{ days}$

Gearing

Gearing	=	$\frac{\text{Long term liabilities}}{\text{Shareholders' funds}} \%$

4. Limitations of ratio analysis

You must learn the various ratios, however, it is important that you are able to discuss briefly the relevance of the various ratios, and also their limitations.

Very few of the ratios mean much on their own – most are only useful when compared with the ratios for previous years or for similar companies.

Many of the ratios use figures from the Statement of Financial Position. These only represent the position at one point in time, which could be misleading. For example, the level of receivables could be unusually high at the year end, simply because a lot of invoicing was done just before the year end. Perhaps more sensible in that sort of case would be to use the average for the year. Normally in the examination you will be expected simply to use Statement of Financial Position figures at the end of the year, but do be prepared to state the problem if relevant.

Chapter 16

NON-FINANCIAL PERFORMANCE MEASUREMENT

1. Introduction

We have looked separately at measures of financial performance. However, it is important to have a range of performance measures considering non-financial as well as financial matters. This is particularly important in the case of service industries where such things as quality are of vital importance if the business is to grow in the long-term.

In this chapter we will consider the various areas where performance measures are likely to be needed.

Various authors have summarized the areas in different ways – the two that you are expected to be aware of are Fitzgerald and Moons building blocks; and Kaplan and Nortons Balanced Scorecard.

2. Fitzgerald and Moon

Fitzgerald and Moon focussed on performance measurement in service businesses. They suggested the following areas needing measures of performance:

- **Financial performance**
- **Competitive performance**
- **Quality**
- **Flexibility**
- **Resource utilisation**
- **Innovation**

3. Kaplan and Norton's Balanced Scorecard

The balanced scorecard (developed by Kaplan and Norton 1992) views the business from four perspectives and aims to establish goals for each together with measures which can be used to evaluate whether these goals have been achieved.

3.1. Possible Measures

Perspective	*Question*	*Possible Measures*
Customer Perspective	What do existing and potential customers value from us?	◉ % Sales from new customers ◉ % On time deliveries ◉ % Orders from enquiries ◉ Customers survey analysis
Internal Business Perspective	What process must we excel at to achieve our customer and financial objectives?	◉ Unit cost analysis ◉ Process/cycle time ◉ Value analysis ◉ Efficiency
Learning and Growth Perspective	How can we continue to improve and create future value?	◉ Number of new products introduced ◉ Time to market for new products
Financial Perspective	How do we create value for our shareholders?	◉ Profitability ◉ Sales growth ◉ ROI ◉ Cash flow/liquidity

When you finished this chapter you should attempt the online PM MCQ Test

Chapter 17

DIVISIONAL PERFORMANCE MEASUREMENT

1. Introduction

In this chapter we will consider the situation where an organisation is divisonalised (or decentralised) and the importance of proper performance measurement in this situation.

We will also consider the possible problems that can result from the use of certain standard performance measures.

2. The meaning of divisionalisation

Divisionalisation is the situation where managers of business areas are given a degree of autonomy over decision making i.e. they are given the authority to make decision without reference to senior management. In effect they are allowed to run their part of the business almost as though it were their own company.

2.1. Advantages of divisionalisation:

2.2. Problems with divisionalisation:

3. The use of performance measures to control divisional managers

If managers are to be given autonomy in their decision making, it becomes impossible for senior management to 'watch over' them on a day-to-day basis – this would remove the whole benefit of having divisionalised!

The way to control their performance is to establish in advance a set of measures that will be used to evaluate their performance at (normally) the end of each year.

These measures provide a way of determining whether or not they are managing their division well, and also communicate to the managers how they are expected to perform.

It is of critical importance that the performance measures are designed well.

For example, suppose a manager was simply given one performance measure – to increase profits. This may seem sensible, in that in any normal situation the company will want the division to become more profitable. However, if the manager expects to be rewarded on the basis of how well he achieves the measure, all his actions will be focussed on increasing profit to the exclusion of everything else. This would not however be beneficial to the company if the manager were to achieve it by taking actions that reduced the quality of the output from the division. (In the long-term it may not be beneficial for the manager either, but managers tend to focus more on the short-term achievement of their performance measures.)

It is therefore necessary to have a series of performance measures for each division manager. Maybe one measure will relate to profitability, but at the same time have another measure relating to quality. The manager will be assessed on the basis of how well he has achieved all of his measures.

We wish the performance measures to be goal congruent, that is to encourage the manager to make decisions that are not only good for him but end up being good for the company as a whole also.

In this chapter we will consider only financial performance. However, non-financial performance is just as important and we will consider that in the next chapter.

4. Controllable profits

The most important financial performance measure is profitability.

However, if the measure is to be used to assess the performance of the divisional manager it is important that any costs outside his control should be excluded.

For example, it might be decided that pay increases in all division should be fixed centrally by Head Office. In this case it would be unfair to penalise (or reward) the manager for any effect on the division's profits in respect of this cost. For these purposes therefore a statement of profit or loss would be prepared ignoring wages and it would be on the resulting controllable profit that the manager would be assessed.

5. Investment Centres and the problem with measuring profitability.

As stated earlier, divisionalisation implies that the divisional manager has some degree of autonomy.

In the case of an investment centre, the manager is given decision making authority not only over costs and revenues, but additionally over capital investment decision.

In this situation it is important that any measure of profitability is related to the level of capital expenditure. Simply to assess on the absolute level of profits would be dangerous – the manager

might increase profits by $10,000 and be rewarded for it, but this would hardly be beneficial to the company if it had required capital investment of $1,000,000 to achieve!!

The most common way of relating profitability to capital investment is to use Return on Investment as a measure. However, as we will see, this can lead to a loss of goal congruence and a measure know as Residual Income is theoretically better.

6. Return on Investment (ROI)

ROI is defined as: Controllable division profit expressed as a percentage of divisional investment

It is equivalent to Return on Capital Employed and this is one of the reasons that it is very popular in practice as a divisional performance measure.

Example 1

Arcania plc has divisions throughout the Baltic States.

The Ventspils division is currently making a profit of $82,000 p.a. on investment of $500,000.

Arcania has a target return of 15%

The manager of Ventspils is considering a new investment which will require additional investment of $100,000 and will generate additional profit of $17,000 p.a..

(a) Calculate whether or not the new investment is attractive to the company as a whole.

(b) Calculate the ROI of the division, with and without the new investment and hence determine whether or not the manager would decide to accept the new investment.

In the above example, the manager is motivated to accept an investment that is attractive to the company as a whole. He has been motivated to make a goal congruent decision.

Note that in this illustration we have used the opening Statement of Financial Position value for capital invested. In practice it may be more likely that we would use closing Statement of Financial Position value (which would be lower because of depreciation). There is no rule about this – in practice we could do whichever we thought more suitable. However, in examinations always use opening Statement of Financial Position value unless, of course, you are told to do differently.

However, there can be problems with a ROI approach as is illustrated by the following example:

Example 2

The circumstances are the same as in example 1, except that this time the manager of the Ventspils division is considering an investment that has a cost of $100, 000 and will give additional profit of $16,000 p.a.

(a) Calculate whether or not the new investment is attractive to the company as a whole.

(b) Calculate the ROI of the division, with and without the new investment and hence determine whether or not the manager would decide to accept the new investment.

In this example the manager is not motivated to make a goal congruent decision. For this reason, a better approach is to assess the managers performance on Residual Income.

7. Residual Income (RI)

Instead of using a percentage measure, as with ROI, the Residual Income approach assesses the manager on absolute profit. However, in order to take account of the capital investment, notional (or imputed, or 'pretend') interest is deducted from the P&L profit figure. The balance remaining is known as the Residual Income.

(Note that the interest charge is only notional, and is only made for performance measurement purposed).

Example 3

Repeat examples 1 and 2, but in each case assume that the manager is assessed on his Residual Income, and that therefore it is this that determines how he makes decisions.

Note that in both cases the manager is motivated to make goal congruent decisions.

8. ROI vs RI

In practice, ROI is more popular than RI, despite the fact that RI is technically superior.

8.1. Reasons for using ROI:

8.2. Reasons for using RI:

When you finished this chapter you should attempt the online PM MCQ Test

Chapter 18

TRANSFER PRICING

1. Introduction

In a previous chapter we looked at divisionalisation. When a company is divisionalised it is very common to have the situation where one division supplies goods or services to another division.

If we are measuring the performance of each division separately then it becomes important that divisions are able to charge each other for goods or services supplied.

In this chapter we will explain the importance of this, and also the importance of divisions charging each other 'sensible' transfer prices.

2. What is a transfer price?

The transfer price is the price that one division charges another division of the same company for goods or services supplied from one to the other. It is an internal charge – the 'sale' of one division is the 'purchase' of the other. Although it will be reflected in the results for each division individually, there is no effect in the accounts of the company as a whole.

Example 1

Division A produces goods and transfers them to Division B which packs and sells them to outside customers.

Division A has costs of $10 per unit, and Division B has additional costs of $4 p.u.. Division B sells the goods to external customers at a price of $20 p.u.

Assuming a transfer price between the divisions of $12 p.u., calculate:

(a) the total profit p.u. made by the company overall

(b) the profit p.u. made by each division

3. Why have a transfer price?

The reason for having a transfer price is to be able to make each division profit accountable. If, in the previous example, there was no transfer price and goods were transferred 'free of charge' between the division, then the overall profit for the company would be unchanged. However, Division A would only be reporting costs, and Division B would be reporting an enormous profit. The problem would be compounded if Division A was selling the same product externally as well as transferring to Division B.

4. Cost-plus transfer pricing

A very common way in practice of determining a transfer price is for the company to have a policy that all goods are transferred at the cost to the supplying division plus a fixed percentage.

Example 2

Division A has costs of $15 p.u., and transfer goods to Division B which has additional costs of $5 p.u.. Division B sells externally at $30 p.u.

The company has a policy of setting transfer prices at cost + 20%.

Calculate:

(a) the transfer price
(b) the profit made by the company overall
(c) the profit reported by each division separately

5. Goal congruence

If we are properly divisionalised, then each divisional manager will have autonomy over decision making. It will be therefore the decision of each manager which products are worth producing in their division (for these purposes we assume that each division has many products and therefore stopping production of one product will not be a problem).

A cost-plus approach, which easy to apply can lead to problems with goal congruence in that in some situations a manager may be motivated not to produce a product which is in fact to the benefit of the company as a whole.

Example 3

Division A has costs of $20 p.u., and transfer goods to Division B which has additional costs of $8 p.u.. Division B sells externally at $30 p.u.

The company has a policy of setting transfer prices at cost + 20%.

Calculate:

(a) the transfer price
(b) the profit made by the company overall
(c) the profit reported by each division separately

Determine the decisions that will be made by the managers and comment on whether or not goal congruent decisions will be made.

6. "Sensible" transfer pricing to achieve goal congruence.

The previous example illustrates that unless care is taken to set the transfer price sensibly, decisions may be made that are not goal congruent.

In the examination you can be asked to suggest sensible transfer prices. (As we will illustrate, you will normally be asked to state a range rather than one specific price.)

There is a 'rule' that may be applied. However, it is dangerous to simply learn a rule without fully understanding the logic. We will therefore build up the rule using a series of small examples, and then state the rule at the end.

Example 4

Division A has costs of $20 p.u., and transfer goods to Division B which has additional costs of $8 p.u.. Division B sells externally at $30 p.u.

Determine a sensible range for the transfer price in order to achieve goal congruence.

Example 5

Division A has costs of $15 p.u., and transfers goods to Division B which has additional costs of $10 p.u.. Division B sells externally at $35 p.u.

A can sell part-finished units externally for $20 p.u.. There is limited demand externally from A, and A has unlimited production capacity.

Determine a sensible range for the transfer price in order to achieve goal congruence.

Example 6

Division A has costs of $15 p.u., and transfers goods to Division B which has additional costs of $10 p.u.. Division B sells externally at $35 p.u.

A can sell part-finished units externally for $20 p.u.. There is unlimited external demand from A, and A has limited production capacity.

Determine a sensible range for the transfer price in order to achieve goal congruence.

Example 7

Division A has costs of $8 p.u., and transfers goods to Division B which has additional costs of $4 p.u.. Division B sells externally at $20 p.u.

Determine a sensible range for the transfer price in order to achieve goal congruence, if Divison B can buy part-finished goods externally for:

(a) $14 p.u.

(b) $18 p.u.

3. The 'rule' for sensible transfer pricing

The following rule summarises the results from the previous examples:

3.1. Minimum transfer price:

3.2. Maximum transfer price:

(Note: we always assume that both divisions are manufacturing many products and that discontinuing one product will have no effect on the fixed costs. It is therefore only the marginal costs that we are interested in when applying the above rules.)

4. Capacity limitations

In one of the previous examples there was a limit on production in one of the divisions. This problem can be made a little more interesting, although the same rule as summarised in Section 7 still applies.

Example 8

A is capable of making two products, X and Y.

A can sell both products externally as follows:

	X	*Y*
External selling price	80	100
Variable costs	60	70
Contribution p.u.	20	30

A has limited labour available.

The labour hours required for each product are

X: 5 hours p.u., Y:10 hours p.u.

A has unlimited external demand for both products.

Division B requires product Y from Division A.

Calculate the minimum transfer price that should be charged by A for supply of Product Y to Division B.

When you finished this chapter you should attempt the online PM MCQ Test

Chapter 19

PERFORMANCE IN THE NOT-FOR-PROFIT SECTOR

1. Introduction

Non-profit seeking organisations are those whose prime goal cannot be assessed by economic means. Examples would include charities and state bodies such as the police and the health service.

For this sort of organisation, it is not possible or desirable to use standard profit measures. Instead (in for example the case of the health service) the objective is to ensure that the best service is provided at the best cost.

In this chapter we will consider the problems of performance measures and suggestions as to how to approach it.

2. Problems with performance measurement

2.1. Multiple objectives

Even if all objectives can be clearly identified, it may be impossible to identify an over-riding objective or to choose between competing objectives

2.2. The difficulty of measuring outputs

An objective of the health service is obviously to make ill people better. However, how can we in practice measure how much better they are?

2.3. Financial constraints

Public sector organisations have limited control over the level of funding that they receive and the objectives that they can achieve.

2.4. Political, social and legal considerations

The public have higher expectations from public sector organisations than from commercial ones, and such organisations are subject to greater scrutiny and more onerous legal requirements.

2.5. Little market competition and no profit motive.

3. Value for money

Non-profit organisations, such as the health service, are expected to provide value for money.

This can be defined as providing a service in a way which is economical, efficient and effective.

3.1. Performance should be assessed under each of these '3 E's '

- **Economy**

  Attaining the appropriate quantity and quality of inputs at the lowest cost

- **Efficiency**

  Maximising the output for a given input (or, for a given output achieving the minimum input).

- **Effectiveness**

  Determining how well the organisation has achieved its desired objectives.

When you finished this chapter you should attempt the online PM MCQ Test

Chapter 20

MANAGING INFORMATION

1. Introduction

Information systems are vital for companies. They help with managing production, sales and marketing, communicating both internally and externally, improve efficiency, and provide information to help with decision making.

2. Costs and benefits of information systems

Although there are many benefits for companies of having management information, there are costs involved of delivering it. It is clearly important that companies ensure that the benefits do exceed the costs, and you should be able to give examples of the sorts of costs and benefits involved.

2.1. Cost examples

- Hardware costs
- Software costs
- Training
- Testing
- Maintenance
- Staff disruption and resistance

2.2. Benefit examples

- Improved efficiency
- Cost reduction
- Customer satisfaction
- Better and faster decision making

3. Terminology

- **Internet**
- **Intranet**
- **Wireless technology**
- **Networks**

4. Controls over information systems

It is of vital importance that adequate controls are in place in order to help ensure that information in the system is accurate and that controls exist to maintain the security of confidential information. You should be aware of the following examples of controls that should exist:

- **Data verification**
- **Data validation**
  - **Consistency checks**
  - **Format checks**
  - **Range checks**
  - **Lookup tables**
  - **Check digits**
- **Direct data capture**
- **Physical access controls**
- **Passwords**
- **Firewalls**
- **Anti-virus software**
- **Encryption**

Chapter 21

USING INFORMATION SYSTEMS

1. Introduction

Different levels of management need different information and the information can be sourced internally or externally. In this chapter we will consider the different information needs of management and the different systems available for dealing with it.

2. Internal and external information

Internal information is information collected from the company's own records. For example, accounting records, production records, employees records.

External information is harder to obtain but is collected from outside the company. For example, information about competitors prices, information from credit rating companies, government data on inflation.

3. Information needs for decision making

You should be aware from earlier studies of the broad levels of decision making within companies and the type of information required at each level

3.1. Strategic decision making

long-term plans (e.g. 5 to 10 years) for the business

e.g. what new offices to open? What new products to launch?

Decisions made by top management

Mainly external information required.

3.2. Tactical decision making

medium-term, more detailed plans - usually involving the preparation of budgets for next year.

e.g. how many staff to employ next year

Decisions made by middle-management

Both internal and external information required.

3.3. Operational decision making

Short-term decision making

e.g. which supplier to choose for a purchase next week

Decisions made by junior management

Internal information required

4. Types of information systems

You should be aware of the following types of software available to provide information, all are explained in the free lecture that goes with this chapter:

- **Transaction processing systems**
- **Management information systems**
- **Executive information systems**
- **Enterprise resource planning systems**
- **Customer relationship management software**

5. Big Data

Big data are extremely large collections of data that may be analysed to reveal patterns and trends, especially relating to human behaviour.

For example, Amazon - one of the world's leading e-retailers - collects an enormous amount of information about each customer. Not only, obviously, what a customer has bought, but what other products they may have looked at on the website but not bought, how they made payment for purchases, where they live, what items they may have returned, what products they have ordered more than once, what ratings and/or comments that customers may have posted about specific products. All of this enables them to make recommendations to customers of other items that might appeal to them.

Big Data has the following characteristics:

- **Volume**

  The amount of data being stored by the likes of Amazon is enormous - many times the amount of data that can be stored on a normal PC.

- **Velocity**

  For the data to be useful, the data needs to be analysed and information provided quickly enough. In the case of Amazon, suggestions need to be presented to customers immediately they access the website.

- **Variety**

  The data being stored will come from a large variety of sources - again, Amazon collects information about past purchases, which other products the customer has looked at on their website, etc. etc.. All of this information needs special software and algorithms that collates the different data into useful information.

ANSWERS TO EXAMPLES

Chapter 1

Answer to example 1

(a) Total overheads $190,000

Total labour hours

A	20,000	× 2 =	40,000
B	25,000	× 1 =	25,000
C	2,000	× 1 =	2,000
			67,000 hours

$$\text{O.A.R.} = \frac{190,000}{67,000} = \$2.836 \text{ per hour}$$

Cost cards:

	A	*B*	*C*
Materials	5	10	10
Labour	10	5	5
Overheads (at $2.84 per hr)	5.68	2.84	2.84
	20.68	17.84	17.84
Selling price	20	20	20
Profit / Loss	$(0.68)	$2.16	$2.16

(b)

	Total	*A*	*B*	*C*
Set-up costs				
(Cost per set up =)	90,000	36,000	46,800	7,200
Receiving				
(Cost per delivery =)	30,000	13,636	13,636	2,728
Despatch				
(Cost per order =)	15,000	5,000	5,000	5.000
Machining				
(Cost per machine hour:)	55,000	23,404	29,256	2,340
	190,00 0	78,040	94,692	17,268
Number of units		20,000	25,000	2,000
Overheads p.u.		$3.90	$3.79	$8.63

Costings:

	A	*B*	*C*
Materials	5	10	10
Labour	10	5	5
Overheads	3.90	3.79	8.63
	18.90	18.79	23.63
Selling price	20	20	20
Profit / Loss	$1.10	$1.21	$(3.63)

Chapter 2

Answer to example 1

Selling price = $20 p.u.

Target return = 40% of selling price

Target Cost = **$12 p.u.**

Answer to example 2

Target return = 30% × 5M = $1.5M p.u.

Expected revenue = 40,000 × $67.50 = $2.7M

$$\text{Target cost.} = \frac{2.7M - 1.5}{40{,}000} = \textbf{£30 p.u.}$$

Chapter 3

Answer to example 1

(a)		Cost	(100%)	7.00
	plus:	Mark-up	(50%)	3.50
	equals:	Selling price	(150%)	10.50

The target cost is **$7.00 per unit**

(b) Estimated total sales = 2,000 + (4 x 12,000) = 50,000 units

Total lifecycle cost = (50,000 x 6) + 60,000 + 30,000 = $390,000

Lifecycle cost per unit = 390,000 / 50,000 = **$7.80**

This is above the target cost per unit, and therefore it would not be worthwhile making the product.

(c) The maximum lifecycle cost per unit = the target cost = $7.00

The part caused by the design and end of life costs :

(60,000 + 20,000 + 30,000) / 50,000 = $2.20

Therefore, the maximum manufacturing cost per unit would have to fall from $6.00 to ($7.00 - $2.20) = **$4.80 per unit**

Chapter 4

No Examples

Chapter 5

Answer to example 1

	A	*B*
Selling price	25	28
Materials	8	20
Other variable	12	4
	20	24
Contribution p.u.	5	4
Machine hrs p.u.	2	1
Contribution per hour	$2.50	$4

Production

	units	*hours*
B:	10,000 × 1 hr =	10,000
A:	19,000 × 2hrs =	38,000
		48,000 hours

Profit

		$
A:	19,000 × $5	95,000
B:	10,000 × $4	40,000
		135,000
less	Fixed costs: [A: 20,000 × $3 B: 10,000 × $2]	80,000
	Profit	$55,000

Answer to example 2

	A	B
Selling price	25	28
Materials	8	20
Throughput p.u.	$17	$8
Machine hrs p.u.	2	1
Contribution per hour	$8.50	$8
	(2)	(1)

Production

	units	hours
A:	20,000 × 2hrs =	40,000
B:	8,000 × 1hr =	8,000
		48,000 hours

Profit

		$
A:	20,000 × $17	340,000
B:	8,000 × $8	64,000
		404,000
less	"fixed" costs:	
	[A: 20,000 × $15	
	B: 10,000 × $6]	360,000
	Profit	$44,000

$$\text{Cost per factory hour} = \frac{360,000}{\$48,000} = \textbf{\$7.50}$$

Throughput accounting ratios:

A: $\frac{8.50}{7.50} = \textbf{1.13}$

B: $\frac{8}{7.50} = \textbf{1.07}$

Answer to example 3

The total processing hours of the factory is 225,000 hours.
Given this, the production capacity for pressing must be 225,000 hours/0·5 hours per metre = 450,000 metres. Using this method the production capacity for all processes is as follows:

	Product A	*Product B*	*Product C*
Pressing	450,000	450,000	562,500
Stretching	900,000	562,500	900,000
Rolling	562,500	900,000	900,000

The bottleneck is clearly the pressing process which has a lower capacity for each product. The other processes will probably be slowed to ensure smooth processing.
Clearly an alternative approach is simply to look at the original table for processing speed and pick out the slowest process. This is pressing.

Chapter 6

Answer to example 1

Let S = number of standard chairs produced per week

E = number of executive chairs produced per week

Constraints:

Materials: $2S + 4E \leq 80$

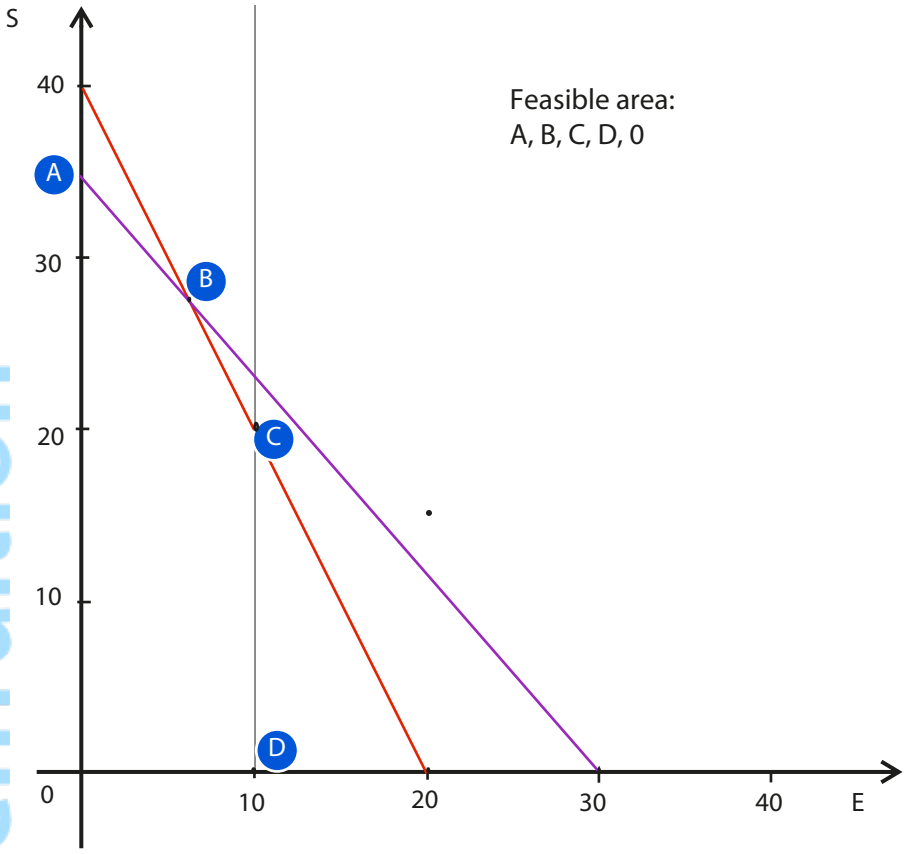
Labour: $5S + 6E \leq 180$

Demand: $E \leq 10$

Non-negativity: $S \geq 0; E \geq 0$

Objective:

Maximise $C = 6S + 9E$



Feasible area:
A, B, C, D, 0

Maximum contribution occurs at point **B** (using the objective function).

At B, $2S + 4E = 80$ (1)

$5S + 6E = 180$ (2)

(1) × 2.5: $5S + 10E = 200$ (3)

(3) – (2): $4E = 20$

$E = 5$

In (1): $2S + 20 = 80$

$2S = 60$

$S = 30$

$C = 6S + 9E$

$= 180 + 45$

$=$ **$225**

Produce 5 Executive chairs and 30 standard chairs per week.

Maximum contribution is $225 per week.

Answer to example 2

There is **no** spare material or labour

The spare demand for executive chairs is 5 chairs (10 – 5)

Answer to example 3

(a) If there was 1 more kg of material available, then the material constraint becomes:

$2S + 4E \leq 81$

Point B will still be the optimum solution, and therefore this will be when:

$2S + 4E = 81$ (1)

$5S + 6E = 180$ (2)

(1) × 2.5 $5S + 10E = 202.5$ (3)

(3) – (2) $4E = 22.5$

E = 5.625

in (1) $2S + 22.5 = 81$

$2S = 58.5$

$C = 6S + 9E$

$= 175.5 + 50.625$

$=$ **226.125**

Shadow price of material = extra contribution

= 226.125 – 225

= **$1.125** per kg

(b) If there was 1 more hour of labour available, then the labour constraint becomes:

$5S + 6E \leq 181$

Point B will still be the optimum solution, and therefore this will be when:

$2S + 4E = 80$ (1)

$5S + 6E = 181$ (2)

(1) × 2.5 $5S + 10E = 200$ (3)

(3) – (2) $4E = 19$

E = 4.75

in (1) $2S + 19 = 80$

$2S = 61$

S = 30.5

$C = 6S + 9E$

$= 183 + 42.75$

$=$ **225.75**

Shadow price of labour = 225.75 – 225

= $0.75 per hour

The shadow price of demand for executive chairs is $0, because there is already spare demand.

Chapter 7

Answer to example 1

(a)	Materials	10
	Labour	8
	Variable o/h	5
	Fixed o/h (50,000 ÷ 10,000)	5
	Full cost	28
	Profit	5.60
	Selling price	$33.60
(b)	Materials	10
	Labour	8
	Variable o/h	5
	Marginal cost	23
	Profit	9.20
	Selling price	$32.20

Answer to example 2

S.P. p.u.	*Demand*	*Cost p.u.*	*Total Revenue*	*Total cost*	*Total profit*	*Marginal Revenue*	*Marginal cost*
16	100	14.0	1,600	1,400	200	1,600	1,400
15.5	200	13.9	3,100	2,780	320	1,500	1,380
15	300	13.8	4,500	4,140	360	1,400	1,360
14.5	400	13.7	5,800	5,480	320	1,300	1,340
14	500	13.6	7,000	6,800	200	1,200	1,320
13.5	600	13.5	8,100	8,100	-	1,100	1,300
13	700	13.4	9,100	9,380	(280)	1,000	1,280

Optimum selling price is $15 per unit

Answer to example 3

(a) $$\text{PED} = \frac{\frac{200-100}{100}}{\frac{15.5-16}{16}} = \mathbf{32}$$

(b) $$\text{PED} = \frac{\frac{400-300}{300}}{\frac{14.5-15}{15}} = \mathbf{10}$$

Answer to example 4

Minimum price is £12 + $\frac{16,000}{2,500}$ x £1 = **£18.40**

$P = 18.40 - \frac{1}{2,500} Q$

(or P = 18.40 – 0.0004Q)

Answer to example 5

$P = 50 - \frac{1}{100}Q \qquad P = 50 - 0.01Q$

$R = PQ = 50Q - 0.01Q^2$

$\text{Marginal revenue} = \frac{dR}{dQ} = \mathbf{50 - 0.02Q}$

$\text{Total cost} = \frac{dC}{dQ} = \mathbf{20}$

For maximum profit, MR = MC

50 – 0.02Q = 20

Q = 1,500

When Q = 1,500

P = 50 – 0.01Q = $35 p.u.

Answer to example 6

P = 120 – 0.001Q

MR = 120 – 0.002Q (given)

MC = variable cost = $5

For maximum profit, MR = MC

120 – 0.002Q = 5

0.002 Q = 115

Q = 57500 units

P = 120 – 0.001Q = 120 – (0.001 × 57,500)

= 120 – 57.5

= **$62.50** per unit

Total contribution =	57,500 × (62.50 – 5) =	3,306,250
Less: Fixed costs		(100,000)
Maximum profit		$3,206,250

Chapter 8

Answer to example 1

	$
Selling price	6
Variable costs	2
Contribution	4

(a)

	$
Total contribution (300u × $4)	1,200
Fixed costs	(1,000)
Profit	$200

(b) Breakeven = $\frac{\text{Fixed costs}}{\text{Contribution p.u}} = \frac{1{,}000}{4} = 250$ units

(c) Breakeven revenue = 250 u × $6p.u. = **$1,500**

(d)

	$
Target profit	300
Fixed costs	1,000
Target contribution	$1,300

Number of units = $\frac{\text{Target contribution}}{\text{Contribution p.u}} = \frac{1{,}300}{4} = 325$ units

Answer to example 2

Budgeted sales = 300 units

Breakeven = 250 units

Margin of safety = $\frac{300 - 250}{300} \times 100 = \mathbf{16.67\%}$

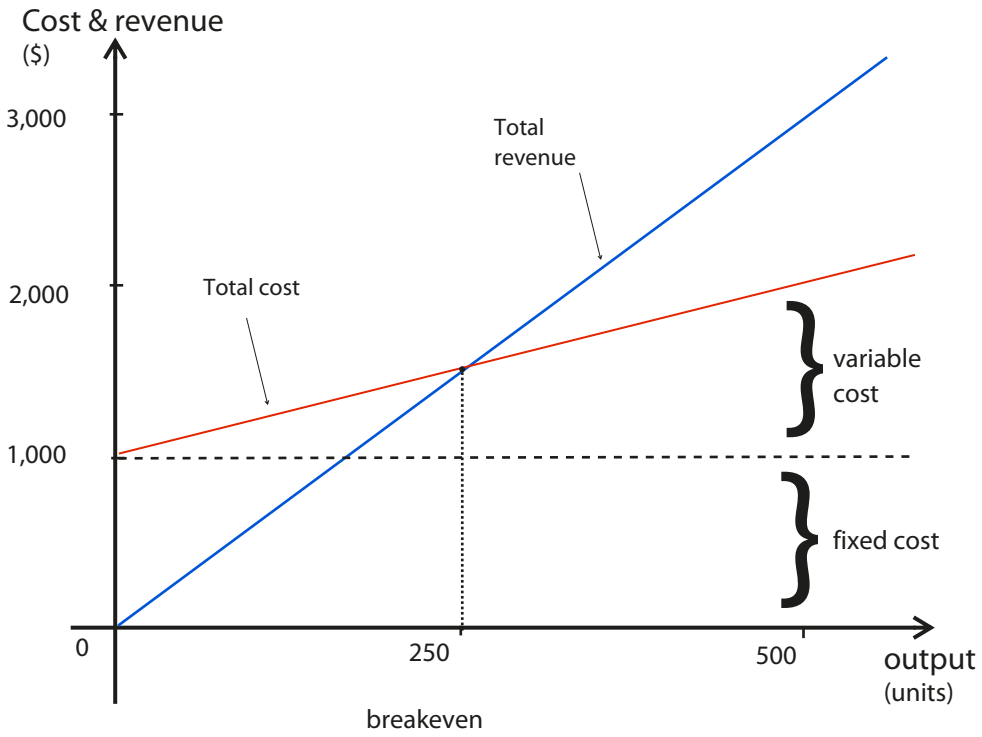
Answer to example 3

C/S ratio = $\frac{\text{Contribution}}{\text{Sales}} = \frac{4}{6} = \mathbf{0.67}$

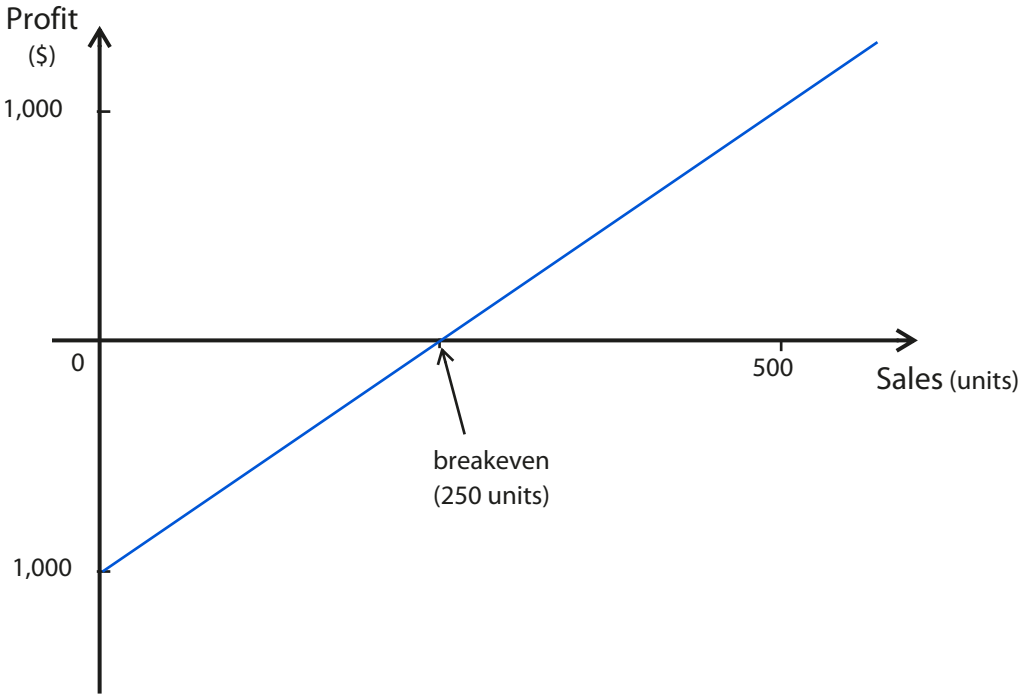
	$
Target profit	320
Fixed overheads	1,000
Target contribution	$1,320

Sales revenue required = Target contribution ÷ C/S ratio = 1320 ÷ 4/6 = **$1,980**

Answer to example 4



Answer to example 5



Answer to example 6

(a) CS ratios:

C = 1.25 / 5.00 = 0.25 (or 25%)

V = 0.75 / 6.00 = 0.125 (or 12.5%)

P = 2.65 / 6.00 = 0.379 (or 37.9%)

(b) Average CS ratio:

Based on budget sales,

Total revenue = (4800 x 5) + (4800 x 6) + (12000 x 7)

= $136,800

Total contribution = (4800 x 1.25) + (4800 x 0.75) + (12000 x 2.65)

= $41,400

Average CS ratio = 41400/136800 = 0.303 (or 30.3%)

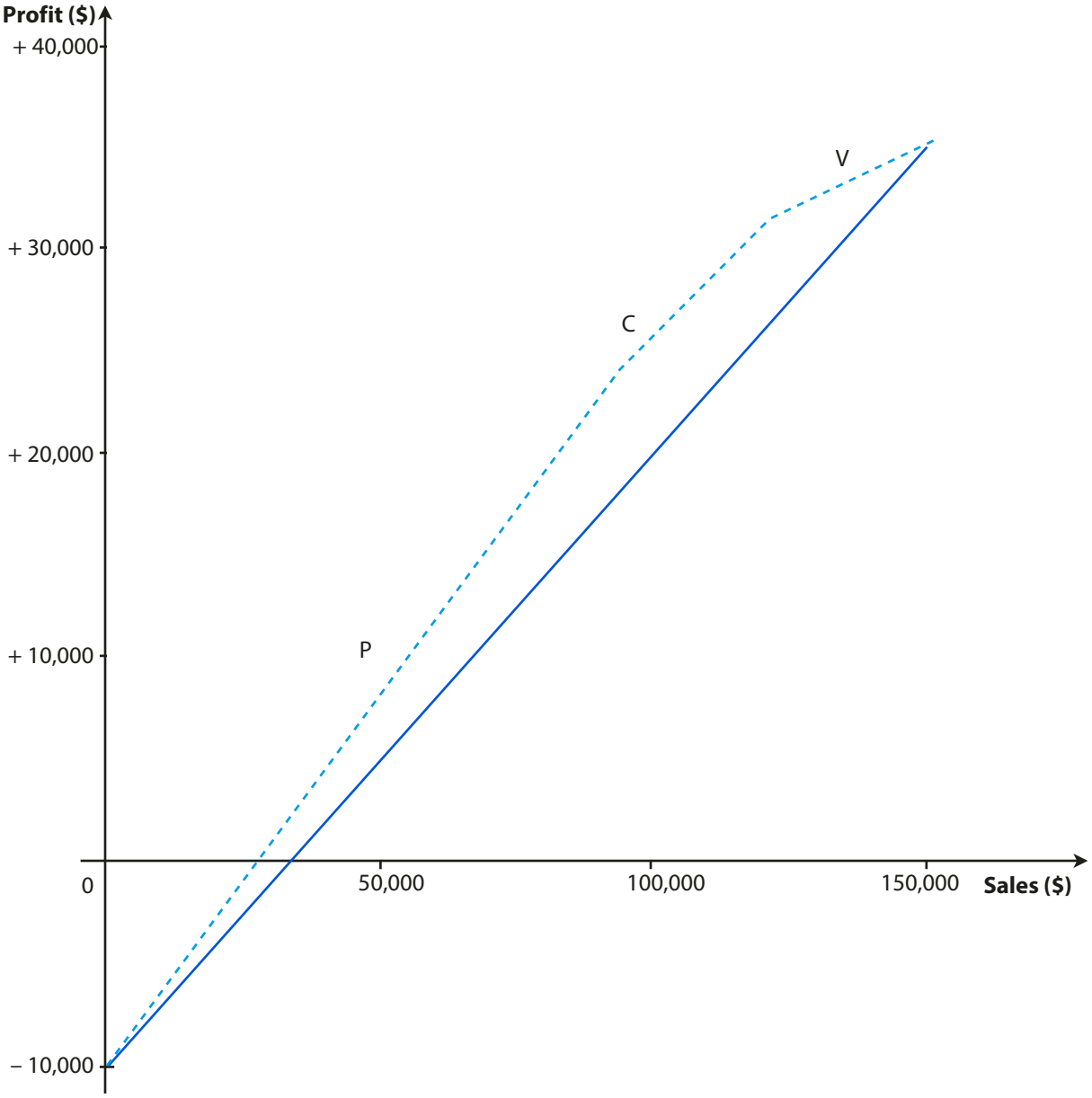
(Alternatively, the average CS ratio may be calculated by taking the weighted average of the individual CS ratios, weighting by the budgeted sales revenues.)

(c) Breakeven sales revenue = fixed overheads / CS ratio

= 8000/0.303

= $26,400

(d) See graph below



(e) P has the highest CS ratio, followed by C, followed by V.

		Cumulative Sales		*Cumulative Profit*
P	(12,000 × 7 =)	84,000	((12,000 × 2.65) – 8000)	23,800
C	(4,800 × 5 = 24,000)	108,000	(4,800 × 1.25 = 6000)	29,800
V	(4,800 × 6 = 28,800)	136,800	(4,800 × 0.75 = 3600)	33,400

(f) Breakeven sales for P are 8000/0.379 = $21,108

Chapter 9

Answer to example 1

(a)	Lost contribution from Rooks	(15,000)
	Save fixed overheads	5,000
	Net loss from ceasing Rooks	10,000

Therefore, should continue production of Rooks.

(b)	Lost contribution from Rooks	(15,000)
	Save fixed overheads	5,000
	Extra contribution from Crowners	20,000
	Extra fixed costs of Crowthers	(6,000)
	Net gain from ceasing Rooks	4,000

Therefore, should cease production of Rooks and produce Crowners instead.

Answer to example 2

Revised costs for special order:

	Notes	*$*
Subcontractor costs	1	31,300
Supervisor costs	2	1,000
General overheads	3	1,000
Machine maintenance	4	500
Machine overheads	5	22,000
Materials	6	31,500
Interest costs	7	900
		88,200

Notes:

(1) The choice lies between the two subcontractor costs that have to be employed because of the shortage of existing labour. The minimum cost is to have subcontractors employed who are skilled in the special process.

(2) Only the difference between the bonus and the incentive payment represents an additional cost that arises due to the special order. Fixed salary costs do not change.

(3) Only incremental costs are relevant.

(4) Depreciation is a period cost and is not related to the special order. Additional maintenance costs are relevant.

(5) The relevant costs are the variable overheads ($3 × 6000 hours) that will be incurred, plus the displacement costs of $2 × 2000 hours making a total of $22,000.

(6) Since the materials are no longer used the replacement cost is irrelevant. The historic cost of $34,000 is a sunk cost. The relevant cost is the lost sale value of the inventory used in the special order which is: 7,500 kg × $4.20 per kg = $31,500.

(7) Full opportunity costing will also allow for imputed interest costs on the incremental loan. The correct interest rate is the overdraft rate since this represents the incremental cost the

company will pay. Simple interest charges for three months are therefore: (3/12) × $20,000 × 18% = $900.

Answer to example 3

	X	*Y*	*Z*
Buy-in price	13	17	16
Cost to make	10	12	14
Saving (p.u.)	$3	$5	$2
Kg of B	3	2	1
Saving per kg	$1	$2.50	$2
RANKING	3	1	2

		Units	*Material B (kg)*
Y	MAKE	2,500	5,000
Z	MAKE	3,000	3,000
			8,000 kg
Z	BUY	1,000	
X	BUY	2,000	

Chapter 10

Answer to example 1

(a)

Demand / *Contract size*	400u	500u	700u	900u
300u	2,900	3,400	4,400	5,400
500u	3,500	4,000	5,000	5,000
700u	4,100	4,600	4,600	4,600
800u	4,400	4,400	4,400	4,400

(b) (i) Expected value if contract size =

300 units = (0.2×2,900) + (0.3 × 3,400) + (0.4 × 4,400) + (0.1 × 5,400) = **$3,900**

500 units = (0.2 × 3,500) + (0.3 × 4,000) + (0.5 × 5,000) = **$4,400**

700 units = (0.2 × 4,100) + (0.8 × 4,600) = **$4,500**

900 units = **$4,400**

Sign contract for **700 units**

(ii) maximin

Worst outcome from:

300 units = **$2,900**

500 units = **$3,500**

700 units = **$4,100**

800 units = **$4,400**

Sign contract for **800 units**

(iii) Best outcome from

300 units = **$5,400**

500 units = **$5,000**

700 units = **$4,600**

800 units = **$4,400**

Sign contract for **300 units**

(iv) Regret table:

Demand / Contract size	400u	500u	700u	900u
300u	1,500	1,200	600	0
500u	900	600	0	400
700u	300	0	400	800
800u	0	200	600	1,000

Worst regret for

300 units = **$1,500**

500 units = **$900**

700 units = **$800**

800 units = **$1,000**

Sign contract for **700 units**

(c) With perfect knowledge of the level of demand, the payoffs would be as follows:

Result of perf. know.	Decision Contract	Payoff $
400	800u	4,400
500	700u	4,600
700	500u	5,000
900	300u	5,400

The expected return with perfect knowledge =

(0.2 × 4,400) + (0.3 × 4,600) + (0.4 × 5,000) + (0.1 × 5,400) = $4,800

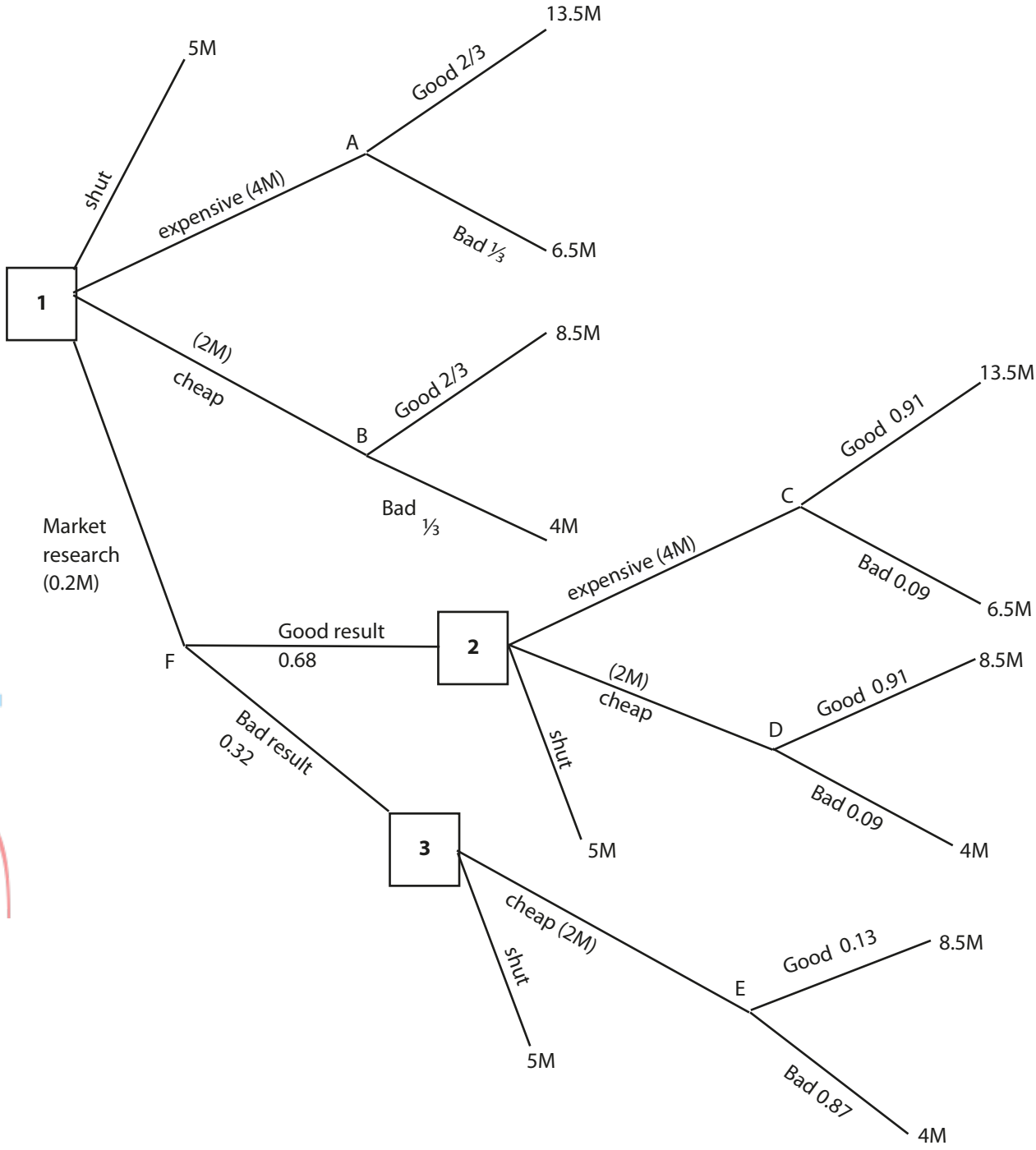
The expected return without perfect knowledge (from (b)(i) is $4,500

So the most to pay for perfect knowledge

= 4,800 – 4,500

= **$300**

Answer to example 2



Expected values:

at	A	(2/3 × 13.5M)	+	(1/3 ×6.5M)	=	11.17M
	B	(2/3 ×8.5M)	+	(1/3 × 4M)	=	7M
	C	(0.91 × 13.5M)	+	(0.09 × 6.5M)	=	12.87M
	D	(0.91 × 8.5M)	+	(0.09 × 4M)	=	8.095M
	E	(0.13 × 8.5M)	+	(0.87 × 4M)	=	4.585M

Decisions

at 2: choose expensive, 8.87M (12.87 – 4)

at 3: choose shut, 5M

Expected value at F, (0.68 × 8.87M) + (0.32 × 5M) = 7.63M

Decision at 1: choose market research, 7.43M (7.63 – 0.2)

Chapter 11

Answer to example 1

(a) Sales budget

				$
X	2,000u	× $100	=	200,000
Y	4,000u	× $130	=	520,000
Z	3,000u	× $150	=	450,000
				$1,170,000

(b) Production budget

	X	Y	Z
Sales	2,000	4,000	3,000
Opening inventory	(500)	(800)	(700)
Closing inventory	600	1,000	800
Production	2,100 u	4,200 u	3,100 u

(c) Material usage budget

			Wood		Varnish	
X	2,100 u	× 5 =	10,500	× 2	4,200	
Y	4,200 u	× 3 =	12,600	× 2	8,400	
Z	3,100 u	× 2 =	6,200	× 1	3,100	
			29,300	kg	15,700	litres

(d) Materials purchases budget

	Wood		Varnish	
Usage	29,300		15,700	
Opening inventory	(21,000)		(10,000)	
Closing inventory	18,000		9,000	
	26,300	kg	14,700	litres
	× $8		× $4	
	$210,400		$58,800	

(e) Labour budget

			hours	
X	2,100u × 4	=	8,400	
Y	4,200u × 6	=	25,200	
Z	3,100u × 8	=	24,800	
			58,400	hours
			×$3	
			$175,200	

Answer to example 2

	Flexed	*Actual*	*Variances*	
Sales	12,000 u	12,000 u		
Production	12,000 u	12,000 u		
Sales	120,000	122,000	2,000	(F)
Materials	60,000	60,000	–	
Labour	30,000	28,500	1,500	(F)
Variable o/h	15,000	15,000	–	
	105,000	103,500		
Contribution	15,000	18,500		
Fixed o/h	10,000	11,000	1,000	(A)
Profit	$5,000	$7,500	$2,500	(F)

Statement

			$	
Original budget contribution	(10,000u × $1.25)		12,500	
Sales volume variance	(2,000 ×$1.25)		2,500	(F)
			15,000	
Sales price variance			2,000	(F)
Labour variance			1,500	(F)
Actual contribution			18,500	
Fixed overheads				
Budget		10,000		
Variance		1,000 (A)	11,000	
Actual profit			$7,500	

Chapter 12

Answer to example 1

	u	*$*
High	700	85,000
Low	100	40,000
	600u	$45,000

$$\text{Variable cost} = \frac{45{,}000}{600} = \textbf{\$75}$$

For high:

Total cost =	85,000
Variable cost (700u @ $75)	52,500
Fixed cost	$32,500

Answer to example 2

units	*Average time*	*Total time*
1	100	100
2	75	150
4	56.25	225
8	42.1875	337.5

	hours	
Time for 8	337.5	
Time for first	100	
Time for additional 7	237.5	hours

Answer to example 3

(a) $b = \dfrac{\log 0.85}{\log 2} = -0.2345$

$y = ax^b$

for 16 batches $y = 200 \times 16^{-02345} = 104.3912$

Total time for 16 = 16 × 104.4	=	1,670	hours
Time for first	=	200	hours
Time for next 15	=	1,470	hours

(b) Average time for 30 = $200 \times 30^{-0.2345} = 90.08$

Total time for 30 = 30 ×90.08 = 2,703 hours

Average time for 29 = $200 \times 29^{-0.2345} = 90.80$

Total time for 29 = 29 × 90.80 = 2,633 hours

Time for 30th = 2,703 – 2,633 = 70 hours

Chapter 13

Answer to example 1

	Original Fixed Budget	*Flexed Budget*	*Actual*	*Variances*	
	$	*$*	*$*		
Sales (units)	8,000	8,400	8,400		
Production (units)	8,700	8,900	8,900		
Sales	600,000	630,000	613,200	16,800	(A)
Materials	156,600	160,200	163,455	3,255	(A)
Labour	217,500	222,500	224,515	2,015	(A)
Variable o/h	87,000	89,000	87,348	1,652	(F)
Fixed o/h	130,500	133,500	134,074	574	(A)
	591,600	605,200	609,392		
Closing inventory	(47,600)	(34,000)	(34,000)		
	544,000	571,200	575,392		
Profit	$56,000	$58,800	$37,808	20,992	(A)

Answer to example 2

Materials

Expense variance

Actual purchases 35,464kg	at actual cost	163,455	
	at standard cost ($4.50)	159,588	
		$3,867	(A)

Usage variance

	kg
Actual usage	35,464
Standard usage for actual production (8,900 u × 4kg)	35,600
	136 kg

at a standard cost ($4.50) = **$612** (F)

Labour

Rate of Pay variance

Actual hours paid at actual cost	224,515
45,400 hours at standard cost ($5)	227,000
	$2,485 (F)

Idle Time Variance

Actual hours paid	45,400
Actual hours worked	44,100
	1,300 hrs

at a standard cost ($5) = **$6,500** (A)

Efficiency variance

Actual hours worked	44,100
Standard hours for actual production (8,900 u × 5hrs)	44,500
	400 hrs

at a standard cost ($5) = **$2,000** (F)

Variable overheads

Expenditure variance

Actual hours worked	at actual cost	87,348
44,100	at standard cost	88,200
		$852 (F)

Efficiency variance

Actual hours worked	44,100
Standard hours for actual production (8,900u × 5hrs)	44,500
	400 hrs

at a standard cost ($2) = $800 (F)

Fixed overheads

Expenditure variance

Actual total	134,074
Original budget total	130,500
	$3,574 (A)

Capacity variance

Actual hours worked	44,100
Budget hours (8,700u × 5hrs)	43,500
	600 hrs

at a standard cost ($3) = **$1,800** (F)

Efficiency variance

Actual hours worked	44,100	
Standard hours for actual production (8,900u × 5hrs)	44,500	
	400	hrs

at a standard cost ($3) = **$1,200** (F)

Operating Statement

		$	
Original budget profit		56,000	
Sales	– volume variance	2,800	(F)
		58,800	
Sales	– price variance	(16,800)	(A)
Materials	– expense variance	(3,867)	(A)
	– usage variance	612	(F)
Labour	– rate of pay variance	2,485	(F)
	– idle time variance	(6,500)	(A)
	– efficiency variance	2,000	(F)
Variable o/hs	– expense variance	852	(F)
	– efficiency variance	800	(F)
Fixed o/hs	– expense variance	(3,574)	(A)
	– capacity variance	1,800	(F)
	– efficiency variance	1,200	(F)
Actual profit		$37,808	

Answer to example 3

No Answer

Answer to example 4

No Answer

Chapter 14

Answer to example 1

Expenditure variance

Actual usage at actual cost:	108,900 × $4.75	=	517,275
Actual usage at standard cost:	108,900 × $5.00	=	544,500
	Variance:		27,225 (F)

Planning variance:

Actual usage at revised cost:	108,900 × $4.85	=	528,165
Actual usage at standard cost:	108,900 × $5.00	=	544,500
	Planning variance:		16,335 (F)

Operational variance:

Actual usage at actual cost:	108,900 × $4.75	=	517,275
Actual usage at revised cost:	108,900 × $4.85	=	528,165
	Operational variance:		10,890 (F)

Usage variance:

Actual usage:			108,900 kg
Standard usage:	11,000 × 10kg		110,000 kg
	1,100 kg × $5	=	$5,500 (F)

Planning variance:

Revised usage:	11,000 × 9.5 kg		104,500 kg
Standard usage:	11,000 × 10 kg		110,000 kg
	5,500 kg × $5	=	$27,500 (F)

Operational variance:

Actual usage:			108,900 kg
Revised usage:	11,000 × 9.5 kg		104,500 kg
	4,400 kg × $5	=	$22,000 (A)

Answer to example 2

Rate of pay variances

Planning variance:

Actual hours at revised cost:	190,000 × $4.10	=	779,000
Actual hours at standard cost:	190,000 × $4.00	=	760,000
	Planning variance:		19,000 (A)

Operational variance:

Actual hours at actual cost:			769,500
Actual hours at revised cost:	190,000 × $4.10	=	779,000
	Operational variance:		9,500 (F)

Efficiency variance:

Planning variance:

Revised hours:	24,000 × 7.5 hours	180,000 hours
Standard hours:	24,000 × 8 hours	192,000 hours
	12,000 hours × $4 =	$48,000 (F)

Operational variance:

Actual hours:			190,000 hours
Revised hours:	24,000 × 7.5 hours		180,000 hours
	10,000 hours × $4	=	$40,000 (A)

Answer to example 3

Total materials cost variance

Actual total cost (27,000 + 11,000)	38,000
Standard total cost (5,000 × $8)	40,000
Total cost variance	$2,000 (F)

Materials price variance

	Actual purchases kg	*Actual cost $*	*Actual purchases kg*	*Standard cost $*
X	9,900	27,000	9,900	29,700
Y	5,300	11,000	5,300	10,600
		38,000		40,300

Price variable = 38,000 – 40,300 = $2,300 (F)

Mix variance

	Actual purchases kg	*Standard cost $*		*Standard mix kg*	*Standard cost $*
X	9,900	29,700	(⅔)	10,133	30,399
Y	5,300	10,600	(⅓)	5,067	10,134
	15,200 kg	40,300		15,200 kg	40,533

Mix variance = 40,300 – 40,533 = 233 (F)

Yield variance

	Standard mix (actual total) kg	*Standard cost $*	*Standard mix kg*	*Standard cost $*
X	10,133	30,399	10,000	30,000
Y	5,067	10,134	5,000	10,000
	15,200 kg	40,533	15,000 kg	40,000

Yield variance = 40,533 – 40,000 = 533 (A)

(Usage variance = Yield variance + Mix variance = 533 (A) + 233 (F) **= 300 (A))**

Answer to example 4

Note: throughout this answer we use standard **costs** because cost variances are calculated separately in the usual way

Total sales margin variance

Budget profit:

A	200u	×	(20 – 17)		600
B	100u	×	(25 – 21)	=	400
C	100u	×	(30 – 24)	=	600
					1,600

Actual profit (using standard costs):

A	180u	×	(22 – 17)		900
B	150u	×	(22 – 21)	=	150
C	170u	×	(26 – 24)	=	340
					1,390

Total variance = 1,390 – 1,600 = $210 (A)

Sales price variance

	Actual sales units	*Actual selling price*	*$*	*Actual sales units*	*Standard selling price*	*$*
A	180	× 22 =	3,960	180	× 20 =	3,600
B	150	× 22 =	3,300	150	× 25 =	3,750
C	170	× 26 =	4,420	170	× 30 =	5,100
			$11,680			$12,450

Sales price variance = 11,680 – 12,450 = $770 (A)

Sales mix variance

	Actual total sales units	*Actual selling price*	*$*		*Actual total sales units*	*Standard profit p.u.*	*$*
A	180	× $3 =	540	(2/4)	250	× $3 =	750
B	150	× $4 =	600	(1/4)	125	× $4 =	500
C	170	× $6 =	1,020	(1/4)	125	× $6 =	750
	500		$2,160		500		$2,000

Mix variance = 2,160 – 2,000 = $160 (F)

Sales quantity variance

	Actual total sales standard mix units	*Standard Profit*	*$*	*Budget sales units*	*Standard profit*	*$*
A	250	× $3 =	750	200	× $3 =	600
B	125	× $4 =	500	100	× $4 =	400
C	125	× $6 =	750	100	× $6 =	600
	500		$2,000	400		$1,600

Quantity variance = 20,000 – 1,600 = $400 (F)

Answer to example 5

(a) Each unit takes 7.6 hours to make, and therefore the company expects to need to pay for 7.6/.95 = 8 hours of labour.

8 hours at the rate of $5.70 per hour gives a standard cost of $45.60 per unit

(b) Each unit should take 7.6 hours to produce, and should cost $45.60 for labour. Therefore, the effective standard cost per hour worked is 45.60 / 7.6 = $6.00

(c) Total labour variance:

Actual cost of production:	50,020
Standard cost of actual production (1,000 units at $45.60)	45,600
Total variance	**4,420 (A)**

(d) Rate of pay variance:

Actual amount paid	50,020
Standard cost of actual hours paid (8,200 hours at $5.70)	46,740
Total variance	**3,280 (A)**

Idle time variance:

Actual idle hours (8,200 – 7,740)	460 hours
Standard idle time (8,200 × 5%)	410 hours
Excess idle time	50 hours
Idle time variance: 50 hours at $6.00 =	**$300 (A)**

Efficiency variance:

Actual hours worked	7,740 hours
Standard hours worked for actual Production: 1000 units × 7.6 hours =	7,600 hours
Idle time variance: 50 hours at $6.00 =	140 hours
Efficiency variance: 140 hours × $6 =	**$840 (A)**

(Check:

Rate of pay	3,280 (A)
Excess idle time	300 (A)
Efficiency	840 (A)
Total	**$4,420**

Answer to example 6

Total variance:

	$
Actual total expenditure	126,720
Standard cost for actual production (50,400 × 120,000/48,000)	126,000
	720 (A)

Expenditure variance:

	$
Actual total expenditure	126,720
Standard cost for actual despatches (2,200 × 120,000/2,000)	132,000
	5,280 (F)

Efficiency variance:

	Despatches
Actual number of despatches	2,200
Standard number of despatches for actual production (50,400 × 2,000/48,000)	2,100
	100

Variance = 100 despatches × standard cost per despatch

= 100 × 120,000/2,000 = $6,000 (A)

Chapter 15

Answer to example 1

		2007	2006
Net profit margin	$\left(\frac{790}{7,180}\right)$	11%	8.5%
Gross profit margin	$\left(\frac{1,795}{7,180}\right)$	25%	22.5%
Return on capital	$\left(\frac{790}{2,690}\right)$	29.4%	25.7%
Asset turnover	$\left(\frac{7,180}{2,690}\right)$	2.67	3.02
Current ratio	$\left(\frac{2,314}{965}\right)$	2.4	2.4
Quick ratio (or acid test)	$\left(\frac{1,308}{965}\right)$	1.36	1.15
Inventory turnover	$\left(\frac{1,006}{5,385}\times 365\right)$	68.2 days	75.5 days
Receivables days	$\left(\frac{948}{7,180}\times 365\right)$	48.2 days	47.5 days
Payables days	$\left(\frac{653}{5,385}\times 365\right)$	44.3 days	44.7 days
Gearing ratio	$\left(\frac{500}{2,190}\right)$	22.8%	28.6%

Chapter 16

No Examples

Chapter 17

Answer to example 1

Return from new project = $\frac{17{,}000}{100{,}000}$ = **17%**

(a) For company:

17% > 15% (target)

Therefore company wants to accept

(b) For division

ROI (without project) $\frac{82{,}000}{500{,}000}$ = 16.4%

ROI (with project) $\frac{82{,}000 + 17{,}000}{500{,}000 + 100{,}000}$ = 16.5%

ROI of division increases therefore divisional manager motivated to accept.

Answer to example 2

Return from new project = $\frac{16{,}000}{100{,}000}$ = 16%

(a) For company: 16% > 15%

Company wants to accept

(b) For division:

ROI (without project) =16.4%

ROI (with project) $\frac{82{,}000 + 16{,}000}{500{,}000 + 100{,}000}$ = 16.3%

Answer to example 3

(1) RI (without project)

Profit	82,000
Less: Interest	
15% × 500,000	(75,000)
	$7,000

RI (with project)

Profit	99,000
Less: Interest	
15% × 600,000	90,000
	$9,000

$9,000 > $7,000 manager motivated to accept

(2)	RI (without project)	$7,000
	ROI (with project)	
	Profit	98,000
	Less: Interest	
	15% × 600,000	90,000
		$8,000

$8,000 > $7,000 manager motivated to accept

In both cases the decisions are goal congruent

Chapter 18

Answer to Example 1

(a)

Selling price			20
Costs:	A	10	
	B	4	14
Profit			$6

(b)

	A		*B*	
Total Profit	12	Selling price		20
Cost	10	Total Profit	12	
Profit	$2	Costs	4	16
		Profit		$4

Answer to example 2

(a) Transfer price = 15 × 1.2 = $18 p.u.

(b)

Selling price			30
Costs:	A	15	
	B	5	20
Profit			$10

(c)

	A		*B*	
Total Profit	18	Selling price		30
Cost	15	Total Profit	18	
Profit	$3	Costs	5	23
		Profit		$7

Answer to example 3

(a) Transfer price = 20 × 1.2 = $24 p.u.

(b)

Selling price			30
Costs:	A	20	
	B	8	28
Profit			$2

(c)

	A		B		
Total Profit	24		Selling price		30
Cost	20		Total Profit	24	
Profit	$4		Costs	8	32
			Profit		$(2)

Answer to example 4

For A: T.P. > 20

For B: T.P. < 30 - 8

< 22

Sensible T.P. between $20 and $22 p.u.

Answer to example 5

For A: T.P. > 15

For B: T.P. < 35 - 10

< 25

Sensible range between $15 and $25 p.u.

Answer to example 6

For A: T.P. > 20

For B: T.P. < 25 (as in previous example)

Sensible range between $20 and $25 p.u.

Answer to example 7

(a) For A: T.P. > 8

For B: T.P. < 14

Sensible range between $8 and $14 p.u.

(b) For A: T.P. > 8

For B: T.P. < 20 – 4

< 16

Sensible range between $8 and $16 p.u.

Answer to example 8

	X	*Y*
Contribution	$20	$30
Hours	5	10
Contribution per hour	$4	$3

Therefore, if no transfers to B then A would sell exactly and generate $4 per hour contribution.

To make transfers of Y worthwhile, A need to charge at least $70 + (10 \times 4) = \$110$ p.u.

Chapter 19

No Examples

Chapter 20

No Examples

Chapter 21

No Examples